Oct. 17, 1950 C. PITON 2,526,610

MECHANICAL TUNING ADJUSTER

Filed March 27, 1945

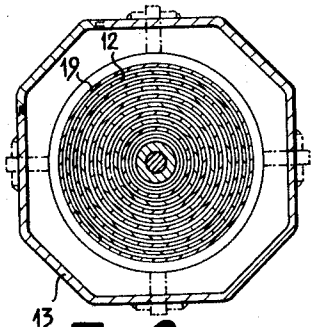


Fig.2

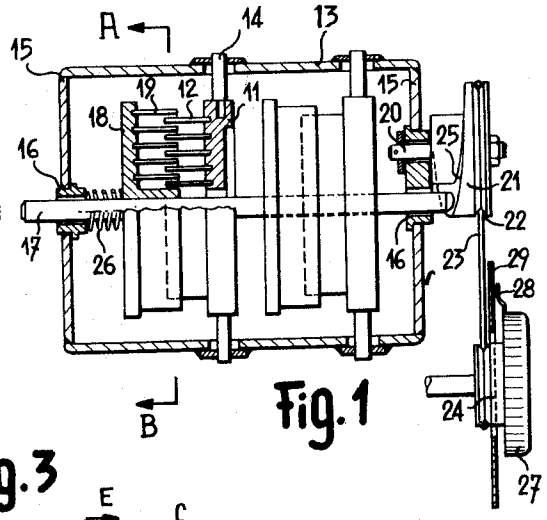


Fig.1

Fig.3

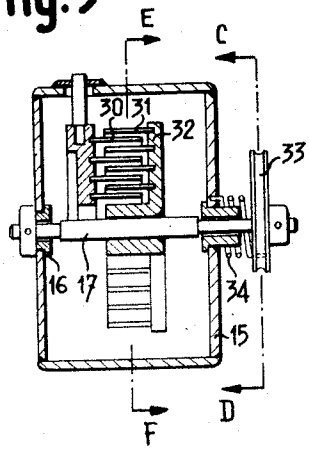


Fig.4

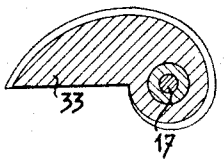


Fig.5

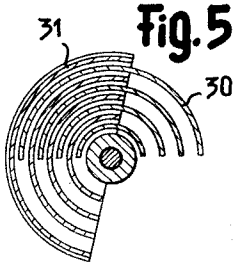


Fig.6

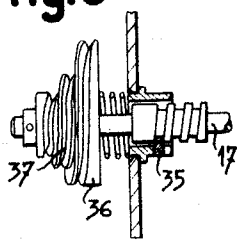


Fig.7

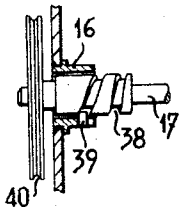
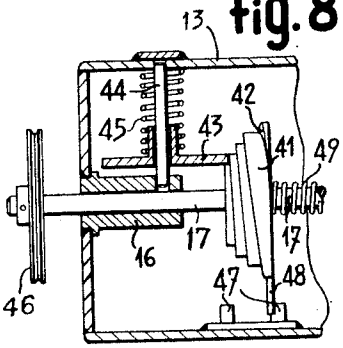


Fig.8



Inventor:

CHARLES PITON

By: Young, Emery & Thompson
Attys.

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MECHANICAL TUNING ADJUSTER

Charles Piton, Geneva, Switzerland, assignor, by mesne assignments, to Hermann Thorens S. A., a corporation of Switzerland

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8 Claims. (Cl. 74—10.6)

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In radio receivers, transmitters, and amplifiers in general of the electronic-tube type, there are employed circuits, the characteristics of which must be adjustable at will (coupling, damping, frequency etc.). For this purpose, the designers have devised oscillation-circuits equipped with at least one adjustable circuit-element. This element may for example be constituted by the movable armature of a condenser, by the plunger-core or another part of the magnetic circuit of an induction coil, by a coil displaceable with respect to another coil (variometer) etc. or by any adjustable element of an electric oscillation-circuit, the position of which defines at least one of the characteristics of the circuit of which it forms a part.

Generally speaking, it is advantageous, that the variation of the characteristics of an electric circuit be a linear function of the displacement of the device controlling the displacement of the adjustable element. In most cases, the variation of the characteristics of the oscillation-circuit is not proportional to the value of the characteristics defining it (the frequency of an oscillation-circuit is neither proportional to the capacity nor to the self-inductance of this circuit, but is a function of both; the damping is also a non-linear function of the resistance of the oscillation-circuit and the coupling between two oscillation-circuits does not vary in a linear manner as a function of the distance separating the two elements of the circuits).

If it is desired that the variation of the characteristics of an electric oscillation-circuit be a linear function of the displacements of the controlling-device, the designers have tried to shape either the adjustable part or the stationary part of the circuit-element in such a manner, as to obtain the result that the variations of the element determining the variations of the circuit-characteristics are not a linear function of the displacements of the controlling device. These devices make it often necessary to employ complicated shapes for certain elements of the said oscillation-circuit and to increase their dimensions.

The object of the present invention is to provide a control-device for controlling the displacements of an adjustable element of an electric oscillation-circuit, control-device which control-device eliminates the disadvantages mentioned above, due to the fact, that the said adjustable circuit-element is mechanically connected to the control device by the intermediary means of at least one transmission-member having a transmission-ratio variable according to a continuous function of the position of the control-device.

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Another object of the invention is to provide a control-device by which the adjustable element of the oscillation-circuit is displaced in a translatory manner with respect to the stationary part of the circuit and is connected mechanically to a control-device by the intermediary means of at least one transmission-member having a transmission-ratio varying according to a continuous function of the position of the control-device.

The said adjustable element may be fixed on a shaft arranged to slide in an axial direction, or arranged to rotate with respect to the stationary part of the circuit. Further this shaft may be displaced in a combined translatory and rotational manner with respect to the stationary part of the circuit, whereby these two displacements of the shaft may be constrained.

The attached drawings show schematically and by way of example several forms of this invention.

Figures 1 to 5 shows a control-device adapted for controlling the displacements of the movable armature of a variable condenser.

Figure 2 shows a cross-section along the line A—B of Fig. 1.

Figure 3 shows a longitudinal cross-section of a second form of execution of the control-device.

Figure 4 is a cross-section along the line C—D of Figure 3, and

Figure 5 is a cross-section along the line E—F of the same figure.

Figures 6, 7 and 8 show axial cross-sections of three other forms of the control-device.

In the forms of invention represented by the Figs. 1 and 2 the device is applied to a variable condenser comprising mobile and stationary armatures, these armatures being formed of a number of metallic, co-axial and concentric cylinders limited at their ends by planes perpendicular to their generating lines. The mobile armatures are displaceable axially in such a manner as to have the cylinder-electrodes of the mobile armature penetrate between the cylinder-electrodes of the stationary armature. In this type of condenser, the variations of the capacity is a linear function of the axial displacement of the mobile armature and the variation of the frequency of the circuit of which it forms part is a non-linear function of this displacement.

In the example shown in Figures 1 and 3, the stationary armatures of the condenser comprise circular plates 11 carrying the stationary cylin-

ders 12, the plates 11 being fastened to the housing 13 by means of several insulators 14. In the end-walls 15 of the housing are provided two bearings 16, in which a shaft 17 carrying the mobile armatures can move freely. Each of the mobile armatures is provided with a circular plate 18 carrying a series of cylinders 19 which penetrate between the stationary cylinders 12. In one of the bearing-bodies is fastened a shaft 20 on which turns freely a pulley 21 provided with groove 22 intended for receiving a cable 23 actuated by a control-device 24. This pulley is provided with a helicoidal ramp 25 of variable pitch in contact with one end of the shaft 17 and controlling the longitudinal displacements of the same. A spring 26 located between one of the bearings and the mobile armature tends to maintain the shaft in contact with this ramp, the pitch of which is so chosen as to alter the capacity according to a given function of the angular displacements of the pulley 21, which displacements are controlled by the displacements of the control device.

In the form of invention described, the capacity of the condenser is a linear function of the axial displacements of the mobile armature with respect to the stationary armature, but this mobile armature is connected to the control-device by the intermediary of a transmission-device provided with the helicoidal ramp of variable pitch 25. For this reason the transmission-ratio of the displacements between the control-device and the mobile armature is a function of the relative positions of the mobile and stationary armature. The pitch of the ramp may vary according to any continuous function and may be chosen in such a manner, that the variation of the capacity as a function of the displacements of the control-device follows a predetermined continuous curve. The control-device may comprise a knob 27 equipped with an index-pointer 28 indicating directly on a dial 29 the frequencies of the circuit of which the condenser constitutes a part. In an alternative form of invention, the cable connecting the pulley 21 to the control-device may carry an index-pointer which is displaced transversely over a graduated dial. The control-device may furthermore be constituted by a hand operated knob fixed to the pulley 21.

In the form of invention represented by the Figures 3, 4 and 5 the condenser is constituted by half-cylindric plates 30 and 31, limited by a plane passing through two generating lines. The mobile armature comprises a half-circular plate 32 fastened to the shaft 17 which turns in the bearings 16. In this case the variation of the capacity is a function of the angular displacements of the mobile armature with respect to the stationary armature. The intermediate transmission device effecting a variable transmission-ratio according to the relative positions of the mobile and stationary armatures, is constituted by a pulley 33 with a spiral groove, fastened to the shaft 17 and driven by a cable, which is fixed at one of its ends to the periphery of the pulley and at its other end to a control-device not shown on the drawing. The radius of the groove of the pulley is variable and increases in a continuous manner. The variation of the transmission-ratio of the displacements between the control-device and the armature is a function of the law governing the increase of the radius of the pulley and may therefore correspond to a predetermined continuous function. A spring 34, one end of which is fixed to the pulley 33 and the other end to the wall 15 assures the tension of the cable.

In the form of invention represented in the Figures 6, 7, and 8, the shaft 17 operating the variable element of the oscillation-circuit executes a combined translationary and angular displacement. In the form of invention shown in Fig. 6, the shaft 17 carries a thread of constant pitch in which engages a finger 35 fastened to one of the bearing-bodies. The angular displacements of the mobile armature or any adjustable element of the oscillation-circuit are therefore directly proportional to these axial displacements. The intermediate transmission-device enabling the variation of the transmission-ratio of the displacements between the control-device and the mobile armature is formed by a pulley 36 provided with a helicoidal groove 37 of progressively increasing radius, this groove receiving a cable connected to a control-device. This pulley not only constitutes a transmission-device of variable ratio, but also a speed reducer, since the total axial course of the mobile armature necessitates several revolutions of the pulley 36.

In the form of invention shown in Fig. 7, the intermediary transmission-device is constituted by a helicoidal groove 38 of variable pitch provided in the shaft 17, with which groove engages a finger 39 fixed to the bearing-body 16. The shaft is driven by a pulley with a circular groove 40. In an alternative form of this form of invention, the helicoidal groove could be provided in the body of the bearing 16 and the finger could be fixed to the shaft 17.

In the form of invention represented in Figure 8, the shaft 17 slides freely in the bearings 16. On this shaft is fixed a cam 41 provided with a helicoidal ramp, the pitch and the radius of which are progressive. A circular disc 43 turning and sliding freely on a fixed shaft 44 is maintained in contact with this ramp 42 by means of a spring 45 and by means of another spring 49 placed on the shaft 17 and abutting a portion of the housing 13 (not shown). The spring 45 may be omitted if the ramp is provided with an exterior collar guiding the disc 43. The shaft 17 is driven by a pulley 46 with circular groove, connected by a cable to a control-device (not shown). The intermediary transmission device of variable ratio, constituted by the cam 41 is also a speed-reducer. The angular and axial displacements of the mobile armatures are limited by stops 47 fixed to the housing and against which come to bear the pins 48 provided on the periphery of the cam. In an alternative form, the cam may be fastened to the housing and the disc may turn and slide on a shaft fixed to the shaft 17.

I claim:

1. In an electric oscillating circuit comprising a mechanically adjustable tuning element, control means for controlling the position of said tuning element, and a mechanical transmission device for transmitting movement from said control means to said tuning element, said transmission of movement taking place with a variable transmission ratio varying continuously from one position to another of said control means, said mechanical transmission device comprising a shaft, means for rotating said shaft, a revolving cam provided with a contact ramp and mounted on said shaft, a mechanical contact member contacting said cam on said ramp, and resilient means urging the ramp of said cam axially against said contact member, said shaft

driving said tuning element, wherein said ramp of said cam has the shape of a spirally wound helicoid with two independent parameters, said helicoid extending over substantially more than one complete turn around said shaft, one of said two parameters varying as a continuous function of the angle measured around the axis of said shaft, whereby there is produced a transmission of movement with continuously varying transmission ratio and where a very large angle of rotation of said cam is made to correspond to a very small displacement of said tuning element in said oscillating circuit.

2. In an electric oscillating circuit, a transmission device according to claim 1, wherein the second parameter of said spirally wound helicoid varies as a continuous function of the angle measured around the axis of said shaft.

3. In an electric oscillating circuit, a mechanical transmission device according to claim 1 wherein said tuning element is mounted rigidly on said shaft.

4. In an electric oscillating circuit, a mechanical transmission device according to claim 1, wherein the generating line of said helicoid has a portion directed substantially in a radial direction relative to the axis of the helicoid, the spirally wound helicoid thus provided being adapted to cooperate with the contact member to transmit a substantial axial thrust upon rotation, said thrust causing an axial displacement of said cam and shaft.

5. In an electric oscillating circuit a mechanical transmission device according to claim 1, wherein the generating line of said helicoid has a portion directed substantially in a radial direction relative to the axis of the helicoid, the spirally wound helicoid thus provided being adapted to cooperate with the contact member to transmit a substantial axial thrust upon rotation, said mechanical contact member being mounted slidably on a stationary guiding surface directed substantially at right angles with said shaft, said resilient means acting axially on said shaft, said thrust causing an axial displacement of said cam and shaft.

6. In an electric oscillating circuit a mechanical transmission device according to claim 1, wherein the generating line of said helicoid has a portion directed substantially in a radial direction relative to the axis of the helicoid, the spirally wound helicoid thus provided being adapted to cooperate with the contact member to transmit a substantial axial thrust, said mechanical contact member being a roller mounted revolubly and slidably on a stationary stub shaft directed substantially at right angles with said shaft, said roller being backed by a spring urging same towards said shaft, said ramp of said cam being kept in contact with the rim of said roller by the resilient means acting axially on said shaft, said thrust causing an axial displacement of said cam and shaft.

7. In an electric oscillating circuit comprising a mechanically adjustable tuning element, control means for controlling the position of said tuning element, and a mechanical transmission device for transmitting movement from said control means to said tuning element, said transmission

of movement taking place with a variable transmission ratio varying continuously from one position to another of said control means, said mechanical transmission device comprising a shaft, means for rotating said shaft, a cam provided with a contact ramp and mounted coaxially with respect to said shaft, a mechanical contact member contacting said ramp on said cam and resilient means urging said ramp of said cam and said contact member against one another, said ramp of said cam having the shape of a spirally wound helicoid with two independent parameters, said helicoid extending over substantially more than one complete turn around said shaft, one of said two parameters varying as a continuous function of the angle measured around the axis of said shaft, whereby there is produced a transmission of movement with continuously varying transmission ratio and where a very large angle of rotation of said control means is made to correspond to a very small displacement of said tuning element in said oscillating circuit.

8. In an electric oscillating circuit comprising a mechanically adjustable tuning element, control means for controlling the position of said tuning element, and a mechanical transmission device for transmitting movement from said control means to said tuning element, said mechanical transmission device comprising a rotary element actuated by said control means, a cam member mounted coaxially with respect to said rotary element and having a contact ramp in the form of a conical spiral extending through an arc of more than 360°, a mechanical contact member contacting said ramp on the cam member, resilient means urging said cam ramp and said contact member into contact with each other, means driven by the rotary element for effecting relative rotation between the contact and cam members about the axis of the rotating element, and means for transmitting motion, resulting from the camming action between said ramp and contact members on relative rotation, to said tuning element.

CHARLES PITON.

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