

March 21, 1944.

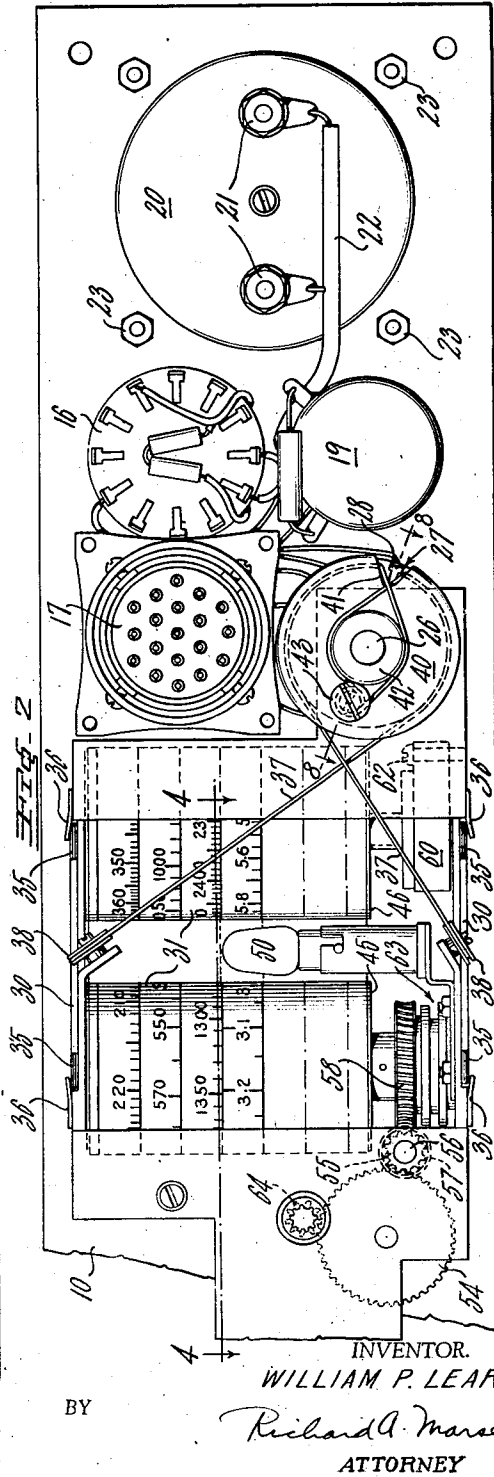
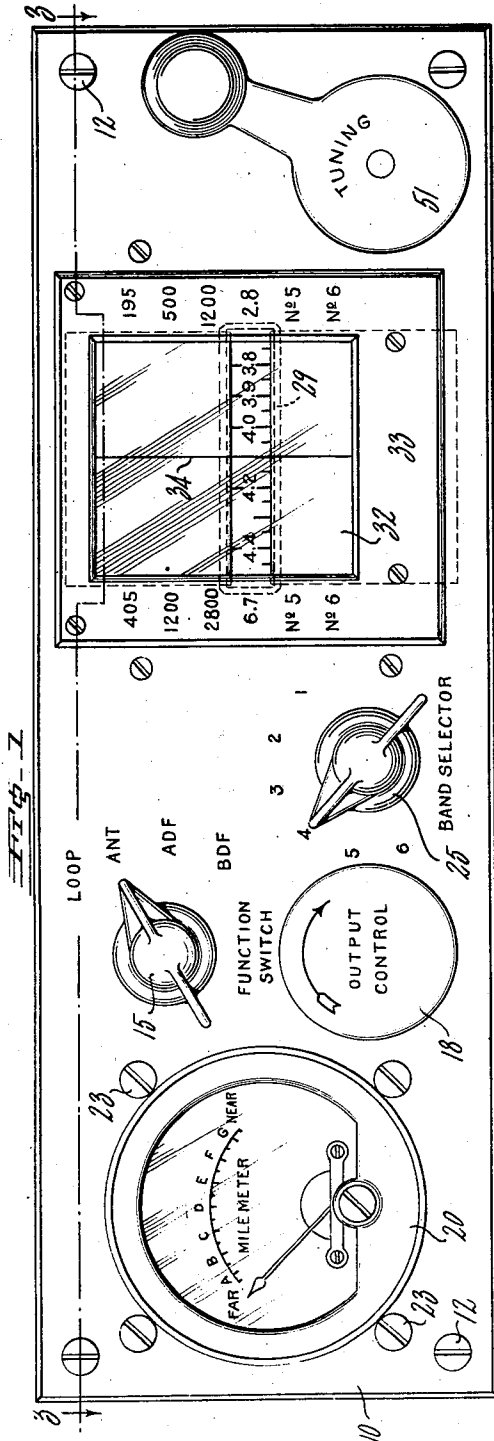
W. P. LEAR

2,344,825

RADIO TUNING MECHANISM

Filed Feb. 12, 1941

3 Sheets-Sheet 1



BY

INVENTOR.
WILLIAM P. LEAR
Richard A. Morse
ATTORNEY

March 21, 1944.

W. P. LEAR

2,344,825

RADIO TUNING MECHANISM

Filed Feb. 12, 1941

3 Sheets-Sheet 3

Fig. 4

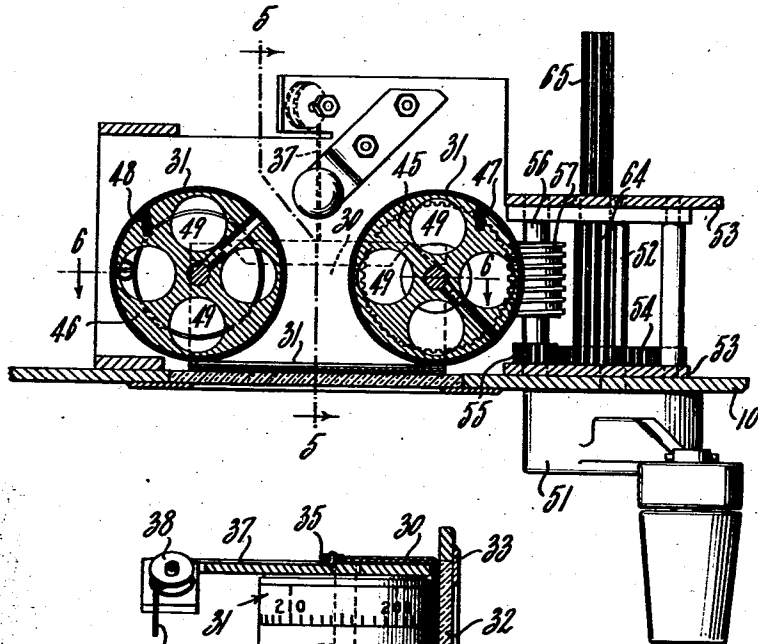


Fig. 5

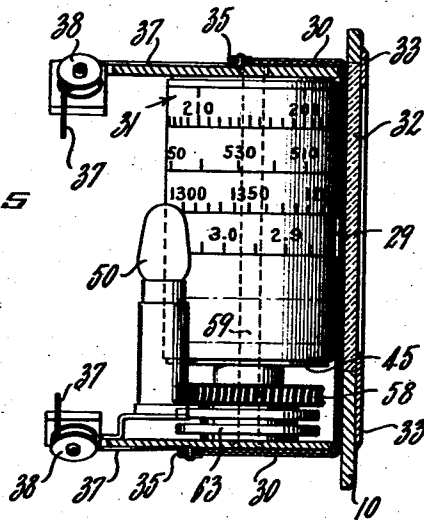
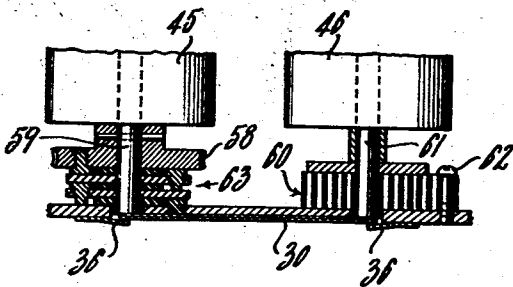


Fig. 6



BY

INVENTOR
WILLIAM P. LEAR

Richard A. Marston
ATTORNEY

UNITED STATES PATENT OFFICE

2,344,825

RADIO TUNING MECHANISM

William P. Lear, Dayton, Ohio, assignor, by mesne assignments, to Lear Avia, Inc., Piqua, Ohio, a corporation of Illinois

Application February 12, 1941, Serial No. 378,490

8 Claims. (Cl. 116—124.1)

This invention relates to radio tuning systems, and more particularly to improved arrangements for remotely controlling the operation and tuning of radio apparatus.

In accordance with the present invention, a control unit is provided remote from the main radio chassis for operating the band setting and tuning therefor. A tuning indicator is provided for accurately indicating the frequency to which the radio system is adjusted. A selector knob is used to connect the remote radio circuits for operation on one of the plurality of radio bands. An important feature of the present invention is the novel tuning indicator coupled to both the band selector and tuning control. A curtain or shutter is arranged to block out all but the tuning scale corresponding to the selected band. The scales are relatively long and are mounted on drums motivated by the tuning. The frequency indications on the long scales are thus spread out so that a busy pilot has no difficulty in reading them. Accurate and convenient remote control of a complex radio system is thus afforded.

The above and other features, advantages, and capabilities of the invention will become more apparent in the following description of a specific embodiment thereof illustrated in the accompanying drawings, in which:

Fig. 1 is a front elevational view of the radio control unit.

Fig. 2 is a rear view of the control unit, with the housing removed.

Fig. 3 is a plan view, partly in section, horizontally across the control unit along the line 3—3 of Fig. 1.

Fig. 4 is a horizontal cross-sectional view through the tuning indicator mechanism, taken along the line 4—4 of Fig. 2.

Fig. 5 is a vertical sectional view of the indicator mechanism, taken along the line 5—5 of Fig. 4.

Fig. 6 is a cross-sectional view through a detail of the tuning mechanism, taken along the line 6—6 of Fig. 4.

Fig. 7 is a rear view of the portion of the band selector unit as seen at 7—7 of Fig. 3.

Fig. 8 is an enlarged sectional view through a detail, taken along the line 8—8 of Fig. 2.

The illustrated embodiment of the remote control unit is particularly designed for a multiple band automatic radio direction finder system, such as disclosed in my Patent No. 2,317,922 dated April 27, 1943, for "Directional radio system," which is assigned to the same assignee as

is this case. The control unit is rectangular in form, and made compact for placement on or at the pilot's instrument panel of an aircraft. The remainder of the radio apparatus is remote therefrom. Referring particularly to Figs. 1, 2 and 3, the control unit is enclosed by a panel 10 and a dust cover or casing 11. The panel is attached to casing 11 with screws 12 cooperating in threaded inserts 13. Inserts 13 are secured to housing 11 by pins 14.

A function switch 15 is arranged to control the circuitual operation of the radio apparatus or direction finder in any one of several predetermined conditions. Four such positions are indicated at follows: LOOP, referring to manual directional reception with a loop antenna only (during static conditions); ANT, for non-directional reception with a directional antenna only; ADF, for normal uni-directional automatic direction finder operation; and BDF, for automatic bi-directional reception employing two loop antennae (during static conditions). The function switch knob 15 is mechanically connected to four-position multiple-contact switch 16. Switch 16 contains a plurality of projecting lugs 16' which are suitably electrically connected to the remotely located radio chassis through an electrical cable. Such cable is not indicated in the drawings. It is attached to the unit through multiple contact plug 17. Details of circuit connections of the control unit are not illustrated, but are understood by those skilled in the art as dependent upon particular radio circuit arrangements employed.

A level or output control knob 18 is directly coupled to potentiometers contained within housing 19. The terminals of the potentiometers are in circuit connection with plug 17, for suitable connection in the radio circuit of the aforementioned cable. The cable is provided with a plug mate for plug 17 to properly connect with the electrical components. An indicator 20 is connected in the automatic volume control circuit of the set, or equivalent position for indicating the relative signal strength of the received signal. Indicator 20 is in effect a relative distance indicator or milemeter. Terminals 21 of meter 20 are respectively connected in the circuit through cable 22. Meter 20 is mounted on panel 10 by screws 23.

The direction finder or radio apparatus is designed for operation on a plurality of ranges or frequency bands. A band selector knob 25 is provided to change the operation of the system to one of several predetermined radio frequency

bands. Six separate bands are shown in the illustrated embodiment, denoted by individual position numbers 1 to 6 on panel 10. Band selector 25 is secured to a rod 26 extending into the control unit. A six-position multiple contact switching unit 27 is mechanically coupled to rod 26. A plurality of connection lugs 28 extend from switching unit 27. Fig. 7 shows a rear view of switching unit 27. Connection wires are soldered to lugs 28 in accordance with the circuit design and as required to effect the respective band switching positions. The wires extend to corresponding connections in multiple plug 17, and the corresponding cable connected to the remote radio chassis. The connections for effecting the band switching changes are not detailed herein, since such details are otherwise known in the art. Plug 17 is supported in the unit, and reenforced in position by screws through posts 39 attached in casing 11. Shielded wires 17' as seen in Fig. 3 extend from the rear of plug 17.

An important feature of the present invention resides in the novel arrangement for simultaneously changing the tuning indications to correspond with the radio frequency band selected. A dial is provided with a plurality of scales calibrated for each of the respective bands. A movable curtain or shutter 30 is arranged to cooperate with dial sheet 31. Dial sheet 31 contains a plurality of calibrated scales. Curtain 30 has a central rectangular opening 29, designed to expose any one of the plurality of scales on dial sheet 31. Curtain 30 is of flexible material, such as fabric. Its position is controlled by band selector 25 to expose the particular scale corresponding to the selected radio frequency band. The selected position shown in Fig. 1 is for band No. 4, corresponding there to the radio frequency band 2.8 to 6.7 megacycles.

The calibrated scales are individually visible through an opening in panel 10 into which a transparent pane 32 is mounted. A rectangular escutcheon plate 33 is attached to the panel, indicating the frequency range corresponding to the adjacent scales, and holding pane 32 in place. A vertical index line 34 is marked on pane 32, serving as the common index for the scales. The scales are moved past index 34 in the tuning, and correspond to the frequency of the remotely tuned radio circuits.

A metal bar 35 is secured to each end of curtain 30. Bars 35 cooperate in tracks or guide strips 36, 36 mounted on a section of the frame. A cord 37 is attached to each end of curtain 30, extending about respective pulleys 38, 38 and pulley 40. Pulley 40 is secured to band selector rod 26 for rotation with selector knob 25 and multi-contact switch 27. Cord 37 is preferably of silk to provide high tensile strength and reliable serviceability under varying weather and humidity conditions. Cord 37 is wound about the groove of pulley 40. The central section of cord 37 is passed through a V-notch 41 in pulley 40, and reentrantly wound about hub 42 of the pulley anchored in post 43. Post 43 contains a hole through which the doubled-up central region of cord 37 is passed. The end 44 of post 43 is peened over to rotatably carry it on pulley 40. Post 43 is rotated to tighten cord 37 in position around pulley 40, whereby its assembly with curtain 30 is rendered taut.

Rotation of selector knob 25 in its six positions correspondingly rotates pulley 40, carrying cord 37 around the peripheral groove of the pulley

and correspondingly moving curtain 30 in accordance with the positions thereof. Uniform radial movements of pulley 40 for the respective band positions are translated into equal linear movements of curtain 30 through cord 37 to properly position its central opening 29 opposite a selected one of the equally spaced scales on dial 31. Thus, for any one of the plurality of distinct positions of selector knob 25, the tuning circuits in the remote radio chassis are connected to correspond to the respective radio frequency bands by switch 27, and curtain 30 is moved to expose the calibrated scale corresponding to the selected radio frequency band. The dotted position 30' in Fig. 3 indicates a displaced position of curtain 30 from that otherwise illustrated.

Another important feature of the present invention resides in extending the individual frequency indicating scales over a long linear path, whereby the individual frequency positions are readily readable by an otherwise busy pilot. An effective band spreading arrangement results, greatly facilitating accurate selection and tuning-in of radio stations by the pilot. Dial sheet 31 is a sheet of translucent material onto which the individual calibrated scales are marked. Dial sheet 31 is wound about two cylindrical drums 45, 46. The ends of dial 31 are anchored in respective slots 47, 48 in the drums 45, 46. Drums 45, 46 may advantageously be made of aluminum for lightness and rigidity, containing holes 49 for reducing weight. Drums 45, 46 are spaced apart so that the intermediate portion of dial sheet 31 is adjacent to and parallel with transparent pane 32. A lamp 50 is arranged between the drums to illuminate the portion of the translucent dial sheet 31 in front of pane 32. However, only the scale opposite the opening 29 of curtain 30 is visible from the front of control panel 10, corresponding to the selected band.

A gear-down arrangement is provided wherein the frequency scales on dial sheet 31 are considerably spread out. Tuning knob 51 is operated by the pilot to remotely tune-in the proper station, or otherwise adjust the frequency of the receiver circuits to the desired value. Knob 51 is connected with rod 52 rotatably mounted behind panel 10 in frame portion 53 as seen in Figs. 3 and 4. A gear 54 is secured with rod 52, coacting with pinion 55 connected with rod 56. Rod 56 carries worm 57 which coacts with worm gear 58 connected to central shaft 59 of drum 45. Rotation of tuning knob 51 in either direction rotates drum 45 correspondingly effecting a substantially reduced turning ratio.

Drum 46 is arranged to rotate in correspondence with drum 45 and hold dial sheet 31 taut. A spiral spring 60 is attached to shaft 61 of drum 46, shown in detail in Fig. 6. One end of spring 60 is anchored to shaft 61; the other end, to the frame by pin 62. Spring 60 is designed to be substantially wound-up and taut when dial sheet 31 is wound onto drum 45. Drum 46 is rotated in one direction by drum 45 through the pull thus imparted to the dial sheet 31. The dial sheet is held taut by the tension of spring 60. For tuning in the opposite direction, wound-up spring 60 causes drum 46 to take on dial sheet 31 as drum 45 turns. Dial sheet 31 is thus held taut in the reverse movement as well, and is wound onto drum 46. A friction drag plate unit 63 is connected to worm gear 58 to stabilize the mechanical operation of the tuning drums, and prevent backlash.

When tuning knob 51 is rotated, the remote ra-

dio circuits are correspondingly motivated and otherwise tuned, in correspondence with the movement of dial sheet 31. A fluted shaft 64 is proportioned to serve as a pinion coacting with the gear 54 operated by tuning knob 51. Fluted shaft 64 is rotatably supported in frame 53, preferably in roller bearings. A fluted extension 65 of shaft 64, of reduced section, extends into externally threaded tube 66. Tube 66 is suitably mounted on cover 11 with a block 67, and supported through an opening in the rear of cover 11, as seen in Fig. 3.

A mechanical shaft or flexible coupling is connected to the end of fluted rod 65, and assembled by a nipple attached to threaded tube 66, in a manner such as disclosed in my Patent No. 2,317,922. The flexible shaft driven with rod 65 is directly coupled to the variable tuning element in the remote radio chassis, such as a ganged variable tuning condenser. The scales on dial sheet 31 are respectively calibrated in accordance with the tuning movement of knob 51 and its effect on the radio circuits. The remote radio set may be a multiple channel radio receiver, a multiple-band radio direction finder, or even a tunable radio transmitter, or the like.

Although I have described a preferred embodiment for carrying out the principles of my present invention, it is to be understood that variations and modifications thereof may be practiced by those skilled in the art without departing from the broader spirit and scope of the invention, as set forth in the appended claims.

What is claimed is:

1. In a multiple band radio set: a tuning indicator comprising a dial sheet having a plurality of frequency scales corresponding to the frequency bands of operation of the set; a tuning control coupled to said dial sheet and connectable to the radio set for tuning the radio circuits thereof and correspondingly motivating the dial sheet; a curtain arranged in front of said dial sheet having one opening to expose a substantial portion of any one of the scales; a band selection device comprising a multiple position switch electrically connectable with the radio set for controlling the band of operation thereof in accordance with the position selected; and means mechanically connecting said device with said curtain for shifting said opening of the curtain to a position opposite the scale on said dial sheet corresponding to the selected band of radio operation and shielding the other scales from view.

2. A remote tuning control unit for a multiple band radio set comprising a dial sheet having a plurality of linear scales corresponding to the frequency bands of operation of the set; a tuning control knob and gearing coupled to said dial sheet and connectable to the radio set for tuning the radio circuits thereof and correspondingly motivating said dial sheet; a rectangular curtain arranged in front of and transverse to said dial sheet and having one opening to expose a substantial portion of any one of the scales; a band selection device comprising a multiple position switch electrically connectable with the remote set for controlling the band of operation thereof in accordance with the position selected; and means mechanically connecting said device with said curtain for shifting said opening thereof across said dial sheet to a position opposite the frequency scale on said dial sheet corresponding to the selected band of radio operation; whereby the frequency of operation of the radio set is directly indicated with respect to a sta-

tionary index of the control unit extending across all the scales.

3. A tuning system for a multiple band radio set comprising a tuning dial sheet having a plurality of calibrated frequency scales individually corresponding to the frequency bands of operation of the radio set; a pair of drums for mounting and carrying said dial sheet in front of a window; a tuning control knob coupled to one of said drums and connectable to the radio set for tuning the radio circuits thereof and correspondingly motivating said dial sheet; a curtain arranged in front of said dial sheet and having one opening to expose a substantial portion of any one of the scales at a time; a band selection device comprising a multiple position switch electrically connectable with the radio set for controlling the band of operation thereof in accordance with the position selected; and means mechanically connecting said device with said curtain for shifting said opening of the curtain across said dial sheet to a position opposite the scale on said dial sheet corresponding to the selected band of radio operation; whereby the frequency of operation of the radio set is directly indicated with respect to a stationary index at said dial sheet.

4. A tuning system for a multiple band radio set comprising a tuning dial sheet having a plurality of calibrated frequency scales individually corresponding to the frequency bands of operation of the radio set; a pair of drums for mounting and carrying said dial sheet in front of a window; a tuning control knob coupled to said dial sheet and connectable to the radio set for tuning the radio circuits thereof and correspondingly motivating said dial sheet; a spring element attached to one of said drums for holding said dial sheet taut; a curtain arranged in front of said dial sheet opposite the dial portion extending between said drums and having an opening to expose a substantial portion of one of the scales at a time; a band selection device comprising a multiple position switch electrically connectable with the radio set for controlling the band of operation thereof in accordance with the position selected; and means mechanically connecting said device with said curtain for shifting said opening of the curtain to a position opposite the scale on said dial sheet corresponding to the selected band of radio operation; whereby the frequency of operation of the radio set is directly indicated with respect to a stationary index at said dial sheet.

5. A tuning system for a multiple band radio set comprising a tuning dial sheet having a plurality of calibrated frequency scales individually corresponding to the frequency bands of operation of the radio set; a pair of drums for mounting and carrying said dial sheet in front of a window; a tuning control knob geared to one of said drums and connectable to the radio set for tuning the radio circuits thereof and correspondingly motivating said dial sheet; a spring wound element attached to the other of said drums for holding said dial taut and for winding the dial sheet on said other drum, and a friction imparting member attached to said one drum to stabilize the operation thereof; a curtain arranged in front of said dial sheet opposite the dial sheet portion extending between said drums and having an opening to expose a substantial portion of one of the scales at a time; a band selection device comprising a multiple position switch electrically connectable with the radio set

for controlling the band of operation thereof in accordance with the position selected; and means mechanically connecting said device with said curtain for shifting said opening of the curtain to a position opposite the scale on said dial sheet corresponding to the selected band of radio operation; whereby the frequency of operation of the radio set is directly indicated with respect to a stationary index at said dial sheet.

6. A tuning system for a multiple band radio set comprising a sheet containing a plurality of calibrated frequency scales corresponding to frequency bands of operation of the radio set; drums carrying said sheet; a tuning control geared to said drums and connectable to the radio set for tuning the radio circuits thereof and correspondingly motivating said sheet; an instrumentality arranged in front of and transverse to said sheet and having one opening to expose a substantial portion of any one of the scales corresponding to the band of operation of the set; a band selection device comprising a multiple position switch electrically connectable with the radio set for controlling the band of operation thereof in accordance with the selected position; and a cord and pulley arrangement mechanically connecting said device with said instrumentality for shifting said opening thereof to a position opposite the frequency scale on said sheet corresponding to the selected band of radio operation; whereby the frequency of operation of the radio set is directly indicated on a stationary index extending across said scales.

7. A tuning system for a multiple band radio set comprising a sheet containing a plurality of calibrated frequency scales corresponding to frequency bands of operation of the radio set; a pair of spaced drums carrying said sheet; a tuning control geared to one of said drums and connectable to the radio set for tuning the radio circuits thereof and correspondingly motivating said sheet; a spring wound element attached to the other of said drums for holding said sheet taut and for winding the sheet on said other drum, and a friction imparting member attached to said one drum to stabilize the operation thereof; and a curtain arranged in front of said sheet and having an opening to expose a substantial portion of the one of the scales corresponding to the band of operation of the set.

8. A tuning system for a radio set comprising a linear sheet containing a calibrated tuning scale; a pair of spaced drums carrying said sheet; a tuning control knob geared to one of said drums and connectable to the radio set for tuning the radio circuits thereof and correspondingly motivating said sheet; and a spring wound element attached to the other of said drums for holding said sheet taut and for winding the sheet on said other drum, and a friction imparting member attached to said one drum to stabilize the operation thereof; whereby the frequency of operation of the radio set is directly indicated on a stationary index.

WILLIAM P. LEAR.