

April 26, 1938.

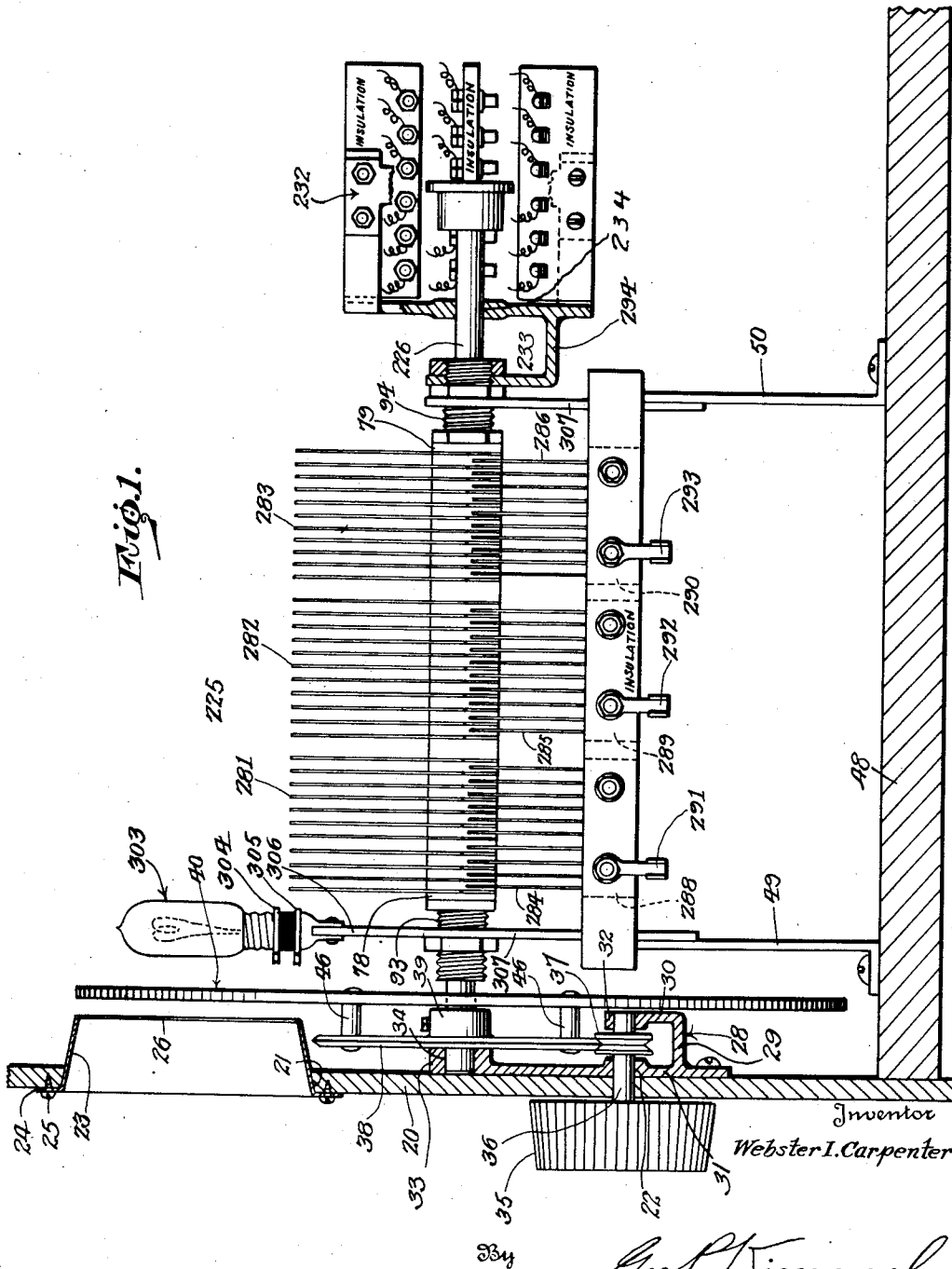
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MULTIFREQUENCY TUNING SYSTEM FOR RADIO RECEIVERS

Filed Dec. 16, 1935

2 Sheets-Sheet 1



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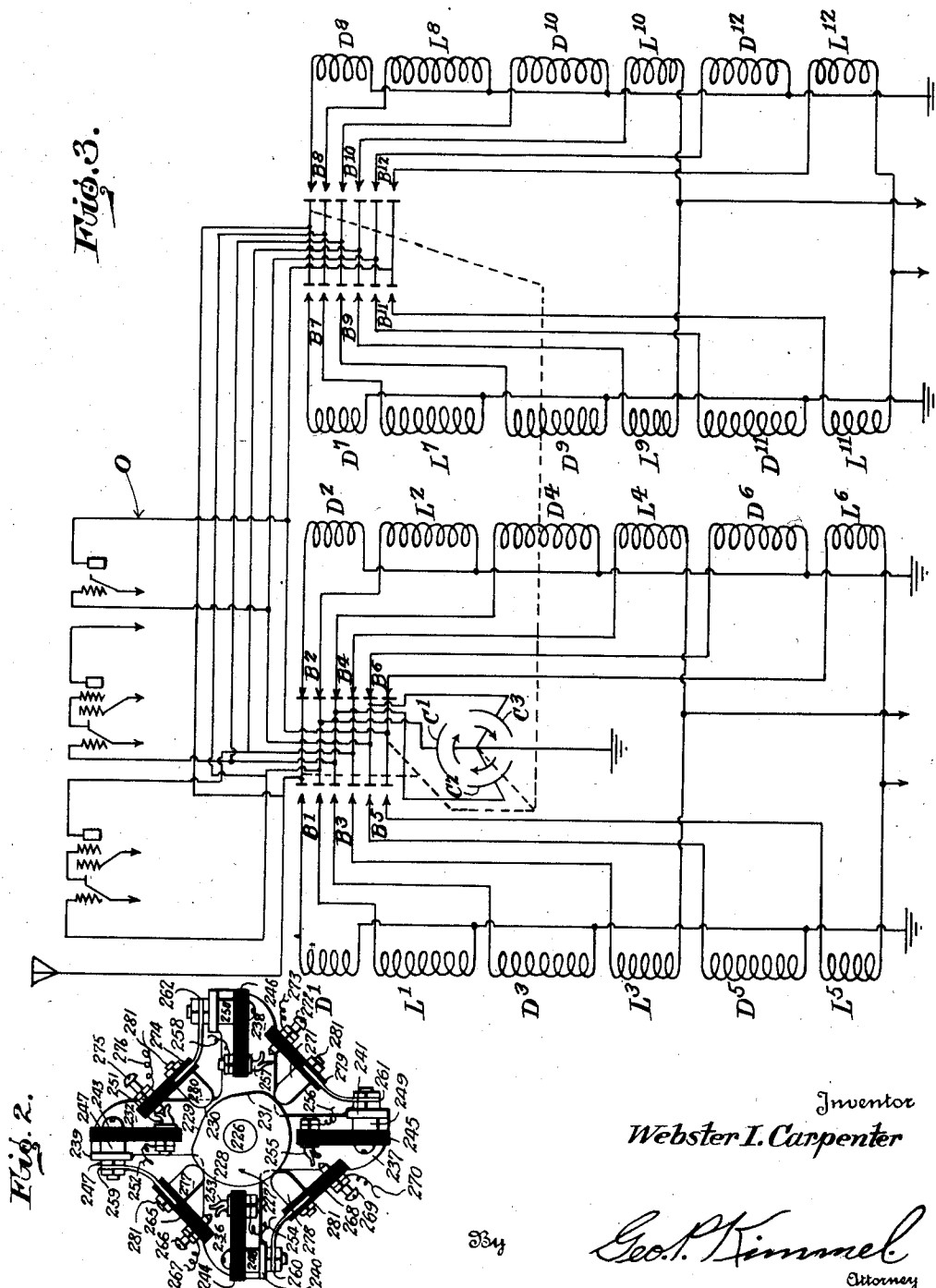
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MULTIFREQUENCY TUNING SYSTEM FOR
RADIO RECEIVERS

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2 Claims. (Cl. 250—40)

This invention relates to a multi-frequency tuning system for radio receivers.

The invention aims to provide, in a manner as hereinafter set forth, a multi-frequency tuning system providing for a more practical usage of a tuning condenser than has been customary in standard practice in that the tuning condenser tunes one band of frequencies from maximum to minimum capacity or vice versa and with a continual rotation of the rotor of the condenser in the same direction cuts out the aforesaid frequency band and cuts in another entirely different band of frequencies from minimum to maximum capacity or vice versa; or in other words, successive different bands of frequencies are tuned in and cut out on the rotation of the rotor of the condenser in the same direction in inverse order of frequencies of the respective bands.

Further objects of the invention are to provide, in a manner as hereinafter set forth, a multi-frequency tuning system which is comparatively simple in its construction and arrangement, strong, durable, thoroughly efficient in its use, conveniently adjusted, accurate in action, readily assembled, and comparatively inexpensive to set up.

With the foregoing and other objects in view, the invention consists of the novel construction, combination and arrangement of parts as will be more specifically referred to and as are illustrated in the accompanying drawings, but it is to be understood that changes, variations and modifications may be resorted to which fall within the scope of the invention as claimed.

In the drawings:

Figure 1 is a vertical sectional view of an apparatus to provide a multi-frequency tuning system in accordance with this invention,

Figure 2 is an end view of the switching mechanism of the apparatus, and

Figure 3 is a diagrammatic view of the pre-selector, detector, oscillatory circuit employed.

With reference to the drawings, the front of the cabinet or housing of a radio receiving set is indicated at 20 and it is formed with superposed openings 21, 22 having their axes aligning. The opening 21 is arranged above and is of materially greater diameter than the opening 22. The wall of opening 21 gradually decreases in diameter from its outer to its inner end. Extending through the opening 21, as well as snugly engaging the wall of the latter, is a rectangular escutcheon member 23 open at its front and rear. The member 23 includes a front endless flange

24 positioned against the outer face of the front 20, as well as being rigidly secured to the latter by the holdfast means 25. Fixed to and within the member 23 at its inner end is a vertical indicator or finder 26, in the form of a thin wire disposed at the lengthwise center of member 23.

Positioned against the inner face of the front 20 is a vertically disposed bracket 27 provided near its lower end with a rearwardly extending angle-shaped arm 28 having a horizontal part 29 and a vertically disposed part 30 integral with and extending upwardly at right angles with respect to the rear end of the part 29. The body of the bracket 27 between its transverse median and lower end is formed with an opening 31 which aligns with the opening 32 provided in the part 30. The opening 31 registers with the opening 22. The body of the bracket 27 at its upper end is enlarged, as at 33, and formed with an opening 34.

A tuning knob arranged forwardly of the front 20 is indicated at 35, fixed to the outer end of a rearwardly extending rotatable short shaft 36 journaled in the openings 22, 31, and 32. Fixedly secured to the shaft 36 is a groove pulley 37 arranged between the body of the bracket 27 and the part 30 of the arm 28. Engaging in and operated from the pulley 37 is a power transmitting pulley 38 of greater diameter than the pulley 37 and formed with a hub 39. Arranged rearwardly of the bracket 27 and member 23 is a translucent dial structure 40 fixedly secured in spaced relation to the pulley 38 by the holdfast means 46. Within the cabinet or housing of the receiving set is a floor board 48 to which is secured an upstanding supporting structure, indicated at 49, 50 for a condenser structure 225 having its shaft indicated at 226. The structure 225 includes gangs of rotors 281, 282 and 283 having their associated gangs of stators indicated at 284, 285 and 286 respectively. The gangs of rotors are carried by shaft 226. Conducting blocks are designated 288, 289, 290 and to which the stators 284, 285, 286 respectively are secured. Circuit wire connections 291, 292, 293 are provided for the blocks 288, 289, 290 respectively.

The shaft 226 has fixed to its rear end the hub 226 of a controlling cam 227 formed with a segmental edge part 228 merging at one end into one end of a concave edge part 229, the other end of the latter merging into one end of a convex edge part 230, and a concave edge part 231 merging at one end into the other end of part 228 and at its other end into part 230. The edge part 230

is of less length than the edge parts 229, 231. The edge part 228 is of materially greater length than any of the other edge parts. The purpose of the cam 227 will be presently referred to.

5 There is associated with the condenser structure 225 a plural switching structure generally indicated at 232 and it includes an upstanding plate 233 formed with an opening 234 for the passage of shaft 226. The plate 233 is formed with
10 four radially disposed stems 235, 236, 237, 238 disposed at right angles to each other. The stem 235 at its outer end and at one side is formed with a rearwardly extending arm 239 disposed at right angles thereto. The stem 236 at its outer
15 end and at one side is formed with a rearwardly extending arm 240 disposed at right angles thereto. The stem 237 at its outer end and at one side is formed with a rearwardly extending arm 241 disposed at right angles thereto. The stem 238 at its outer end and at one side is formed with a
20 rearwardly extending arm 242 disposed at right angles thereto. The arms 239, 241 are arranged one above the other and in non-alignment and disposed on their lower lengthwise edges. The
25 arm 240 is arranged below the arm 242 and disposed flatwise. The arm 241 is disposed in lateral relation with respect to the arm 239. The lengthwise edges of the arms 240, 242 are disposed at right angles with respect to the lengthwise
30 wise edges of the arms 239, 241. Arranged in parallel spaced relation relative to the arm 239 and depending relative to the latter is a rectangular plate 243 of insulation of materially greater length than the length of arm 239. The plate 243
35 is disposed on its lower lengthwise edge. Arranged above and in spaced relation to arm 240, as well as extending inwardly therefrom, is a horizontally disposed rectangular plate 244 of insulation of materially greater length than the length of arm
40 240. Opposing in parallel spaced relation the front face of arm 241 is a rectangular plate 245 of insulation disposed on its lower lengthwise edge and of materially greater length than the length of arm 241. Arranged below the arm 242
45 and extending inwardly therefrom, as well as being spaced from the lower face of arm 242, is a horizontally disposed plate 246 of insulation of materially greater length than the length of arm 242. The bottom edge of plate 243 is arranged
50 in parallel spaced relation with the top edge of plate 245. The inner side edges of the plates 244, 246 are arranged in parallel spaced relation. The forward ends of the plates 243, 244, 245, and 246 are arranged in close proximity to the stems
55 235, 236, 237, 238, respectively. The plate 243 is secured to and arranged in spaced relation relative to arm 239 by the combined spacing and holdfast means 247. The plate 244 is maintained in spaced relation relative to and anchored with
60 the arm 240 by a combined spacing and holdfast means 248. The plate 245 is secured to and maintained in spaced relation relative to arm 241 by the combined spacing and holdfast means 249. The plate 246 is maintained in spaced relation
65 relative to and anchored to the arm 242 by the combined spacing and holdfast means 250. The said several holdfast means extend through the said several plates and arms as well as project from the said several arms.

70 The plate 243 in proximity to its lower edge has anchored thereto transversely thereof spaced independent contacts 251, six in number, and to each of which is electrically connected a circuit connection 252. The active ends of the contacts
75 251 extend laterally and rearwardly from the

plate 243. The plate 244 in proximity to its lower edge has anchored thereto transversely thereof spaced independent contacts 253, six in number, and to each of which is electrically connected a circuit connection 254. The active ends of the
5 contacts 253 extend upwardly from the plate 244. The plate 245 in proximity to its upper edge has anchored thereto transversely thereof spaced independent contacts 255, six in number, to each of which is electrically connected a circuit connection 256. The active ends of the contacts 255
10 extend forwardly from the plate 245. The plate 246 in proximity to its inner edge has anchored thereto transversely thereof spaced independent contacts 257, six in number, and to each of which is electrically connected a circuit connection 258. The active ends of the contacts 257 extend downwardly from the plate 246. The contacts 251,
15 253, 255 and 257 at their active ends are split.

Secured to the arm 239 adjacent its forward side by the combined spacing and holdfast means 247 is an angle-shaped carrier 259. Secured to the arm 240 by the combined spacing and holdfast means 248 and adjacent the lower face of said arm is an angle-shaped carrier 260. Secured to the arm 241 by the combined spacing and holdfast means 249 and adjacent the rear face of the arm 241 is an angle-shaped carrier 261. Secured to the arm 242 by the combined spacing and holdfast means 250 and adjacent its upper
20 face is an angle-shaped carrier 262. Each carrier, with reference to Figure 2, includes an arm 263 and an arm 264 disposed at right angles to the arm 263. The arms 264 of the carriers are resilient. The arm 264 of the carrier 259 depends from and is curved outwardly relative to arm 239. The arm 264 of the carrier 260 depends inwardly relative to arm 240 and is curved. The arm 264 of the carrier 261 extends upwardly upon an outward curve relative to the arm 241. The arm 264
25 of the carrier 262 extends inwardly upon an up-curve relative to the arm 242.

The arm 264 of the carrier 259 extends into the upper side of a rectangular block 265 of insulation and provides a resilient suspension for the
30 latter. The block 265 has secured thereto a series of spaced independent adjustable circuit closing members 266 and six in number. To each circuit closing member 266 is attached a circuit connection 267. The members 266 coact with the contacts 253 for closing the circuits associated therewith. The carrier 259 normally tends to shift the members 266 to engage the contacts 253. The members 266 extend inwardly at an inclination with respect to the block 265. The arm 264
35 of the carrier 260 extends into the upper side of a rectangular block 268 of insulation and provides a resilient suspension for the latter. The block 268 has secured thereto a series of spaced independent adjustable circuit closing members 269, six in number. To each circuit closing member 269 is attached a circuit connection 270. The members 269 coact with the contacts 255 for closing the circuits associated therewith. The carrier 260 normally tends to shift the members 269
40 to engage the contacts 255. The members 269 extend upwardly at an inclination with respect to the block 268. The arm 264 of the carrier 261 extends into the lower side of a rectangular block 271 of insulation and provides a resilient suspension for the latter. The block 271 has secured thereto a series of spaced independent adjustable circuit closing members 272, six in number. To each circuit closing member 272 is attached a circuit connection 273. The members 272 coact
45 50 55 60 65 70 75

with the contacts 257 for closing the circuits associated therewith. The carrier 261 normally tends to shift the members 272 to engage the contacts 257. The members 272 extend inwardly at an upward inclination with respect to the block 271. The arm 264 of the carrier 262 extends into the lower side of a rectangular block 274 of insulation and provides a resilient suspension for the latter. The block 274 has secured thereto a series of spaced independent adjustable circuit closing members 275, six in number. To each circuit closing member 275 is attached a circuit connection 276. The members 275 coact with the contacts 251 for closing the circuits associated therewith. The carrier 262 normally tends to shift the members 275 to engage the contacts 251. The members 275 extend downwardly at an inclination with respect to the block 274. The circuit closing members are adapted to engage in the split active ends of the contacts for closing the circuits.

The blocks 265, 274 are arranged at opposite inclinations. The block 265 extends below the block 274. The latter extends above the block 265. The inclinations of the blocks 265, 274 are downward and outward. The blocks 268, 271 are disposed at opposite inclinations. Block 268 depends below the block 271. The latter extends above the block 268. The blocks 268, 271 extend upwardly at outward inclinations. The blocks 265, 268, 271, and 274 have extending inwardly therefrom abutment members 277, 278, 279, and 280 which ride against the edge portion 228 of the cam 227. Holdfast means 281 are employed for connecting the carriers and abutment members to the blocks 265, 268, 271, and 274. The said abutment members 277 to 280 act to arrest the shifting of the blocks 265, 268, 271, and 274 by the carriers towards the edge portions of the cam whereby the high edge portion 228 of the cam 227, coacting with the said abutment members, will maintain circuit closing members clear of their contacts. The edge portions 229, 230 and 231 of the cam 227 constitute clearances and will permit the blocks 265, 268, 271, and 274 to extend inwardly to an extent whereby the circuit closing members may engage their associated contacts. The high edge portion 228 of the cam 227 coacts with the abutment members to move the circuit closing members clear of the contacts to open the circuits.

The edge portions of the cam 227, in connection with the abutment members 277 to 280, inclusive, will provide for the system to operate in a manner to be referred to.

The apparatus includes a dial illuminating means 303. Terminals 304, 305 form elements of the means 303. The latter is secured to an extension 306 formed on and centrally of the top edge of the front cheek 307 of the structure 225.

The illuminating means 303 is made active and inactive in a known manner.

The elements as shown and described, in connection with the circuit arrangement to be referred to will provide a multi-frequency tuning system, including a tuning condenser having a stator and a rotor revoluble through a cycle of 360°, a set of normally open tuning circuits common to a first range of frequencies, a set of normally open tuning circuits common to a second range of frequencies, a set of normally open tuning circuits common to a third range of frequencies, a set of normally open tuning circuits common to a fourth range of frequencies, each range of frequencies covering a portion of the spectrum different from that covered by any one of the

other ranges of frequencies, and a multiple switching assembly, the condenser and assembly having coacting means to respectively provide, on the revolving of the rotor for a part of its cycle in one direction to partly enmesh it with the stator for the closing of the circuits common to the first range for a period to tune the frequencies of the first range from a higher to a lower frequency; on a continuance of the revolving of the rotor in a like direction for another part of its cycle to complete the extent of the enmeshing thereof with the stator for opening the circuits common to the first range and the closing of the circuits common to the second range for a period to tune the second range from a higher to a lower frequency; on a continuance of the revolving of the rotor in a like direction for another part of its cycle to partially unmesh with the stator, for opening the circuits common to the second range and closing the circuits common to the third range for a period to tune the third range from a lower to a higher frequency; and on a continuance of the revolving of the rotor in a like direction for another part of its cycle to completely unmesh it from the stator, for opening the circuits of the third range and the closing of the circuits common to the fourth range for a period to tune the fourth range from a lower to a higher frequency.

With reference to Figure 3, there is illustrated a circuit arrangement 0 which is termed a pre-selector, detector, oscillator circuit covering four bands of frequencies.

An explanation relative to circuit 0 will be as follows: With reference to band one, for example, the switches B², B⁴ and B⁶ are closed with tuning condensers C¹, C² and C³ completely unmeshed. With the aforesaid switches closed then tuning elements C¹, D²—L², and C², D⁴—L⁴, and C³, D⁶—L⁶ are made active in circuit and tune a band of frequencies as the tuning condensers C¹, C² and C³ are turned through 90° during which time the dial band scale turns only through 90°. This represents the end of band one, and with the aforesaid tuning condensers partly enmeshed. Now as the aforesaid tuning condensers are turned further in the same direction, then switches B², B⁴, and B⁶ open, throwing out of circuit C¹, D²—L², and C², D⁴—L⁴, and C³, D⁶—L⁶ and at the same time switches B¹, B³, and B⁵ close with tuning condensers C¹, C², and C³ partly enmeshed. With the aforesaid switches closed, then tuning elements C¹, D¹—L¹, and C², D³—L³, and C³, D⁵—L⁵ are made active in circuit and tune a second band of frequencies different from band one frequencies as the tuning condensers C¹, C², and C³ are turned in the same direction through 90° during which time the dial band scale turns through a second range of 90°. This point is the end of band two, and with the aforesaid tuning condensers fully meshed. Now as the aforesaid tuning condensers are turned further in the same direction, then switches B¹, B³, and B⁵ open, throwing out of circuit tuning elements C¹, D¹—L¹, C², D³—L³, and C³, D⁵—L⁵ and at the same time switches B⁸, B¹⁰, B¹² close with tuning elements C¹, C², and C³ completely meshed. With the aforesaid switches closed, then tuning elements C¹, D⁸—L⁸, C², D¹⁰—L¹⁰, and C³, D¹²—L¹² are made active in circuit and tune a third band of frequencies different from bands one and two frequencies as the tuning condensers C¹, C², C³ are turned in the same direction through another 90° during which time the dial band scale turns through a third range of 90°. This point is the

end of band three, and with the aforesaid tuning condensers partly unmeshed. Now as the aforesaid tuning condensers are turned further in the same direction, then switches B⁸, B¹⁰, B¹² open, throwing out of circuit tuning elements C¹, D⁸—L⁸, C², D¹⁰—L¹⁰, and C³, D¹²—L¹², and at the same time switches B⁷, B⁹, and B¹¹ close with tuning condensers C¹, C², and C³ partly unmeshed. With the aforesaid switches B⁷, B⁹, and B¹¹ closed, then tuning elements C¹, D⁷—L⁷, C², D⁹—L⁹, and C³, D¹¹—L¹¹ are made active in circuit and tune a fourth band of frequencies different from bands one, two, and three frequencies as the tuning condensers C¹, C², and C³ are turned further in the same direction another 90° during which time the dial band scale turns through a fourth range of 90°, which marks the end of one complete turn of the tuning condensers C¹, C², and C³, and one complete turn of the dial band scale.

Now as the aforesaid tuning condensers are turned further in the same direction, then switches B⁷, B⁹, and B¹¹ open, throwing out of circuit tuning elements C¹, D⁷—L⁷, C², D⁹—L⁹, and C³, D¹¹—L¹¹, and at the same time switches B², B⁴, and B⁶ close with tuning condensers C¹, C², and C³ fully unmeshed. With the aforesaid switches B², B⁴, and B⁶ closed, then tuning elements C¹, D²—L², C², D⁴—L⁴, and C³, D⁶—L⁶ are made active again, which brings us back to the starting point again of band one. It is to be noted that the coils are in inductive relation as follows: D¹ with L¹, D³ with L³, D⁵ with L⁵, D² with L², D⁴ with L⁴, D⁶ with L⁶, D⁷ with L⁷, D⁹ with L⁹, D¹¹ with L¹¹, D⁸ with L⁸, D¹⁰ with L¹⁰, and D¹² with L¹².

The system in accordance with this invention provides for the operator tuning two different bands of frequencies going into mesh and two when coming out of mesh. This gives a condenser double function, whereas it has been conventional to use single function. It saves equipment use. It saves time in tuning. It simplifies the tuning for the operator. It makes one-spot tuning possible on the dial, and eliminates the use of a number of visible dial scales over all and the associated double end pointers that are confusing to the operator as to where the dial is supposed to be read.

When the tuning condenser is full in mesh with a given coil inductance, the condenser is set at its highest capacity, but its lowest frequency range; and when the tuning condenser is out of mesh with the same given coil inductance as used aforesaid, the condenser is set at its lowest capacity, but its highest frequency range, whereby right

after a switch action the follower band is tuned in the opposite direction as to frequency or capacity direction.

What I claim is:

1. In a multi-frequency tuning system, a tuning condenser including a stator and a rotor revoluble through a cycle of 360°, a set of normally open tuning circuits common to a first range of frequencies, a set of normally open tuning circuits common to a second range of frequencies, a set of normally open tuning circuits common to a third range of frequencies, a set of normally open tuning circuits common to a fourth range of frequencies, each range of frequencies covering a portion of the spectrum different from that covered by any one of the other ranges of frequencies, and a multiple switching assembly, said condenser and assembly having coacting means to respectively provide, on the revolving of the rotor for a part of its cycle in one direction, to partly enmesh it with the stator for the closing of the circuits common to the first range for a period to tune the frequencies of the first range from a higher to a lower frequency; on a continuance of the revolving of the rotor in a like direction another part of its cycle, to complete the extent of the enmeshing thereof with the stator for the opening of the circuits common to the first range and the closing of the circuits common to the second range for a period to tune the second range from a higher to a lower frequency; on a continuance of the revolving of the rotor in a like direction for another part of its cycle to partially unmesh with the stator, for opening the circuits common to the second range and closing the circuits common to the third range for a period to tune the third range from a lower to a higher frequency; and on a continuance of the revolving of the rotor in a like direction for another part of its cycle and to completely unmesh it from the stator, for opening of the circuits of the third range and the closing of the circuits common to the fourth range for a period to tune the fourth range from a lower to a higher frequency.

2. The invention as set forth in claim 1 having said switching assembly formed with a series of independent sets of contacts and a series of independent sets of circuit closers, each set of circuit closers for coaction with a set of contacts to close a set of tuning circuits, a set of contacts and the set of circuit closers coacting therewith being interposed in a set of tuning circuits, the circuit closers of each set thereof being adjustable.

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