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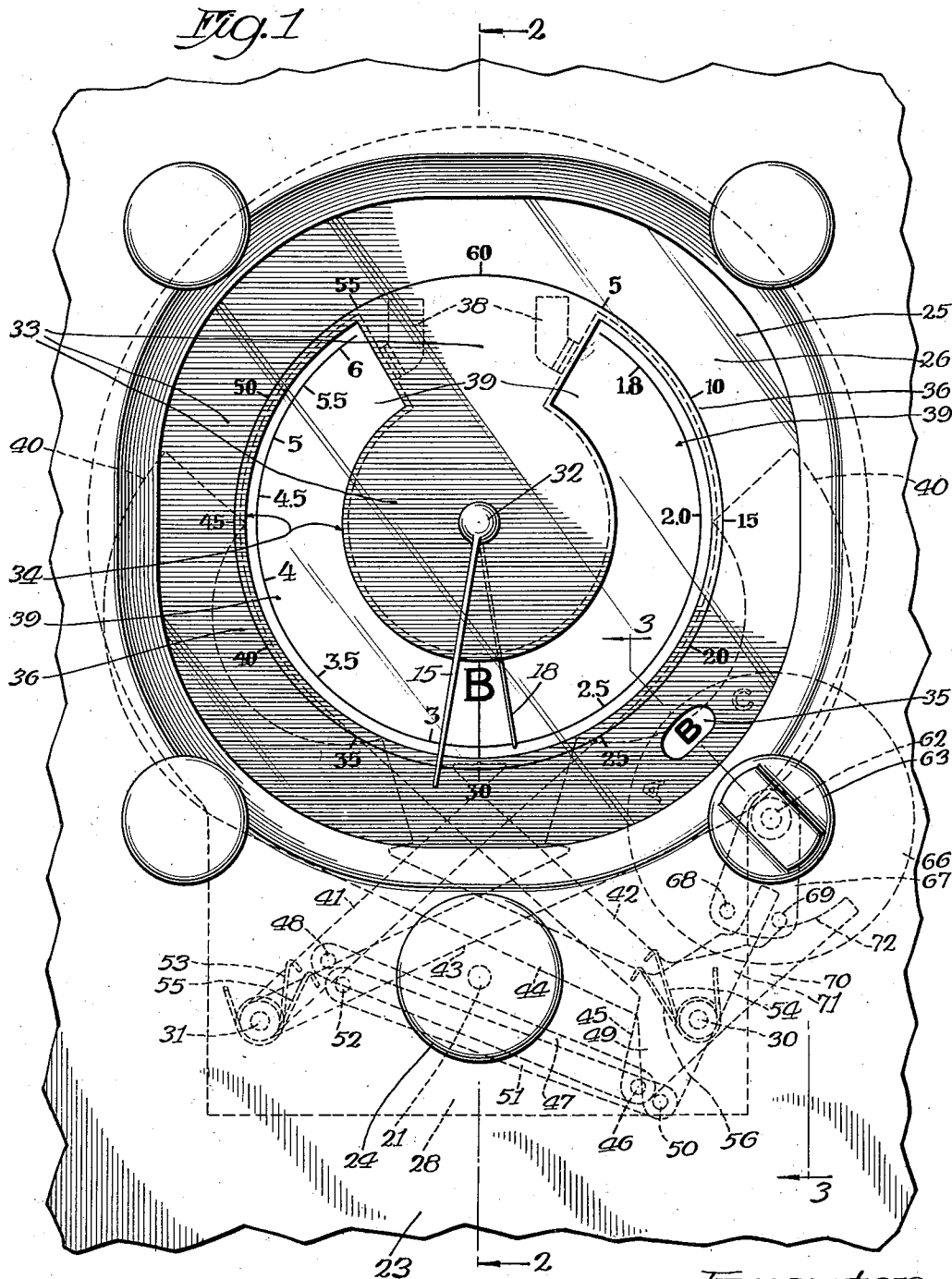
K. EMDE

2,078,031

DIAL MECHANISM

Filed Dec. 3, 1936

3 Sheets-Sheet 1



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April 20, 1937.

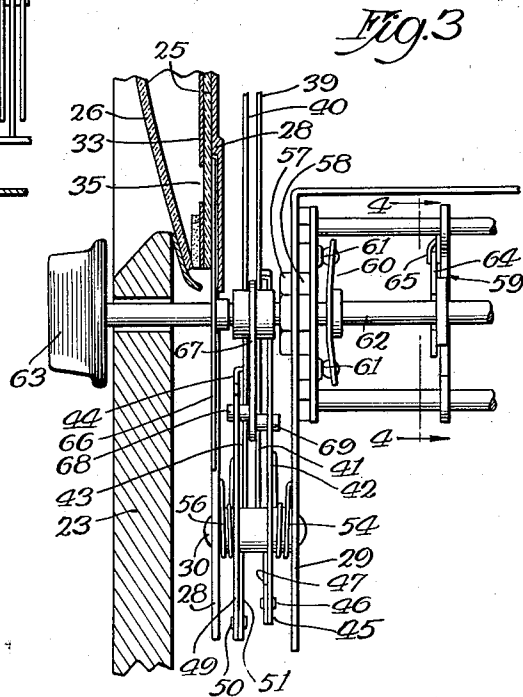
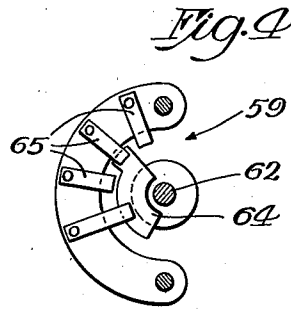
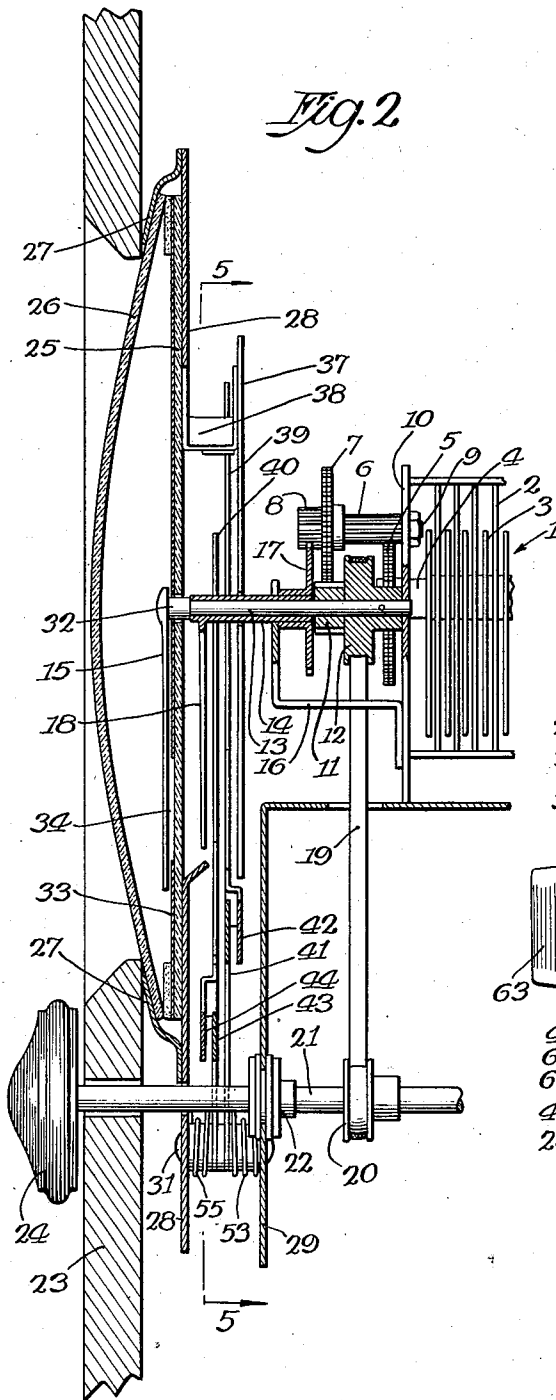
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DIAL MECHANISM

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3 Sheets-Sheet 2



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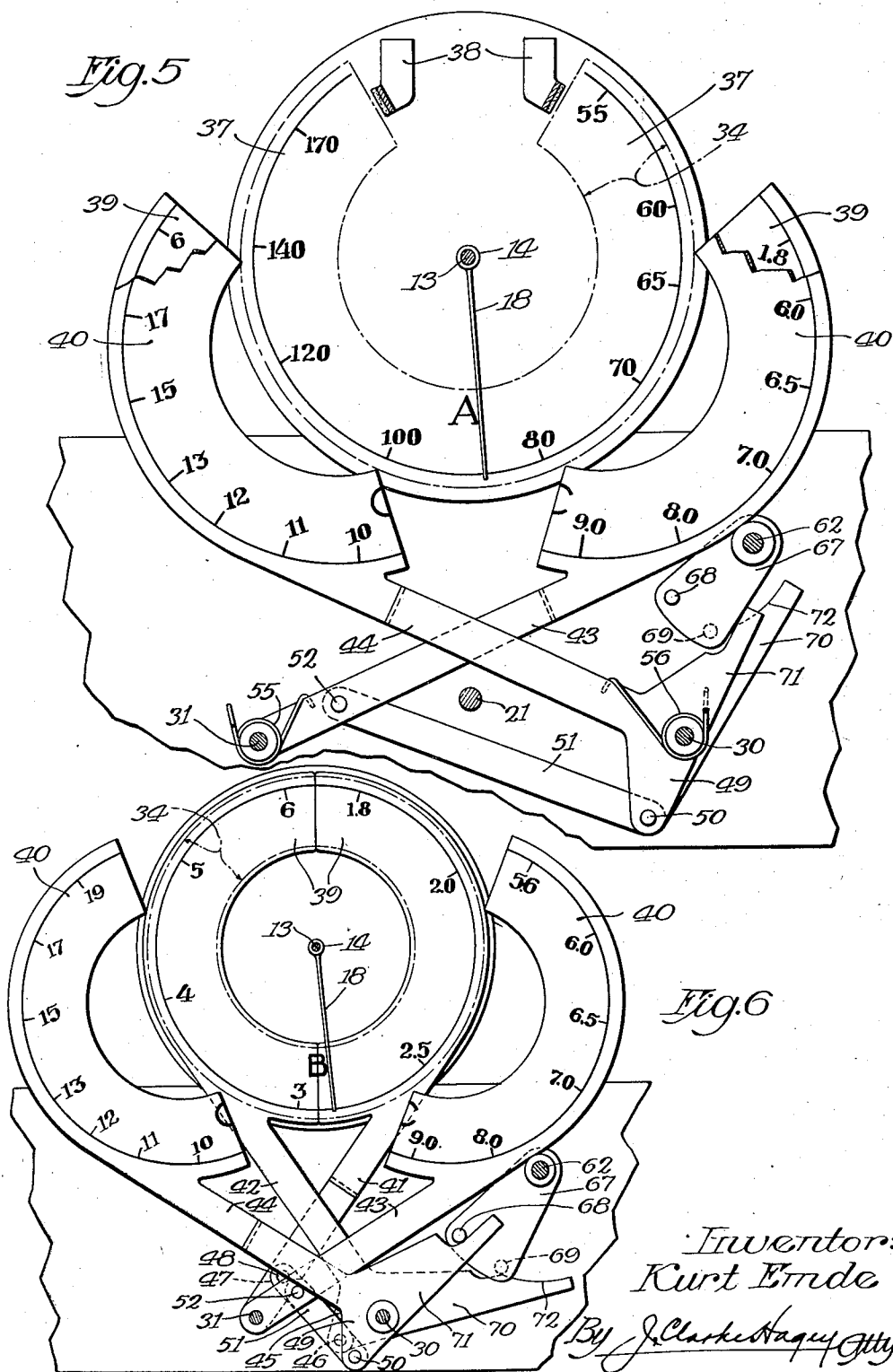
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DIAL MECHANISM

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UNITED STATES PATENT OFFICE

2,078,031

DIAL MECHANISM

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Application December 3, 1936, Serial No. 113,993

19 Claims. (Cl. 116—124.1)

This invention relates to dial mechanism, and more particularly concerns dial mechanism adapted to selectively display different frequency band scales to be used in tuning so-called "all-wave" or multi-band radio apparatus.

The principal object of the invention is to provide a multi-scale dial mechanism which is particularly useful in accomplishing what is known as "band spreading", in that it permits the use of complete, or substantially complete, circular scales of like diameter for each of the several frequency bands included within the tuning range of "all-wave" radio apparatus, which arrangement of the scales provides for maximum band spread and visibility. Another object of the invention is to provide a multi-scale dial mechanism in which, if desired and as herein shown, one only of the several frequency band scales may be viewed at a time, thus avoiding any possibility of confusion in the employment of such scales during tuning adjustments of the apparatus. A further object of the invention is to provide a multi-scale dial mechanism of the aforesaid character connected with the usual frequency band switch so that the proper tuning scale will be brought into service automatically and coincidentally with the adjustment of the radio apparatus for operation within any selected one of the several frequency wave bands. While the invention has been shown and will be described as embodied in tuning dial mechanism for "all-wave" radio receiving sets, it is to be understood that it is not in any sense limited thereto.

In the drawings,

Figure 1 is a front elevational view of a radio tuning dial mechanism constructed according to my invention;

Fig. 2 is a vertical sectional view, taken upon the line 2—2 of Fig. 1, illustrating the tuning and indicator adjusting connections;

Fig. 3 is a fragmentary vertical sectional view, taken upon the line 3—3 of Fig. 1, showing a portion of a conventional type of frequency band switch, the adjusting manual therefor, and the connection therewith of my dial mechanism;

Fig. 4 is a detail view, taken upon the line 4—4 of Fig. 3, of one of the stage adjusting switches of the frequency band switch;

Fig. 5 is a front elevational view, partly in section, taken upon the line 5—5 of Fig. 2, illustrating a different adjustment of the dial mechanism from that shown in Fig. 1; and

Fig. 6 is a view, similar to Fig. 5, showing a modified construction of the dial mechanism, in which

the tuning scales are completely circular in extent.

In the construction shown in Figures 1 and 5, inclusive, the tuning scales are not completely circular in extent, the intervening space being reserved for the display of indicia which is not shown since it does not form a part of this invention. Where complete circular scales are employed, as shown in Fig. 6, the withdrawing movement of the scale sections must be slightly greater in order to completely expose the underlying scale, but in all other respects the operating construction and connections are the same in all of the figures, and a description of one embodiment of the invention will suffice for both.

For various practical reasons, not necessary to mention here, so-called "all-wave" radio receiving sets have not been constructed to cover the entire radio frequency spectrum, but only a limited number of selected portions thereof, embracing several of what are termed the short wave, or high frequency, bands as well as the broadcast band of much lower frequencies. Such sets usually employ a plurality of inductance windings, corresponding to the several selected portions of the radio frequency spectrum, and an adjustable band switch for selectively throwing them into and out of circuit connection with a single variable capacitance unit, or tuning condenser. As is well known to those familiar with such apparatus, tuning condensers having sufficient maximum capacity for tuning in the lower frequencies of the broadcast band must be very carefully and accurately adjusted when employed for tuning in the higher frequencies of the short wave bands. Operating mechanism has been provided for effecting this careful and accurate adjustment, one arrangement of which is shown herein as comprising a step-down gear-train connecting the rotor-shaft of the tuning condenser with the manually adjustable tuning knob, and many different types of tuning indicators and dial mechanisms have been devised to facilitate frequency-selecting adjustment of such mechanism.

However, in most if not all of the dial mechanisms in use upon "all-wave" radio receiving sets, the different tuning scales displayed upon the dials are semi-circular and quite limited in length, and the wide ranges of frequencies covered thereby, particularly by those scales for use with the short wave bands, cannot be indicated thereupon for lack of space, excepting in a general way. As a result, in the short wave bands, where the tuning adjustments require the greater degree of care and accuracy, the divisions of the tuning scales

represent such wide differences in frequencies as to be of little practical value. Another objectionable feature of the multi-scale dial mechanisms in general use upon "all-wave" radio receiving sets is that, even where scale-identifying indicia is provided, the number of scales displayed upon the dial is confusing to the operator.

The present dial mechanism comprises a plurality of interchangeable dial faces having different scale arrangements displayed thereupon. I prefer to display but one frequency band scale upon each of the dial faces and to spread each scale at or near the outer periphery of each dial face, but I do not desire to be limited to any particular scale arrangement. It will be seen that each scale may be completely circular, if desired, and that but one scale-arrangement is viewable at a time. I thus obtain a much greater band spread and avoid the possibility of any confusion in the use of the different scales.

Considering, first, the tuner and indicator operating mechanism, and referring to Figures 1 and 2 of the drawings, a variable tuning condenser is illustrated at 1, having the usual stator-plates 2, rotor-plates 3, and adjusting shaft 4. A gear-wheel 5 is secured upon shaft 4 and meshes with a pinion 6, which is mounted for rotation as a unit with a gear-wheel 7 and pinion 8 upon a stub-shaft secured as at 9 to frame-member 10. Gear-wheel 7 meshes with a pinion 11 which is fixed with belt-pulley 12 upon the pointer-shaft 13. Pointer-shaft 13 is supported at its rearward end-part in frame-member 10, extends through and turns freely within a sleeve 14, and carries at its forward end a high-speed pointer 15. Sleeve 14 is rotatably supported in the frame-bracket 16, carries a gear-wheel 17 fixed upon its rearward end-part and a slow-speed pointer 18 at its forward end-part. Gear-wheel 17 meshes with pinion 8, and belt-pulley 12 is connected by a belt 19 with a belt-pulley 20 secured upon the tuning shaft 21. Tuning shaft 21 is rotatably supported in bearings, one of which is shown at 22, projects through the front panel 23 of the casing, and carries the manually operable tuning knob 24 secured upon its forward end-part.

Turning of knob 24 will rotate shaft 21 and belt-pulley 20 and, through connecting belt 19, will effect the rotation of belt-pulley 12, pointer-shaft 13, and high-speed pointer 15. It will be noted that the diameter of belt-pulley 12 is greater than that of belt-pulley 20 and that, consequently, tuning knob 24 must be given more than one turn to effect a complete rotation of high-speed pointer 15. Rotation of pointer-shaft 13 will rotate pinion 11 and gear-wheel 7 to effect the adjustment of tuning condenser 1 through pinion 6, gear-wheel 5 and adjusting shaft 4, and the rotation of slow-speed pointer 18, through pinion 8, gear-wheel 17 and sleeve 14. Where, as in this instance, a standard 180-degree variable condenser is used and the slow-speed pointer cooperates with a frequency band scale of circular, or nearly circular, extent, the ratio of the gearing, comprising pinion 6 and gear-wheel 5, and pinion 8 and gear-wheel 17, must be such that rotation of gear-wheel 7 to effect the full half-turn movement of shaft 4 of condenser 1 will coincidentally effect the complete, or nearly complete, rotation of pointer 18. The ratio of movement of the high-speed pointer 15, with respect to that of slow-speed pointer 18, may be arranged to suit requirements. I have employed various ratios extending from 20-to-1 to 50-to-1, depending to a considerable extent upon the sensitivity of the

radio apparatus with which the arrangement was to be used. The high-speed pointer cooperates with an evenly divided fixed circular scale to indicate fractional adjustments of the condenser and the slow-speed pointer, and thus serves as a vernier for each and all of the frequency band scales.

Coming, now, to the description of the dial mechanism, the flat glass face 25 and convex crystal 26 are supported in a bezel 27 which is secured to a flat metal backing-plate 28. Backing-plate 28 is supported upon, and in spaced relation to, the forward vertical face of chassis 29, as by rivets or studs 30 and 31. Face 25 is centrally apertured to accommodate hub 32 of the high-speed pointer 15 and is coated, or otherwise partially covered, with an opaque overlay 33, leaving clear the annular window space 34 through which the frequency band scales may be viewed. Other clear window spaces may be provided in the overlay, such as indicated at 35, through which additional indicia may be viewed. An evenly divided circular scale 36 is arranged around the outer edge of space 34 to be traversed by the high-speed or vernier pointer 15. The arrangement herein shown comprises three frequency band scales, hereinafter referred to as bands "A", "B" and "C". The scale for the broadcast band "A" (Fig. 5) is preferably displayed upon the fixed one-piece dial 37, supported in position by rearwardly projecting bracket-extensions 38-39 of backing-plate 28 (see Fig. 2). The scale for what is generally termed the police and amateur band "B" (Fig. 1) is displayed upon the two arcuate sections of the intermediate dial 39, and the scale for the foreign broadcast or short wave band "C" (Fig. 5) is spread upon the two arcuate sections of the forwardly arranged dial 40. The right and left sections of dial "B" are carried by respective legs 41 and 42, which legs are crossed and pivotally supported upon studs 31 and 30, respectively, and the right and left sections of dial "C" are carried by respective legs 43 and 44, which legs are also crossed and likewise supported upon said studs. As best illustrated in Figures 1 and 6, legs 42 and 44 are each formed with heel and toe portions which extend laterally in opposite directions from the pivot-stud 30. Heel 45 of leg 42 is pivotally connected at 46 with one end of a link 47, the other end of which link is pivotally connected at 48 with leg 41, so that the two sections of dial "B" are coupled together for scissors-like movement. Heel 49 of leg 44 is likewise pivotally connected at 50 with one end of a link 51, the other end of which link is pivotally connected at 52 with leg 43, so that the two sections of dial "C" are also coupled together for scissors-like movement. Each of the legs 41, 42, 43 and 44 are acted upon by respective springs 53, 54, 55 and 56 to influence the sections of the dials "B" and "C" toward open or withdrawn positions. Springs 54 and 55 are coiled around stud 30, and springs 53 and 56 are coiled around stud 31, and one prong of each spring acts upon its respective dial-section-leg, the other prong of each spring being hooked into an opening in the adjacent backing-plate 28 or the vertical face of chassis 29.

In Figure 3, the forward end-part of a conventional type of 3-position band switch is shown, the frame of which is secured, as by nuts 57 and 58, to the forward vertical face of chassis 29. This band switch comprises a plurality of stage-adjusting multiple-point switches, one of which is indicated at 59 (Figs. 3 and 4), and a spring 75

positioning-disc 60 having spaced projections thereupon which cooperate with detents 61—61. The movable contact-plates of the several switches and the positioning-disc 60 are fixed upon a central adjusting shaft 62 which projects forwardly through the front panel 23 of the casing and carries a manually adjustable knob 63. As knob 63 is turned and the projections of the positioning-disc 60 engage the detents 61—61, the movable contact-plate 64 of each switch 59 engages the proper fixed spring-finger contacts 65 (Fig. 4) to adjust the respective stages of the radio apparatus for the different wave bands "A", "B" and "C". A disc 66 (Figs. 1 and 3), having the letters "A", "B" and "C" thereupon, is fixed upon shaft 62 in a position to cooperate with window-space 35 to visibly indicate the position of the band switch and the wave band for which the apparatus has been adjusted.

Secured upon shaft 62 is a crank-arm 67 which carries a pair of crank-studs 68 and 69 projecting respectively from the front and rear surfaces thereof. Referring more particularly, now, to Figures 5 and 6, it will be seen that, when adjusting shaft 62 of the band switch has been positioned to place crank-arm 67 at the leftward end of its swing (Fig. 5), the arcuate sections of dials 39 and 40 are in their open or withdrawn positions, exposing dial 37 and the tuning scale for the broadcast band "A". With this position of shaft 62 and crank-arm 67, the adjustment of the band switch is such as to condition the circuits of the radio apparatus for tuning within the broadcast band. As shaft 62 is turned to swing crank-arm 67 into the position shown in Figs. 1 and 6, crank-stud 69 will engage the toe 70 of leg 42 and move it, together with link-connected leg 41, to close the two arcuate sections of dial 39, masking dial 37 and the scale for the broadcast band and substituting therefor the tuning scale for the police and amateur band "B". With this adjustment of shaft 62 and crank-arm 67, the band switch is also adjusted to condition the radio apparatus for tuning within the frequency range of band "B", as represented upon the only dial which may then be viewed by the operator. As shaft 62 is turned to adjust the band switch to condition the apparatus for tuning in the foreign broadcast or short wave band, crank-arm 67 will be swung thereby further to the right, and crank-stud 68 will engage toe 71 of leg 44 and move it, together with link-connected leg 43, to close the two arcuate sections of dial 40, masking dial 39 and the scale displayed thereupon and substituting therefor the tuning scale for the foreign broadcast or short wave band "C". During the opening and closing of the two arcuate sections of dial 40 through the rocking of crank-stud 68 in contact with toe 71 of leg 44, the sections of dial 39 will be held closed, as crank-stud 69 moves along the arcuate face 72 of toe 70. The reverse operation of the parts is too simple and obvious to need description. It is sufficient to state that, while the springs 53 to 56, inclusive, are not required where the dial mechanism is to be used in upright position, they are quite necessary where it is horizontally arranged in order to effect the withdrawal of the dial sections as crank-studs 68 and 69 are retreated, and in order to prevent said dial sections from swinging into view when not desired.

I claim:—

1. Dial mechanism comprising a dial formed of a plurality of relatively movable sections

mounted for movement toward and from each other, an indicator, and adjustable means acting upon adjustment thereof to effect movement of the sections of said dial into and from position for cooperation with said indicator.

2. Dial mechanism comprising a dial formed of a plurality of relatively movable sections mounted for movement toward and from each other, each section having a portion of a scale displayed thereupon, an indicator, and adjustable means acting upon adjustment thereof to move the sections of said dial to thereby join the portions of the scale displayed thereupon for cooperation with said indicator.

3. Dial mechanism comprising a plurality of dials, each formed of a plurality of relatively movable sections mounted for movement toward and from each other, an indicator, and adjustable means acting upon one adjustment thereof to effect movement of the sections of one of said dials into position for cooperation with said indicator and upon another adjustment thereof to effect movement of the sections of another of said dials into position for cooperation with said indicator.

4. Dial mechanism comprising a plurality of dials, one of said dials being formed of a plurality of relatively movable sections mounted for movement toward and from each other to cover and uncover another of said dials, and indicator, and adjustable means acting upon adjustment thereof to effect movement of the sections of said one of said dials into and from position in front of said another of said dials to alternately mask and supplant it and unmask and restore it in service for cooperation with said indicator.

5. Dial mechanism comprising first, second and third dials and a movable indicator, said first dial being fixed in position for cooperation with said indicator, and said second and third dials being each formed of a plurality of parted sections mounted for movement toward each other in front of said first dial, and adjustable means acting upon adjustment thereof to effect movement of the sections of said second dial and afterwards the sections of said third dial into position in front of said first dial for cooperation with said indicator.

6. Dial mechanism comprising a dial formed of a plurality of relatively movable sections mounted for movement toward and from each other, each section having an arcuate scale displayed thereupon, an axially mounted rotatable indicator, and adjusting means acting upon adjustment thereof to effect movement of the sections of said dial toward each other to bring the arcuate scales displayed thereupon into a position in which the axes thereof are made coincident with the axis of said rotatable indicator.

7. Dial mechanism comprising a first dial and an indicator cooperating therewith, a second dial and a second indicator cooperating therewith, said second dial and said second indicator being viewable through said first dial, a third dial mounted for movement into position in front of said second dial for cooperation with said second indicator and viewable when in such position through said first dial, and adjustable means acting upon adjustment thereof to effect movement of said third dial into and from said position.

8. Dial mechanism comprising a first dial having a circular scale displayed thereupon and a rotatable indicator cooperating with said scale, a second dial having indicia thereupon viewable

through said first dial within the circular scale displayed thereupon and a second rotatable indicator cooperating with the indicia upon said second dial, said rotatable indicators being coaxially arranged, a third dial mounted for movement into and from position to mask said second dial and having indicia thereupon for cooperation with said second indicator, means operating to rotate said indicators simultaneously at relatively different speeds, and adjustable means acting upon adjustment thereof to effect movement of said third dial into and from said position.

9. Dial mechanism comprising a first dial having a circular scale displayed thereupon and a space circumscribed by said scale in which other indicia may be viewed, a first rotatable indicator cooperating with said scale, a second dial formed of a plurality of relatively movable sections mounted for movement toward and from each other and each having indicia displayed thereupon, a second rotatable indicator the axis of rotation of which is coincident with that of said first indicator, and adjustable means acting upon adjustment thereof to effect movement of the sections of said second dial into and from a position in which the indicia thereupon may cooperate with said second indicator and in which said indicia may be viewed in said space circumscribed by said circular scale of said first dial.

10. The combination, with adjustable tuning devices and adjustable band selecting devices of radio apparatus, of dial mechanism comprising an indicator connected for movement with the adjustment of said tuning devices, a dial formed of a plurality of relatively movable sections mounted for movement into and from a position for cooperation with said indicator, and adjustable means connected for movement with the adjustment of said band selecting devices and acting upon adjustment thereof to effect movement of the sections of said dial into and from said position.

11. The combination, with adjustable tuning devices and adjustable band selecting devices of radio apparatus, of dial mechanism comprising an indicator connected for movement with the adjustment of said tuning devices, a dial formed of a plurality of relatively movable sections mounted for movement toward and from each other, each section having tuning indicia displayed thereupon, and adjustable means connected for movement with the adjustment of said band selecting devices and acting upon adjustment thereof to effect movement of the sections of said dial toward each other to place the tuning indicia displayed thereupon in position for cooperation with said indicator.

12. The combination, with adjustable tuning devices and adjustable band selecting devices of radio apparatus, of dial mechanism comprising an indicator connected for movement with the adjustment of said tuning devices, a plurality of dials each formed of a plurality of relatively movable sections mounted for movement toward and from each other, and adjustable means connected for movement with the adjustment of said band selecting devices acting upon one adjustment thereof to effect movement of the sections of one of said dials into position for cooperation with said indicator and upon another adjustment thereof to effect movement of the sections of another of said dials into position for cooperation with said indicator.

13. The combination, with adjustable tuning devices and adjustable band selecting devices of

radio apparatus tunable in a plurality of selectable frequency bands, of dial mechanism comprising an indicator connected for movement with the adjustment of said tuning devices, a plurality of dials each formed of a plurality of relatively movable sections, the sections of one of said dials having tuning indicia for one frequency band displayed thereupon and the sections of another of said dials having tuning indicia for another frequency band displayed thereupon, the sections of each of said dials being mounted for movement into and from a position for cooperation with said indicator and the sections of one of said dials being movable in front of the sections of another of said dials, and adjustable means connected for movement with the adjustment of said band selecting devices acting, upon adjustment of said band selecting devices to condition the apparatus for tuning in one selected band, to effect movement of the sections of the dial having the tuning indicia representing that band into position for cooperation with said indicator and, upon adjustment of said band selecting devices to condition the apparatus for tuning in another selected band, to effect movement of the sections of the dial having the tuning indicia representing that band into position for cooperation with said indicator.

14. The combination, with adjustable tuning devices and adjustable band selecting devices of radio apparatus tunable in a plurality of selectable frequency bands, of dial mechanism comprising an indicator connected for movement with the adjustment of said tuning devices, first and second dials, said first dial having tuning indicia displayed thereupon representing one of said frequency bands and being fixed in position for cooperation of said indicia with said indicator, and said second dial having tuning indicia displayed thereupon representing another of said frequency bands and being formed of a plurality of relatively movable sections mounted for movement toward and from each other in front of said first dial, and adjustable means connected for movement with the adjustment of said band selecting devices and acting upon adjustment thereof to effect movement of the sections of said second dial into and from position for cooperation of the indicia thereupon with said indicator.

15. The combination, with adjustable tuning devices and adjustable band selecting devices of radio apparatus tunable in a plurality of selectable frequency bands, of dial mechanism comprising an indicator connected for movement with the adjustment of said tuning devices, first, second and third dials, said first dial having tuning indicia displayed thereupon representing one of said frequency bands and being fixed in position for cooperation of said indicia with said indicator, and said second and third dials each having tuning indicia displayed thereupon representing others of said frequency bands, said second and third dials being each formed of a plurality of relatively movable sections mounted for movement toward each other, the sections of one being movable in front of the sections of the other and the sections of both being movable in front of said first dial, and adjustable means connected for movement with the adjustment of said band selecting devices acting upon adjustment thereof to effect movement of the sections of said second dial and afterwards the sections of said third dial into position for cooperation with said indicator.

16. The combination, with adjustable tuning devices and adjustable band selecting devices of

radio apparatus tunable in a plurality of selectable frequency bands, of dial mechanism comprising a plurality of coaxially mounted rotatable indicators connected for movement with the adjustment of said tuning devices, a first dial having tuning indicia displayed thereupon cooperating with one of said indicators, a second dial having tuning indicia displayed thereupon representing one of said frequency bands viewable through said first dial and cooperating with the other of said indicators, a third dial mounted for movement into and from a position in front of said second dial and having tuning indicia displayed thereupon representing another of said frequency bands, and adjustable means connected for movement with the adjustment of said band selecting devices acting upon adjustment thereof to effect movement of said third dial into and from said position whereupon the tuning indicia displayed upon said third dial may cooperate with said other of said indicators and be viewed through said first dial.

17. The combination, with adjustable tuning devices and adjustable band selecting devices of radio apparatus tunable in a plurality of selectable frequency bands, of dial mechanism comprising first and second coaxially mounted rotatable indicators connected for movement with the adjustment of said tuning devices, a first dial having a circular scale displayed thereupon cooperating with said first indicator and having a space circumscribed by said scale in which other indicia may be viewed, a second dial having tuning indicia displayed thereupon representing one of said frequency bands cooperating with said second indicator and viewable in the aforesaid space, a third dial having tuning indicia displayed thereupon representing another of said frequency bands and formed of a plurality of relatively movable sections mounted for movement into and from a position in front of said second dial, and adjustable means connected for movement with the adjustment of said band selecting devices acting upon adjustment thereof to effect movement of the sections of said third dial into position to cover said second dial, cooperate with said second indicator and be viewable in the aforesaid space.

18. The combination, with adjustable tuning devices and adjustable band selecting devices of radio apparatus tunable in a plurality of select-

able frequency bands, of dial mechanism comprising first and second coaxially mounted rotatable indicators connected for movement with the adjustment of said tuning devices, a first dial having a circular scale displayed thereupon cooperating with said first indicator and having a space circumscribed by said scale in which other indicia may be viewed, a second dial having tuning indicia displayed thereupon representing one of said frequency bands cooperating with said second indicator and viewable in the aforesaid space, third and fourth dials each having tuning indicia displayed thereupon representing others of said frequency bands and each formed of a plurality of relatively movable sections mounted for movement into and from a position in front of said second dial, and adjustable means connected for movement with the adjustment of said band selecting devices acting upon one adjustment thereof to effect movement of the sections of said third dial into position for cooperation with said second indicator and upon another adjustment thereof to effect movement of the sections of said fourth dial into position for cooperation with said second indicator.

19. The combination, with adjustable tuning devices and adjustable band selecting devices of radio apparatus tunable in a plurality of selectable frequency bands, of dial mechanism comprising first and second coaxially mounted rotatable indicators connected for movement with the adjustment of said tuning devices, a dial having an outer circular tuning scale displayed thereupon for cooperation with said first indicator and having a space circumscribed by said scale in which other indicia may be viewed, a plurality of dials each having tuning indicia displayed thereupon representing one of said frequency bands for cooperation with said second indicator, certain of which dials are mounted for movement into and from position for such cooperation and to be viewable in the aforesaid space, and adjustable means connected for movement with the adjustment of said band selecting devices acting, upon adjustment of said devices to condition the apparatus for tuning in a selected frequency band, to selectively effect the display in the aforesaid space of the dial having the tuning indicia thereupon representing that band.

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