

Oct. 15, 1940.

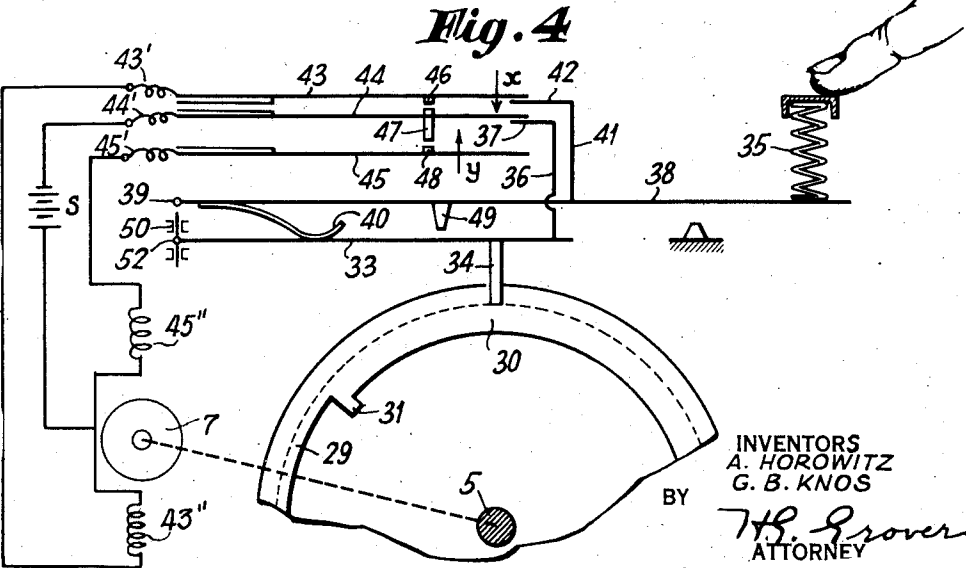
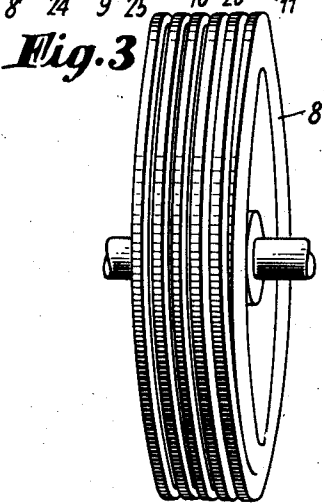
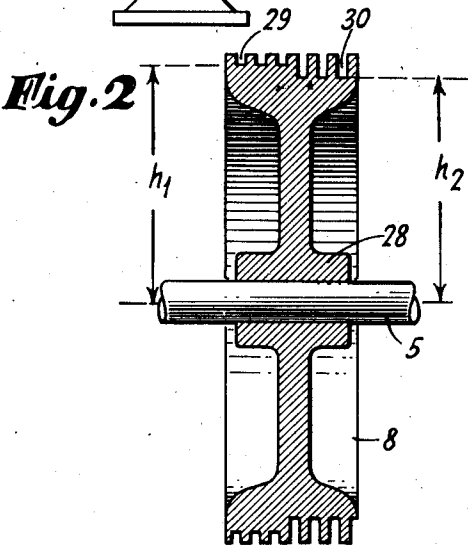
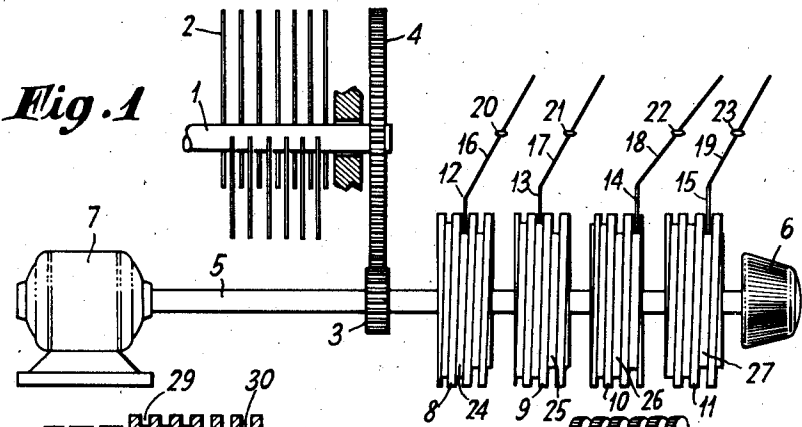
A. HOROWITZ ET AL

2,218,088

AUTOMATIC TUNING FOR RADIO RECEIVING APPARATUS

Filed Oct. 4, 1938

2 Sheets-Sheet 1



INVENTORS
A. HOROWITZ
G. B. KNOS
BY
H. B. Grover
ATTORNEY

Oct. 15, 1940.

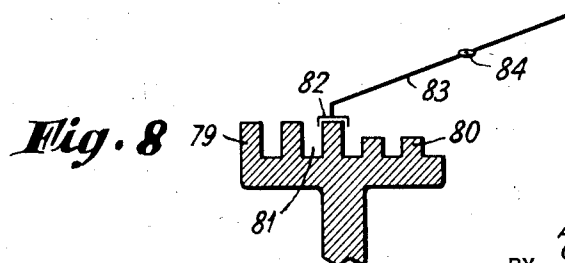
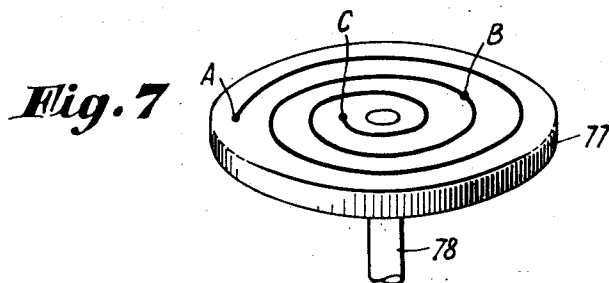
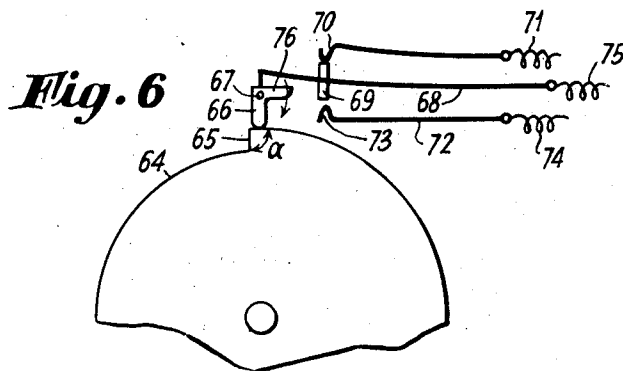
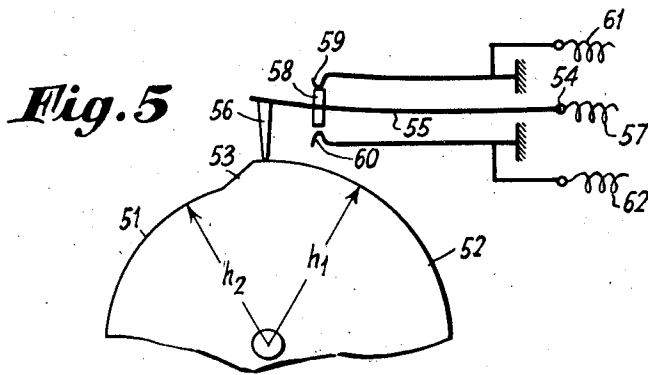
A. HOROWITZ ET AL

2,218,088

AUTOMATIC TUNING FOR RADIO RECEIVING APPARATUS

Filed Oct. 4, 1938

2 Sheets-Sheet 2



INVENTORS
A. HOROWITZ
G. B. KNOS
BY *W. H. Grover*
ATTORNEY

UNITED STATES PATENT OFFICE

2,218,088

AUTOMATIC TUNING FOR RADIO RECEIVING APPARATUS

Alexandre Horowitz and Gunnar Borge Knos,
Eindhoven, Netherlands, assignors, by means
assignments, to Radio Corporation of America,
New York, N. Y., a corporation of Delaware

Application October 4, 1938, Serial No. 233,188
In Germany March 18, 1938

7 Claims. (Cl. 172-239)

Radio receiving apparatus adapted to be automatically tuned to a plurality of pre-determined stations with the aid of a station selector consisting of a selector disc, a key-board or a similar device are already known. In such apparatus there is for each of these stations a position-determining disc which is coupled with the shaft of the tuning condenser and which is equipped with two guide tracks which differ in operative height and with which cooperates a member for the motor by which the tuning members are adjusted. In these known apparatus the position-determining disc consists as a rule of a flat disc provided at its circumference with two circular guide tracks which, having different diameters are also different in operative height. By the "operative height" of the guide tracks we mean hereinafter the height of the operative guide portions with respect to a fixed plane. In the known devices these position-determining discs are mounted on the shaft of the movable portion of the tuning condenser. Owing to the manipulation of a tuning member, for example, a push-button corresponding to one of the stations which are to be automatically tuned, an actuating member for the motor which actuates the tuning members, in the present instance the rotor of the tuning condenser, comes into contact with one of both portions of the guide track with the result, that the motor starts rotating and continues to rotate until the actuating member for the motor attains the point where the one guide track merges into the other track on the position disc under consideration. By exactly adjusting the position-determining discs on the shaft of the tuning condenser it is achieved that at the moment when the actuating member is at the point where the one guide track merges into the other, correct tuning of the condenser is obtained. The invention relates to a radio receiving apparatus of the above-described kind, wherein, however, owing to the particular shape of the guide tracks, it is achieved that automatic tuning is effected with considerably greater precision than in the known devices. The apparatus according to the invention is characterised in that each of the two guide tracks with different operative heights which are provided on the position-determining discs which are driven at a higher speed than the shaft of the condenser extends on the disc in question over an angle which exceeds an angle of 180° having its apex in the centre-line of the shaft carrying the discs. Owing to this construction each of the guide tracks is consequently longer than in the usual

devices. The transmission between the shaft of the position-determining disc and the shaft of the movable condenser portion must be chosen in proportion to the length of each of the guide tracks.

In one particular form of construction of the apparatus according to the invention the guide tracks are provided in the form of helical lines on the cylindrical outer surface of the position-determining discs.

In a further embodiment the guide tracks are provided in the form of spirals on one of the, preferably flat, terminal faces of the disc.

In the first-mentioned case the discs are consequently formed more or less as drums and the shaft on which the discs are mounted is preferably horizontally disposed.

In the second form of construction the position discs may be formed as gramophone records, in the sense that in this case the groove usually present in such a record has two different profiles, for example, depths. The shaft of the discs is preferably arranged in this case so as to occupy a vertical position.

Owing to the fact that the guide tracks extend over an angle which exceeds an angle of 180° having its apex in the centre line of the shaft and consequently have, in the forms of construction shown, the shape of helices or spirals, the path traversed, in the manipulation of a station selector by the actuating members for the motor by which the tuning members are adjusted, is considerably longer than in the known devices. Slight inaccuracies which may be due, for example, to the unavoidable inertia of the rotor of the motor, consequently have substantially no influence on the correct tuning and the forces by which this is brought about may be considerably smaller. Furthermore the amount of play which is always present is, also considerably smaller. In order to ensure that the angle of rotation of the position-determining discs should correspond to the materially smaller angle of rotation of the movable portion of the tuning condenser, the shaft on which the discs are mounted must be driven at an increased speed with respect to the shaft of the tuning condenser.

The manner in which the two guide tracks with different operative heights provided on each of the position discs merge into one another must be chosen in accordance with the method by which automatic tuning is affected in one system, these two guide tracks on each of the position discs are separated, in accordance with the invention, by a depression which has at its base

a smaller operative height than the two guide tracks.

According to the invention, in a further system the two guide tracks on each position disc are separated by a portion which gradually passes from the operative height of the one guide track to that of the other.

In a further system according to the invention the two guide tracks on each position disc are separated by a contact surface which makes an angle of 90° or less with the guide track of larger operative height.

It is evident that the guide tracks may have different forms. They may be formed, for example, by grooves in the surface of the position discs. According to the invention it is alternatively possible to constitute them by ridges on the position discs which are separated from one another by depressions.

The invention will be explained more fully with reference to the accompanying drawings, wherein Fig. 1 discloses the automatic control mechanism associated with the tuning element of a radio receiver according to the invention; Figs. 2 and 3 are views in cross-section and perspective respectively of one of the tuning element position-determining discs; Fig. 4 discloses in diagrammatic fashion the cooperation of the motor control switch, one of the push button members and its associated disc; Figs. 5-7 are modified forms of position-determining discs that may be employed; and Fig. 8 is a cross-sectional view of the form shown in Fig. 7.

Referring now to Fig. 1 the tuning element of the radio receiver is represented by the usual tuning condenser, the rotor 2 of which is mounted on a shaft 1 which supports, in addition, a gear wheel 4 which meshes with a pinion 3. The pinion 3 is mounted on a shaft 5 which carries at one end a tuning knob 6 and at the other end the rotor of a tuning motor 7. In this case the shaft 5 has mounted thereon four position-determining discs 8, 9, 10 and 11 which are formed as drums and on which helical guide tracks are provided. It may be noted that each of these discs co-operates with an actuating member (12, 13, 14 and 15) for the tuning motor 7. These actuating members are mounted on arms 16, 17, 18 and 19 (shown in perspective) which are adapted to rotate about spindles 20, 21, 22 and 23. This construction makes it possible for the members actuating the motor to perform, when the shaft 5 rotates, a reciprocating motion as is shown in Fig. 1 for the member 12, said motion being required to be enabled to follow the course of the helical grooves 24, 25, 26 and 27 in the position discs 8, 9, 10 and 11.

Fig. 2 represents in transverse section the position disc 8 which is constituted here by a moulding. This disc is mounted by a hub 28 on the shaft 5 and the drumlike outer surface has two helical guide tracks which have different operative heights (h_1 larger than h_2). The guide track of larger operative height h_1 is denoted by 29 and the guide track with the smaller operative height h_2 is designated by 30.

Fig. 3 represents a perspective view of the disc 8, the situation of the helical guide tracks on the drum-like surface of the disc 8 may be clearly seen from this figure.

As appears from Fig. 4, which shows diagrammatically the operation of one of the tuning systems, the guide track 29 with the larger operative height h_1 merges into the guide track 30 with the smaller operative height h_2 through a depression 31 in the groove which forms the guide tracks.

The base of this depression has a smaller operative height than have the guide tracks 29 and 30. A lever 33 carrying at its end a feeler 34 whose lower end rests upon manipulation of a push-button 35, on the base of one of the guide tracks 29 and 30, is pivoted on a point 52. The lever 33 has an extension 36 which is provided at its upper end with a projection 37. The push-button 35 is provided on a lever 38 which is pivoted on a point 39; it may be noted that between the levers 38 and 33 there is provided a blade spring 40 which, when the push-button 35 is depressed, exerts on the lever 33 a pressure which is directed downwardly. The lever 38 is furthermore provided with an extension 41 which has at its upper end a projection 42.

There are furthermore three contact springs 43, 44 and 45, which are provided with contacts 46, 47 and 48. The projections 37 and 42 enter between the contact springs 43, 44 and 45. The contact spring 43 is formed in such manner that it always tends to move, as is shown, in the direction of the arrow x , that is to say downwardly, whereas the contact spring 45 always has a tendency to move upwardly, as is indicated by the arrow y . The contact springs 43 and 45 have each connected thereto a current supply conductor 43' and 45' respectively. The stator of the motor is provided with two oppositely wound windings 43'' and 45'' which are connected to the contact springs 43 and 45 through their respective supply conductors 43' and 45'. A source of power supply S is connected between the current supply conductor 44' of the contact spring 44 and the conductor connecting the two motor windings. It is consequently clear that when the contacts 46 and 47 come into contact with one another, the motor starts rotating in the one direction and, when the contacts 47 and 48 engage one another, the motor will rotate in the other direction.

If in the position shown the push-button 35 is depressed a projection 49 provided on the lever 38 comes into contact with the lever 33, and if the push-button 35 is depressed still further the lower end of the feeler 34 comes to rest on the base of the guide track 30. When the button 35 is being depressed the extensions 36 and 41 also move downwardly. The projection 42, which initially prevented the contact 46 from coming into contact with the contact 47 has also moved downwardly, just as the extensions 36 and 37. The projection 42 presses the contacts 47 and 48 against one another with the result that the motor is energized by the winding 45'' whose circuit is closed via the contacts 47 and 48. This results in the right handed rotation of the motor, which lasts until the blade spring 40, by which the feeler 34 is depressed, acquires the opportunity of pressing said feeler into the depression 31 by which the guide tracks 29 and 30 are separated from one another. Owing to the movement which is now performed by the lever 33 the extension 36 removes the lever 45 from the lever 44 with the result that the contact 47, 48 is broken and consequently the motor is stopped. Any inertia of the motor has practically no influence on the tuning since, as appears from Fig. 1, the shaft 5 on which the position discs are mounted rotates at a higher speed than the shaft 1 of the rotor 2 of the condenser.

If the push-button had been depressed at the moment when the feeler 34 was opposite the guide track 29 with the operative height h_1 , the feeler 34 could be depressed only over a smaller distance than in the first-described instance. In conse-

quence thereof the projection 42 would have allowed the lever 43 to move downwardly with the result that the contacts 46 and 47 would have come into contact with one another and the motor now energized by the winding 43' would have started rotating in the left-hand direction until the feeler 34 would have reached the depression 31. For prior to this moment the displacement of the feeler would have been so slight that by its displacement the projection 42 would not yet have brought the lever 44 out of the range of action of the lever 43.

There may be provided a device (not shown) which will ensure that when a second push-button is subsequently depressed, the push-button, which has been previously depressed is released so that the feeler 34 is caused to leave the depression 31. From Fig. 4 it may furthermore be seen that the lever 33 can pivot, in a plane perpendicular to the plane of the drawing, on the spindle 50 which is similar to the spindles 20, 21, 22 and 23 of Fig. 1.

Fig. 5 represents one embodiment of the position disc in a radio receiving apparatus according to the invention, wherein two helical guide tracks 51 and 52, whose portions shown in the figure are represented for simplicity as being located in one plane, are separated from one another by a portion 53 which gradually passes from the operative height h_2 of the portion 51 into the operative height h_1 of the portion 52. At the point 54 is pivoted a lever 55 whose finger 56 provided at the end thereof bears permanently on one of the guide tracks 52 and 51 so that the said finger always follows the course of the guide tracks. The lever 55 is connected by means of a conductor 57 to one of the terminals of the motor, which actuates the tuning means, said motor not being shown. This lever carries a contact 58. Above and below the lever 55 there are provided contacts 59 and 60. Depending on the fact whether the contact 58 makes contact with the contact 59 or 60, which contacts are connected by means of conductors 61 and 62 to two oppositely wound windings of the motor, the motor rotates left-handedly or right-handedly until the finger 56 attains the transition 53 between the two guide tracks, owing to which the contact 58 is connected neither to the contact 59 nor to the contact 60, so that the motor energizing circuit is broken and the tuning condenser remains in this position.

In the form of construction shown in Fig. 6 the two helical guide tracks 63 and 64, whose portions shown in Fig. 6 are represented for simplicity, as in Fig. 5, as located in a single plane, are separated by a contact surface 65 which makes in this instance an angle α of 90° with the track 63. If desired, this angle α may have a smaller value. On the guide track 63 bears the arm 66 of an angle lever which is pivoted on a point 67 and which is suspended from a slightly resilient lever 68. The lever 68 is provided with a contact 69 which makes contact in this instance with a resilient contact 70 which has secured thereto a winding 71 of the motor for the tuning means 72, which motor is not shown. Below the lever 68 there is arranged a further lever 72 provided with a contact 73. This lever has secured thereto a winding 74 of the motor which is oppositely wound with respect to the winding 71. The lever 68 is connected by a wire 75 to the other terminal of the motor.

In the position shown the angle lever 66 raises the lever 68, owing to the fact that the angle lever 75 rests on the guide track 63, with the result that

the contact 69 engages the contact 70 and the motor and therefore the position disc shown start rotating in right-handed direction. At a given instant the angle lever drops from the guide track 63 on the track 64 with the result that the contact 69 engages the contact 73 and the sense of rotation of the motor is reversed, which motor consequently starts rotating in left-handed direction. This goes on until the arm 66 of the angle lever butts against the contact surface 65 owing to which the angle lever rotates in the direction of the arrow and the arm 76 of the angle lever removes the lever 72 from the region of action of the contact 69 with the result that the motor energizing circuit is broken and the shaft of the condenser comes to a stop.

Fig. 7 represents a form of construction of a position disc wherein the guide tracks are provided in the form of spirals on the flat terminal face of the position disc. In this form of construction a position disc 77 is mounted on a shaft 78; the guide track with the larger operative height extends from A to B and that with the smaller operative height from B to C. The transition from the one guide track into the other is located at the point B; this transition may be formed in any of the above-described ways.

Fig. 8 represents a sectional view of a part of a position disc with the corresponding actuating member for the motor. In this form of construction the guide tracks are formed by ridges 79 and 80 of the larger and smaller operative height, respectively, the ridges being separated from one another by depressions 81. The grooves are here assumed to extend helically on the cylindrical drum-like surface of the position disc. On the top of the ridges rests an actuating member 82 of the motor, which member is formed in this instance as a strap and is secured to a lever 83 which, being pivoted on a point 84, is enabled to follow the course of the guide tracks.

What we claim is:

1. Mechanism for automatically adjusting a shaft to a plurality of predetermined positions, comprising a reversible motor for driving said shaft, a plurality of shaft position-determining discs also driven by said motor, there being one such disc for each of the predetermined shaft positions, each disc being provided with two guide tracks which extend over an angle greater than 180° and which are spaced at different radial distances from the shaft supporting the discs, switch mechanism for controlling the direction of motor operation having a plurality of control members each cooperating with the guide tracks of one of the discs, and manually-operated means for causing the selective co-operation of a particular control member with the guide tracks of its associated disc whereby the motor is actuated to operate in the proper direction for adjusting the shaft to the predetermined position.

2. Mechanism as defined in claim 1 wherein each of the position-determining discs is in the form of a drum and the guide tracks are formed on the outer cylindrical surface of said drum.

3. Mechanism as defined in claim 1 wherein each of the position-determining discs is in the form of a drum and the guide tracks have a spiral formation on the outer cylindrical surface of said drum.

4. Mechanism as defined in claim 1 wherein each of the position-determining discs is in the form of a flat disc and the guide tracks are

in the form of spirals formed on the flat surface of the disc.

5. Mechanism as defined in claim 1 wherein the two guide tracks on each position-determining disc are separated by a depression which extends radially below the depth of the two guide tracks.

6. Mechanism as defined in claim 1 wherein the two guide tracks on each position-determining disc are separated by a portion which

gradually merges from the operative height of one guide track into that of the other.

7. Mechanism as defined in claim 1 wherein the two guide tracks on each disc are separated by a contact surface which makes an angle of approximately 90° with the guide track having the larger operative height.

ALEXANDRE HOROWITZ.
GUNNAR BORGE KNOS.