

Feb. 20, 1945.

F. S. MABRY

2,370,056

ELECTRIC POSITION INDICATOR

Filed July 4, 1942

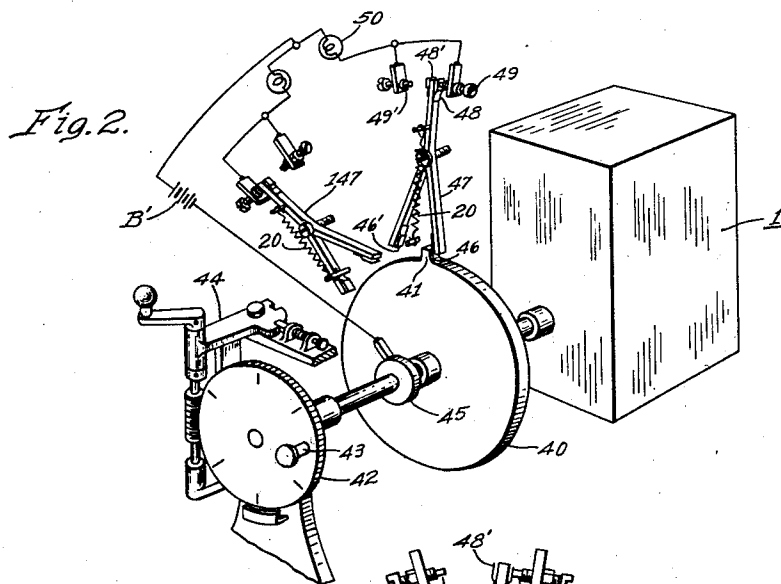
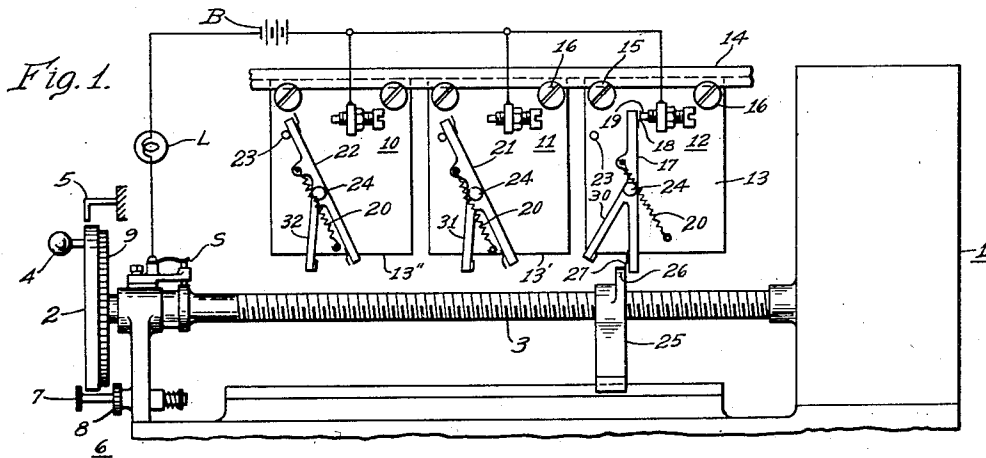
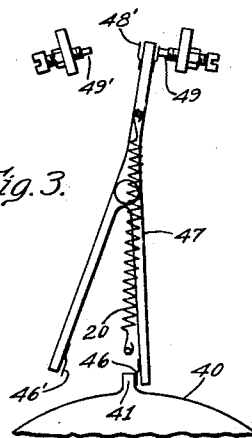


Fig. 3.



WITNESSES:

Lo J. Willey.
Wm. C. Gosnell

INVENTOR

Forrest S. Mabry.

BY

Paul E. Friedemann
ATTORNEY

UNITED STATES PATENT OFFICE

2,370,056

ELECTRIC POSITION INDICATOR

Forrest S. Mabry, Catonsville, Md., assignor to
Westinghouse Electric & Manufacturing Com-
pany, East Pittsburgh, Pa., a corporation of
Pennsylvania

Application July 4, 1942, Serial No. 449,703

12 Claims. (Cl. 177—311)

My invention relates to electric position indicators and, more particularly, to electric means for accurately tuning radio equipment.

In many radio transmitter tuning dials, as high as fifty revolutions on the control dial are required to tune from one end of the tuning band to the other end of the tuning band. In actual use, there are really only a few definite points in the entire tuning band that are normally used, and it is very helpful if these relatively few points can be quickly and accurately indexed. Mechanical "clicker" devices for such tuning are known in the prior art, but these devices are not sufficiently accurate.

One broad object of my invention is to electrically indicate with accuracy the location of a machine element.

A more specific object of my invention is the provision of means for electrically indicating with accuracy when radio equipment, in the tuning operation thereof, has been tuned to a selected wave length.

The foregoing recited objects are merely illustrative, and many other objects of my invention will, no doubt, become apparent from a study of the following specification and the accompanying drawing, in which:

Figure 1 is a side view of one embodiment of my invention;

Fig. 2 is a perspective view of a modification of my invention; and

Fig. 3 is an enlarged detail of a portion of the subject-matter of my invention shown in Fig. 2.

To facilitate the disclosure of my invention, I have shown the elements somewhat diagrammatic.

In Fig. 1, 1 designates the tuning equipment for a radio transmitter, or for that matter any other type of tuning equipment, or other machine, having elements the exact location of which during operation is to be determined.

To operate the tuning equipment, I show a handwheel 2 for operating the shaft 3 which, in turn, operates the mechanisms of the tuning equipment. The handwheel has the actuating handle 4 and is usually provided with graduations on its face, or edge, or both, for coacting with the index 5. To save time, the handwheel is rapidly operated to about the desired tuning position and then the vernier mechanism 6 may be actuated to slowly and accurately operate the tuning equipment.

The vernier equipment may, of course, take any desirable form, but as shown includes a spring biased shaft having an operating knob 7 and a

pinion 8 for engaging the gear teeth 9 on the handwheel 2. By slowly moving the knob, a very slow tuning operation may be effected.

To accurately indicate when a certain tuning operation is effected, I provide a plurality of adjustably mounted position indicators generally indicated by 10, 11 and 12, respectively. These units are all alike and a description of one will thus suffice.

The base 13 is slidably mounted in the sub-base 14, and when the apparatus is set up, the base is moved to the exact desired position and then clamped in position on the sub-base by the heads of screws 15 and 16.

On the base, I pivotally mount a lever 17. This lever is normally biased by spring 20 to the position shown at the right in Fig. 1, in which position contacts 18 and 19 will be in engagement. When the lever has been actuated, the lever will trip counter-clockwise to a position as shown for levers 21 and 22. The lever then makes contact with stop 23, and the biasing force of spring 20 now is to the left of pivot 24. The lever thus remains in the counter-clockwise position.

The position indicating circuit includes a battery B, a light L, a slip-ring assembly S, the shaft 3, which is threaded as shown to receive the conductive traveling nut 25, contact 26 on nut 25, contact 27 on lever 17, lever 17, contact 18 on lever 17, adjustable contact 19, back to the battery.

A better understanding can, no doubt, be had from a study of a typical operation. Suppose an accurate tuning is to be effected for the position to be indicated by lever 17. The attendant operates handwheel 2 through knob 4 until nut 25 is in the neighborhood of lever 17, but preferably still to the left of this lever. Then through suitable actuation of the vernier mechanism, the nut 25 is slowly moved toward the right. As soon as the correct position is attained, contacts 26 and 27 close thus establishing the circuit hereinbefore traced. A very accurate indication of the correct point is thus indicated by signal light L, because the rigid pivoted lever 17 permits the closure of contacts 18 and 19 and 26 and 27 only over an extremely short excursion of nut 25. For example, if nut 25 is still to the left of the correct position by as little as 0.001 of an inch, the circuit for signal light L would be open at contacts 26 and 27, and if the nut 25 is moved to the right of the correct position by as little as 0.001 of an inch, the circuit for the signal light L would be opened at contacts 18 and 19. Thus, the accuracy of the indication, depending of course on

the accuracy of making the various parts, would be of the order of ± 0.001 inch.

This degree of accuracy may be excessive in some cases so that it may be desirable to make the contacts 18 and 27 more or less resilient, as shown. This will give a greater tolerance to the position of nut 25 during which the signal light would be energized, and thus a greater tolerance in the tuning whenever such tuning tolerance is permissible.

I have shown a plurality of indicating positions as is evidenced by levers 21 and 22. As nut 25 is moved to the right, all those levers to the left of nut 25 will be tripped, as shown. On return movement of the nut 25, the nut engages the arms 30, 31, 32, etc., to set all the levers.

To make the device operative in either direction, the levers 17, 21, 22, etc., may be modified as shown in Fig. 3. The levers need not necessarily be actuated by a traveling nut, but may be actuated by a suitable disc, as disc 40 shown in Fig. 2, having one or more projections, as projection 41.

In the showing in Fig. 2, the levers are all mounted for individual circumferential adjustment about disc 40 on individual bases (not shown to clarify the disclosure) corresponding to the bases 13, 13' and 13'' shown in Fig. 1.

To effect accurate tuning, the handwheel 42 is first actuated directly by knob 43 until projection 41 is somewhere near the desired position, which position can be read off the graduations on the handwheel in relation to the fixed index shown. The vernier mechanism 44 may then be clutched to handwheel 42 and manipulated to slowly move the disc 40 to the correct position.

At the instant the desired tuning is effected, a circuit is established from battery B', the slipping assembly 45, the disc 40, projection 41, contact 46 which may be slightly resilient, lever 47, contact 48 which may also be slightly resilient, adjustable contact 49, signal light 50 to the battery B'. Again, if the projection, or contact, 41 is just short of the desired position, contacts 41 and 46 are open, and when a trifle too far in the clockwise position, contacts 48 and 49 are open.

To make the indication equally effective for either direction of rotation, it is clear that contacts 46', 48' and 49' should be so positioned that the contacts 48' and 49' and contacts 41 and 46' are closed, on counter-clockwise rotation, when projection 41 is in exactly the same mechanical position as it was when contacts 41 and 46 and 48 and 49 were closed. That this can readily be done can be seen from Fig. 3. When the projection is in clockwise position beyond the position shown, the lever 47 will take a position such as is shown for lever 147 in Fig. 2. Then upon rotation of disc 40 in the counter-clockwise direction, contacts 41 and 46' and 48' and 49' will close when contact 41 is in exactly the same position it held when contacts 41 and 46 and 48 and 49 were closed.

In the modification shown in Fig. 2, each tuning position may be provided with its own signal light. The lights may have different colors, have different illuminated numbers or other indicating indicia adjacent the lights.

In both modifications, it is, of course, clear that the needed electric insulation is provided in the locations desired so that no stray electric circuits are provided.

From the foregoing, it will be seen that I have provided an electric system for accurately indicating the position of a machine element, but I do not wish to be limited to the specific showing

made but wish to be limited only by the scope of the claims hereto appended.

I claim as my invention:

1. In an electric system, in combination, a source of electric energy, an electric device having a characteristic indicating when the device is energized, and an electric circuit for connecting the electric device to the source of energy, said circuit including a stationary contact, a rotatable member, an overcenter-type spring for biasing the rotatable member when said member is in one position for clockwise rotation and when said member is in another position for counter-clockwise rotation, a first switch contact on the rotatable member facing said stationary contact and making contact with the stationary contact when the member is biased for clockwise rotation, a movable contact for rotating said rotatable member in a counter-clockwise direction to interrupt the connection between the first switch contact and the stationary contact, a second switch contact on the rotatable member, electrically connected to the first switch contact, said second switch contact being disposed in the path of the movable contact, whereby a circuit is established for the electric device through the movable contact, the two switch contacts on the rotatable member and the stationary contact only when the movable contact has just made contact with the second switch contact on the rotatable member but has not yet rotated the rotatable member sufficiently to interrupt the connection between the stationary contact and the said first switch contact.

2. In an electric system, in combination, a source of electric energy, an electric device having a characteristic indicating when the device is energized, and an electric circuit for connecting the electric device to the source of energy, said circuit including a stationary contact, a rotatable member, an overcenter-type spring for biasing the rotatable member when said member is in one position for clockwise rotation and when said member is in another position for counter-clockwise rotation, a first switch contact on the rotatable member facing the stationary contact and making contact with the stationary contact when the member is biased for clockwise rotation, a movable contact for rotating said rotatable member in a counter-clockwise direction to interrupt the connection between the first switch contact and the stationary contact, a second switch contact on the rotatable member, electrically connected to the first switch contact, said second switch contact being disposed in the path of the movable contact, whereby a circuit is established for the electric device through the movable contact, the two switch contacts on the rotatable member and the stationary contact only when the movable contact is moved through an extremely small range of its total range of movement, and means on the rotatable member for resetting the position thereof by the movable contact, if it is in the overcenter counter-clockwise position, by a return movement of the movable contact.

3. In an electric circuit system, the sub-combination of, a bifurcated electrically conductive lever pivoted near the base of the bifurcation, two stationary contact members, one disposed at each side of the nonbifurcated end of the bifurcated lever, a spring of the overcenter-type for biasing the lever so that the nonbifurcated end contacts either one or the other of said stationary contact members depending on the position of the lever, a movable contact member when in a given posi-

tion adapted to engage the inner side of the end of one bifurcation when the lever is in one position and when the movable contact is in the same given position adapted to engage the inner side of the end of the other bifurcation when the lever is in its other position.

4. In an electric circuit system, the subcombination of, a bifurcated electrically conductive lever pivoted near the base of the bifurcation; a stationary contact member disposed at one side of the nonbifurcated end of the bifurcated lever; a spring of the over-center type for biasing the lever so that the nonbifurcated end contacts the stationary contact member or is biased away from the stationary contact member depending on the position of the lever; a movable contact member when in a given position adapted to engage the inner side of the end of one bifurcation when the lever is in one position and adapted to engage the inner side of the end of the other bifurcation when the lever is in its other position.

5. In an electric system for indicating the position of a machine element, in combination, a source of electric energy, an electric signal device, a pair of switches which when both are closed establish a circuit from the source of energy, through the two switches, through the electric signal device back to the source of electric energy, said switches including a bifurcated lever, a stationary contact member disposed at one side of the nonbifurcated end of the lever, a spring of the overcenter-type for biasing the lever so that the nonbifurcated end contacts the stationary contact member or is biased away from the stationary contact member depending on the position of the lever, a movable machine element, the position of which is to be indicated, a contact, mounted on the movable machine element, adapted to engage the inner side of the one end of the bifurcation as the machine in its movement arrives at a given position and adapted to trip the lever to open the circuit between the lever and the stationary contact member as the machine element moves beyond the said given position, said contact on the machine element being adapted to engage the inner side of the end of the other bifurcation when the lever is in its tripped position and the machine element is moving in a reverse direction.

6. In an electric system for indicating the position of a machine element, in combination, a source of electric energy, an electric signal device, a pair of switches which when both are closed establish a circuit from the source of energy, through the two switches, through the electric signal device back to the source of electric energy, said switch including a bifurcated electrically conductive lever pivoted near the base of the bifurcation, two stationary contact members, one disposed at each side of the nonbifurcated end of the bifurcated lever, a spring of the overcenter-type for biasing the lever so that the nonbifurcated end contacts either one or the other of said stationary contacts depending on the position of the lever, a movable machine element, a contact on the machine element adapted to engage, as the machine element moves in one direction, the inner side of the end of one bifurcation to establish a circuit for the signal device when the machine element has arrived at a given position and to trip the lever to its other position if the movement of the machine element is continued beyond the given position, whereby only a very transient circuit is established for the signal device, said contact on the machine ele-

ment being adapted to engage, as the machine element is being returned by a movement in the opposite direction, the inner side of the end of the other bifurcation to establish a circuit for the signal device when the machine element has in its return movement again arrived at the said given position and to trip the lever to its original position if the return movement of the machine element is continued to a point ahead of said given position, whereby again only a very transient circuit is established for the signal device.

7. In a system of control for tuning radio equipment, in combination, a tuning mechanism, a machine element movable as a function of the tuning mechanism, said radio equipment having a plurality of tuning positions, a plurality of means for indicating the tuning positions, said means including a source of energy, a signal device, and, for each tuning position, a stationary contact, movably mounted switching means biased to make contact with the stationary contact, a second movable switching means operable to move the first movable switching means to break the contact with the stationary contact, but which second movable switching means at the instant when it first makes contact with the first movable switching means closing a transient circuit to indicate the particular tuning position to be indicated, the circuit being transient only if the movement of the second movable switching means when first contacting the second movable switching means is greater in the direction of its movement than a relatively small fraction of its entire range of movement.

8. In an electric system, in combination, a sub-base, a base, means for fixing the base in any one of a plurality of adjusted positions on the sub-base, electric means for indicating the position of adjustment of the base with reference to the sub-base, a contact fixed on the base, a pivoted conducting bar on the base, said bar having a given range of angular movement and being biased so that one side near one end engages the contact, a movable contact on the sub-base, said movable contact having a path of movement on the sub-base so that it can make contact with the opposite side and opposite end of the conducting bar, regardless of the position of adjustment of the base with reference to the sub-base, to rotate the bar against its bias to thus, the instant the bar is engaged, interconnect the source of supply and the means for indicating the position of adjustment of said base on the sub-base and to break this interconnection by any rotation of the bar in excess of a small angular rotation with reference to the total range of angular movement of said bar.

9. In an electric system, in combination, a source of energy having two terminals, an electric device, a circuit for connecting said device to said source of energy, said circuit including a stationary contact connected to one terminal of said source of energy, a movable conducting bar, having a given range of movement, biased to engage the stationary contact at one point, and a movable contact, connected to the other terminal of said source, movable in a direction to engage the conducting bar at another point and to move the conducting bar to immediately break the contact between the stationary contact and the conducting bar upon a small movement of the conducting bar with reference to its total range of movement.

10. In an electric system, in combination, a sub-base, a base, means for fixing the base in any

one of a plurality of adjusted positions on the sub-base, electric means for indicating the position of adjustment of the base with reference to the sub-base, a resilient contact fixed on the base, a pivoted conducting bar on the base, said bar having a given range of angular movement and being biased so that one side near one end engages the contact, a resilient movable contact on the sub-base, said movable contact having a path of movement on the sub-base so that it can make contact with the opposite side and opposite end of the conducting bar, regardless of the position of adjustment of the base with reference to the sub-base, to rotate the bar against its bias to thus, the instant the bar is engaged, interconnect the source of supply and the means for indicating the position of adjustment of said base on the sub-base and to break this interconnection by any rotation of the bar in excess of a small angular rotation as determined by the resilient character of the contacts with reference to the total range of angular movement of said bar.

11. In an electric system, in combination, a source of electric energy, an electric signal device, and a circuit for connecting the electric signal device to the source of electric energy, said circuit including a stationary contact, a substantially rigid conducting bar pivoted intermediate its ends and biased for rotation about its pivot in one direction so that said bar makes contact with one side of one of its ends with the stationary contact, and a movable contact disposed to move into engagement with the other side of the other end of the bar, and means for moving the movable contact to rotate the pivoted bar counter to its bias, whereby a circuit is established for the signal

device only when the movable contact is moved sufficiently to engage with the said other side of the other end of the bar but not sufficiently to rotate the bar to break the contact it makes with the stationary contact.

12. In a system of control for the tuning of radio equipment, in combination, a tuning mechanism; a machine element movable in proportion to the tuning mechanism; said radio equipment having a plurality of means indicating tuning positions, said means including a source of energy, a signal device, and, for each tuning position, a stationary contact and a switch member pivoted intermediate its ends, said switch member having a contact on one side at one end, said switch member being biased about its pivot point so that the contact it has on one side at one end engages the stationary contact, said switch member having a second contact on the other side at the other end disposed in the path of said machine element; and a contact on the machine element disposed to successively contact the second contact on each of the switch members to establish, at each tuning position, an energizing circuit for the signal device when the machine element in its movement in a given direction has arrived at a given tuning position but operable, upon causing the slightest rotation of the switch member counter to its bias by continued movement of the machine element in the given direction, to open the circuit for the signal device, and, upon the slightest movement of the machine element from a given tuning position in a direction opposite to the given movement, to open the circuit for the signal device.

FORREST S. MABRY.