June 2, 1942. L. H. ZEPP 2,285,247

CONTROL DEVICE FOR RADIO RECEIVERS AND THE LIKE

Filed March 10, 1938 4 Sheets-Sheet 1

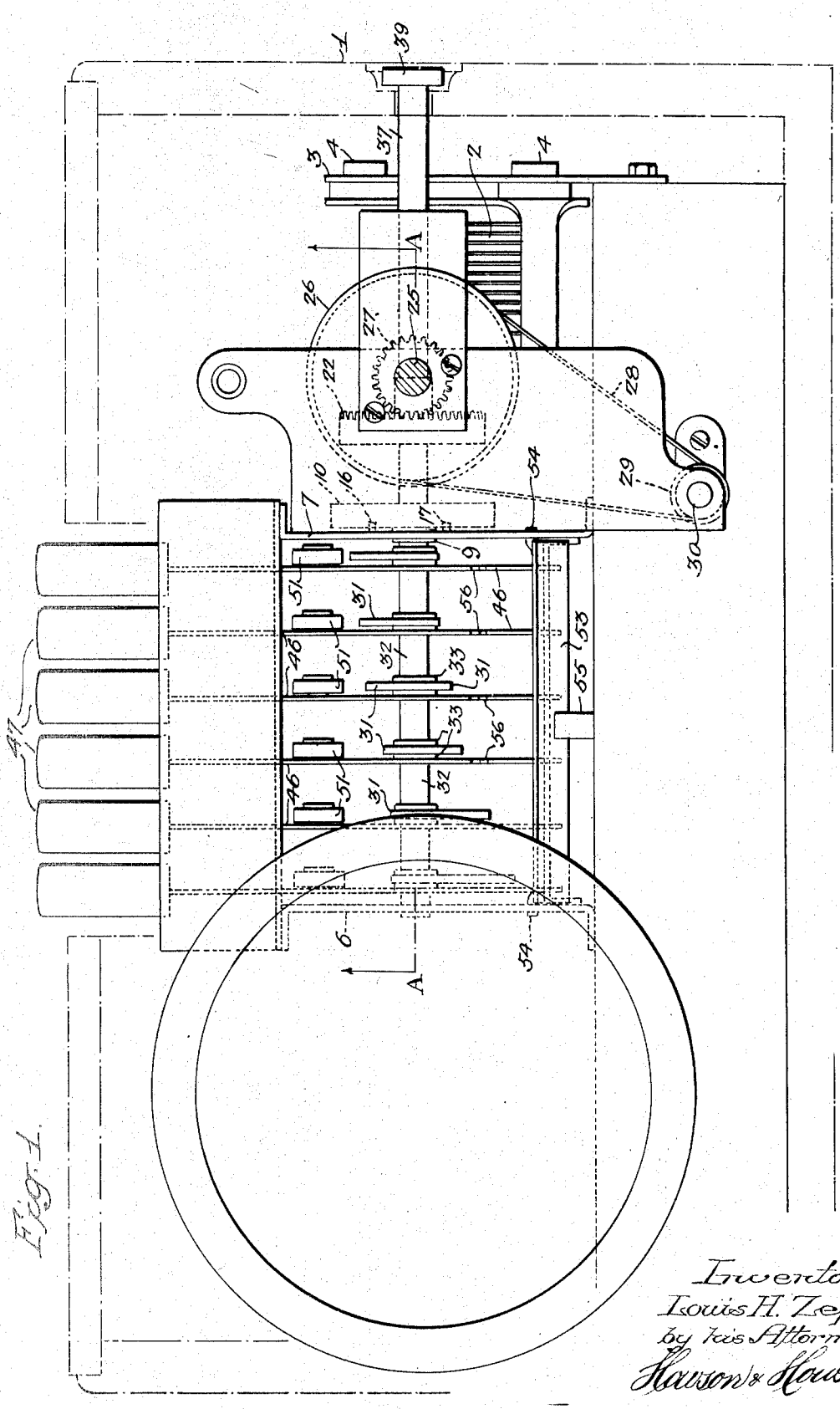


Fig. 1.

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CONTROL DEVICE FOR RADIO RECEIVERS AND THE LIKE

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Fig. 1.

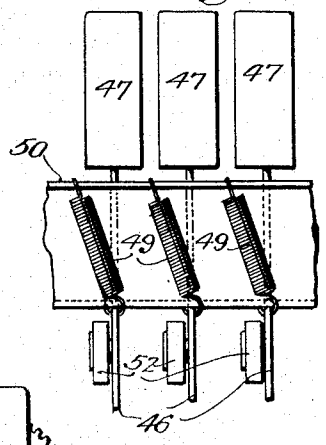


Fig. 2.

Fig. 10.

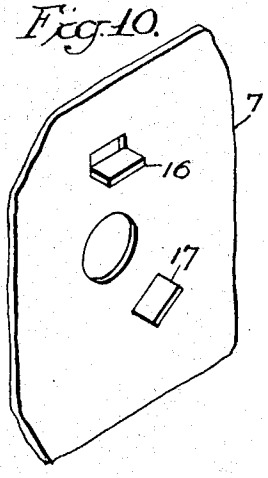
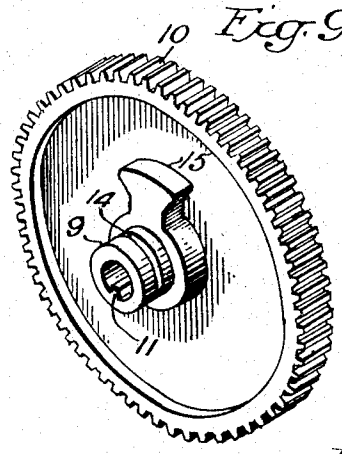


Fig. 9.



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CONTROL DEVICE FOR RADIO RECEIVERS AND THE LIKE

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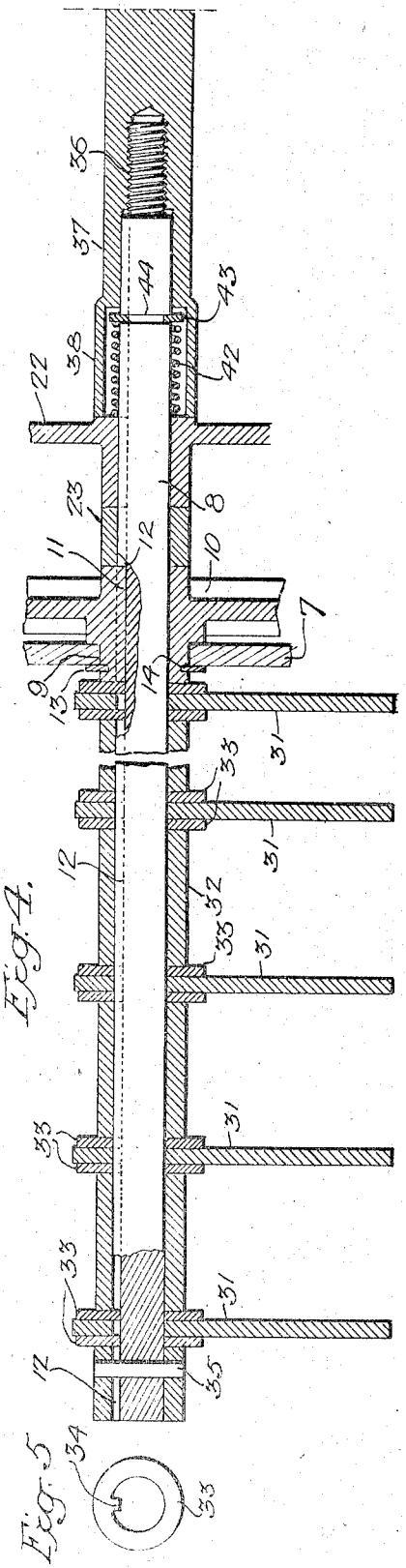


Fig. 4.



Fig. 5

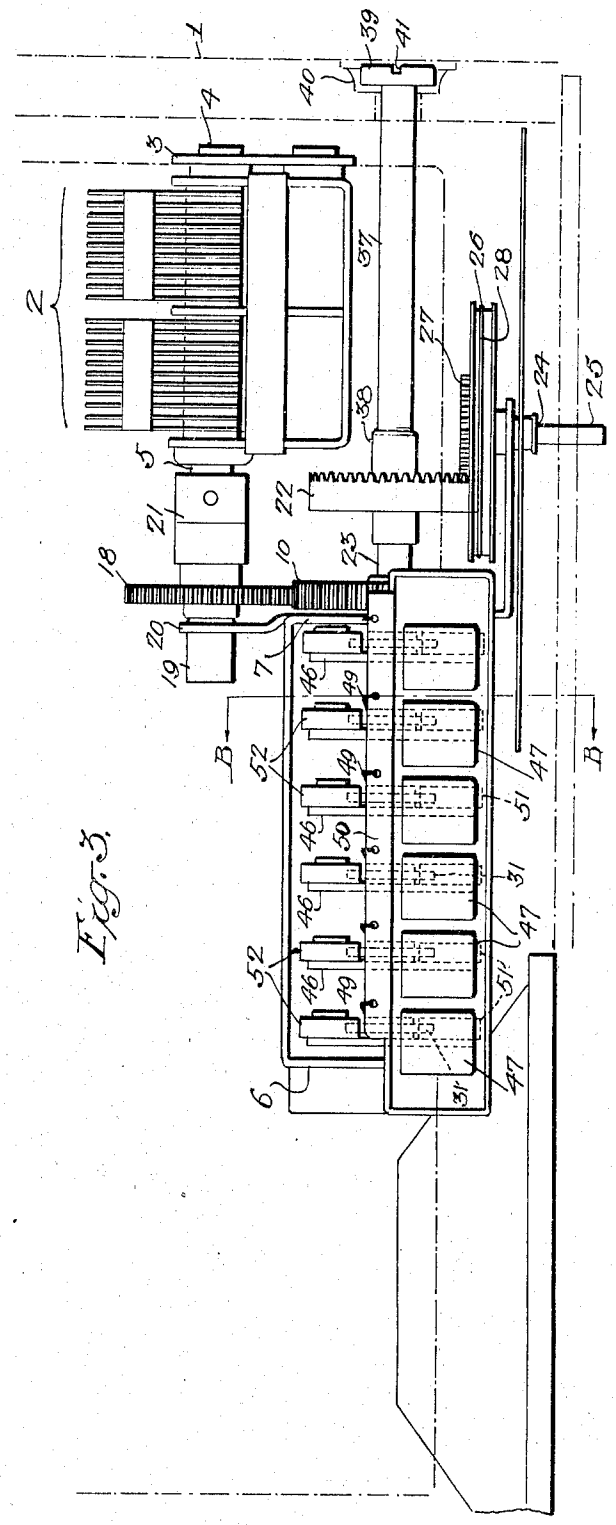


Fig. 3.

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CONTROL DEVICE FOR RADIO RECEIVERS AND THE LIKE

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Fig. 6.

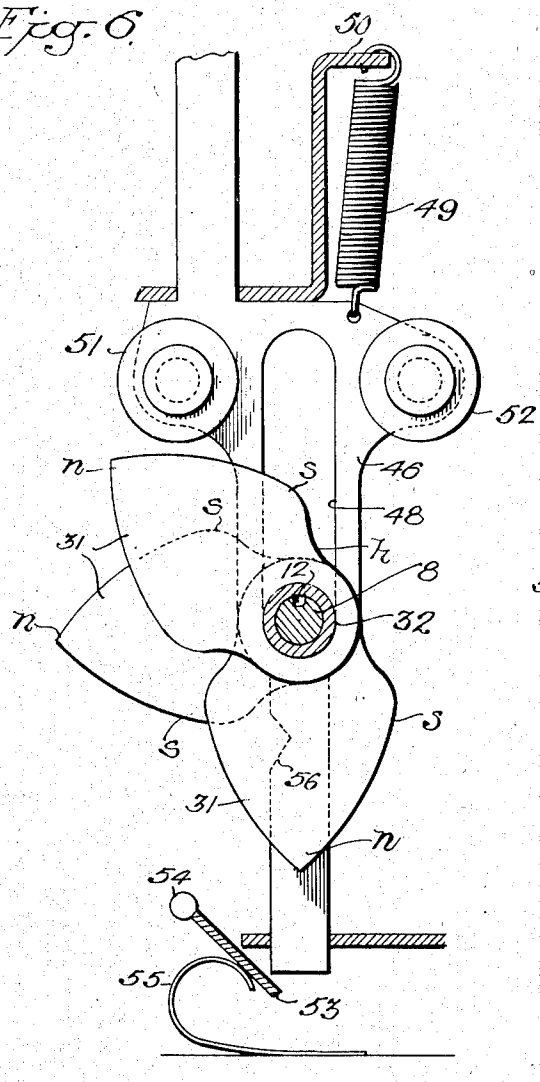


Fig. 8.

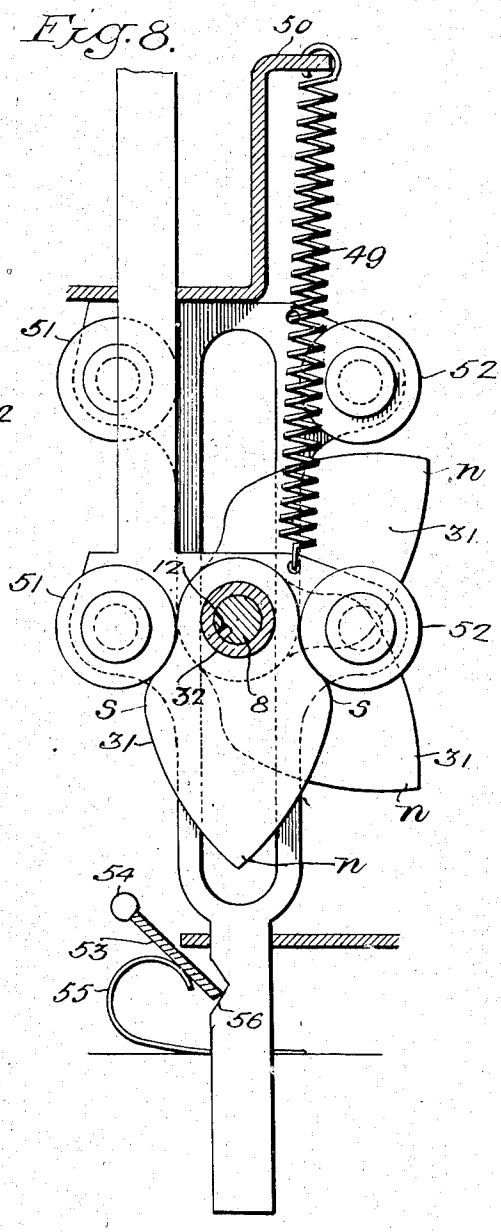
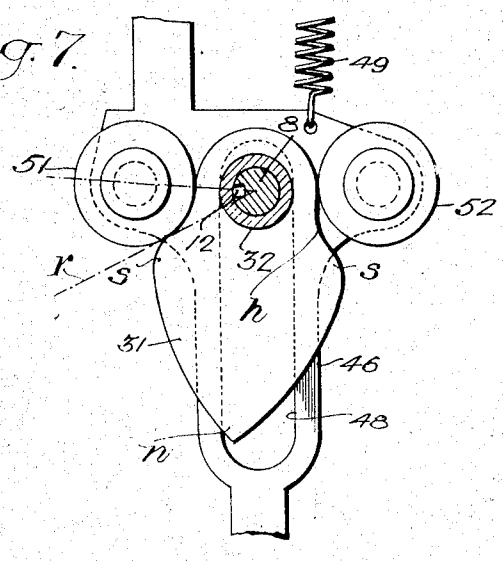


Fig. 7.



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2,285,247

UNITED STATES PATENT OFFICE

2,285,247

CONTROL DEVICE FOR RADIO RECEIVERS AND THE LIKE

Louis H. Zepp, Philadelphia, Pa., assignor, by mesne assignments, to Philco Radio and Television Corporation, Philadelphia, Pa., a corporation of Delaware

Application March 10, 1938, Serial No. 195,182

9 Claims. (Cl. 74—10)

This invention relates to new and useful improvements in tuning control devices for radio receivers and more particularly tuning control devices of the push button operated type.

The principal object of the present invention is to provide a device of the character set forth having novel mechanism for positively and accurately turning the condenser or other tuning element of a radio receiving set into a predetermined position corresponding to the wave length of a selected radio station.

Another equally important object of the invention is to provide a radio tuning device of the push-button-operated cam-controlled type which is operable to effect relatively easy, rapid tuning of the receiver and is constructed and arranged to positively control actuation of the cams entirely to their final rest or tuning positions thus eliminating over carry thereof and insuring precision tuning of the radio receiver.

A still further object of the invention is to provide a push-button-actuated cam-controlled radio tuning device of the character set forth which embodies novel features of construction and arrangement whereby the several cams, or any of them, may be quickly and easily adjusted into any predetermined tuning position desired.

A still further object of the invention is to provide a radio receiving set tuning device of the type described which is comparatively inexpensive to manufacture and, as respects its external operating instrumentalities, does not destroy or detract from the general external appearance of the cabinet in which it and the radio receiver are mounted.

These and other objects of the invention and the features and details of its construction and operation are hereinafter fully set forth and shown in the accompanying drawings, in which:

Figure 1 is a front elevation view of a tuning device embodying the invention in association with a radio receiving set of the cabinet type;

Figures 2 and 3 are end elevation and plan views respectively of the disclosure in Figure 1;

Figure 4 is an enlarged fragmentary view in section taken on line A—A Figure 1;

Figure 5 is a plan view of one of several washers embodied in the invention;

Figures 6, 7 and 8 are fragmentary views partially in section on line B—B Figure 3 showing the relationship of various elements of the mechanism when the cams are in inoperative, intermediate and operative or final rest positions;

Figure 9 is a view in perspective illustrating certain details of construction of a gear wheel forming a feature of the invention;

Figure 10 is a view in perspective of a plate or member constituting a part of the frame structure for the mechanism and arranged for cooperative association with the gear wheel shown in Figure 9; and

Figure 11 is a detached fragmentary view illustrating the angular arrangement or mounting of the plunger springs.

Referring now more particularly to Figure 1 of the drawings, the tuning mechanism is shown as mounted within the cabinet 1 of a radio receiving set which has as its tuning element a variable condenser 2 supported endwise of said tuning mechanism by a bracket or plate 3 to which it is connected by means of resilient bushings 4 so that its shaft 5 extends horizontally and longitudinally of the cabinet.

The tuning mechanism comprises a frame structure including end or side plate members 6 and 7 in which a shaft 8 is journalled. The journal for the shaft 8 in the plate 7 is provided by the projecting hub portion 9 of a gear wheel 10 which has a key or projection 11 thereon arranged to engage a groove 12 extending lengthwise of the shaft 8 thus slidably keying said gear 10 thereon. The gear is fixedly positioned relative to the plate 7 at the condenser side thereof by virtue of a "C" type washer 13 which is mounted in a slot or groove 14 in the hub portion 9 thereof and engages the opposite face of the plate 7 as shown in Figure 4 of the drawings.

For a purpose that will later appear, rotation of the shaft 8 is limited to approximately 145 degrees by means of a lug or projection 15 on the face of the gear 10 which is arranged to move within the longer distance between stops 16 and 17 pressed out from the frame plate 7. As shown, the shaft 8 is operatively connected to the shaft 5 of the condenser 2 through the gear 10, a gear 18 and its shaft 19 which is journalled in a portion or arm 20 of the frame structure. One end of this shaft 19 is connected to the condenser shaft 5 by means of a resilient coupling member 21 and in order to effect the requisite approximately 180 degrees rotation of the condenser 2 and its shaft 5, the ratio of the diameters of the gears 10 and 18 is such that rotation of the shaft 8 and gear 10 through 145 degrees will cause said condenser and its shaft to rotate through approximately 180 degrees.

Also keyed upon the shaft 8 at the condenser side of the plate 7 is a second gear 22 which is spaced from the gear 10 by means of a sleeve 23.

A pointer 24 of any usual or suitable construction is carried by a shaft 25 and exposed in cooperative association with a dial in the conventional manner through an opening to the front face of the cabinet 1 to indicate the setting of the device. This shaft 25 has fixed thereon a pulley 26 and a gear 27 which meshes with the said gear 22 thus operatively connecting the said shaft 25 and pointer 24 to the condenser 2 through the shaft 8, gears 16 and 18 and shaft 19. A belt or cable 28 passes about the pulley 26 and also a smaller pulley 29 carried by a shaft 30 which projects beyond the front face of the cabinet 1 and is provided with a suitable button or knob (not shown) by means of which said shaft 30 may be rotated to drive the pulley 26 through said cable 28 and hence turn the pointer 24, shaft 8 and the condenser 2 through the aforementioned gear connections to manually tune the receiver in accompaniment to movement of said pointer 24 relative to the dial to indicate the setting of said condenser in the usual manner.

Mounted upon the shaft 8 at the opposite side of the frame plate 7 are a plurality of cam elements 31 which under certain conditions are intended to be adjusted relative to the shaft 8 and therefore are not keyed thereon. The cams 31 are spaced relative to one another by means of sleeves 32 and washers 33, the latter being disposed at opposite sides of each such cam between it and the adjacent sleeve. These washers 33 are of the general construction shown in Figure 5 and include a lug or projection 34 for engagement with the groove 12 in shaft 8 so that said washers 33 rotate therewith.

As shown in Figure 4, the innermost sleeve 32 is connected to the adjacent or inner end of the shaft 8 by means of a pin 35. On the other hand, the opposite or outer end of the shaft 8 is threaded and engages a threaded socket portion 36 provided in a locking and adjusting member 37 which is journalled in the cabinet 1 and has a cup shaped inner end portion 38 which, when the member is tightened upon the shaft, normally abuts or engages the outer face of the hub portion of the gear 22. The other or outer end of the member 38 is provided with an enlarged head 39 which resides within a recess 40 flush with the external surface of the end of said cabinet and has a slot or groove 41 therein to enable turning of said member 37 by means of a screw driver, cam or the like. The inner cup shaped portion 38 of the member 37 provides sufficient clearance for a coil spring 42 which surrounds the shaft 8 and acts between the adjacent hub face of the gear 22 and a "C" type washer 43 which engages a groove 44 in said shaft and acts as a stop or abutment for said spring 42.

From the foregoing description it will be seen that when the locking member 37 is tightened upon the shaft and resides firmly against the face of the hub of the gear 22 pressure is exerted through the sleeves 32 and washers 33 upon the cams 31 with the result that the latter are securely bound and gripped therebetween to an extent affording in effect a unitary structure or assembly rotatable with the shaft 8. On the other hand, when the locking member 37 is loosened sufficiently the grip upon the cams 31 afforded by the sleeves 32 and washers 33 is lessened to an extent permitting adjustment of said cams circumferentially of the shaft 8 as desired although when said member 37 is thus loosened the spring 42 exerts sufficient pressure upon the cams 31 through the sleeves 32 and washers 33 to normally hold said cams in position upon said shaft during adjustment of any one cam thereon until said locking member is again tightened against the gear 22.

Assuming for the present that the cams 31 are in desired positions of adjustment circumferentially of the shaft 8, actuation of said cams 31 and consequently the shaft 8, condenser 2 and pointer 24 is effected by means of plungers 46 which are mounted for movement within predetermined limits vertically within the cabinet 1, and provided with button elements 47 at their upper ends which project a suitable distance above the top of the cabinet 1 as indicated in Figure 1. The plungers 46 are each provided with a slot 48 therein through which the shaft 8 and one of the spacing sleeves 32 extends and the length of said slots 48 is such as to determine the limits and extent of movement of the plungers 46 inwardly of the cabinet 1 with respect to the said shaft 8 and cams 31 thereon, said plungers 46 being normally urged outwardly of the cabinet 1 by means of springs 49 which are connected at an angle between said plungers and the portion 50 of the frame structure of the tuning mechanism as shown in Figure 11 for the purpose of preventing rattling.

As shown particularly in Figures 6, 7 and 8 of the drawings, engagement and rotation of the cams 31 and consequently the shaft 8 is accomplished by means of a pair of rollers 51 and 52 carried by each plunger 46 in horizontally spaced relation at respectively opposite sides of the axis of movement of said plungers. The distance between the centers of the rollers 51 and 52 and the length of stroke of the plungers 46 as limited by the slots 48 is preferably of the ratio of approximately one to one, said ratio affording maximum over all precision through a large angle of rotation.

Precision, as herein used, relates to the measure of the possible angular rotation of the shaft 8, and hence the condenser 2, when the plunger 46 is not fully depressed but is a small fixed distance which might be called a tolerance from the lowermost position of the plunger stroke and obtains from the fact the distance from the center of rotation of the cams 31 to the point of contact thereof with the rollers 51 and 52 increases as the distance between said rollers is increased, and also the fact that with a given tolerance the angle through which the cam is free to rotate varies inversely with the last mentioned distance.

Due consideration must be given to the form or contour of the cams 31 and for purposes of description, the several portions of said cams are herein designated as the nose *n*, shoulders *s* and heel *h* and these portions will be individually considered inasmuch as the requirements for each such portion are different. The nose portions *n* of the cams 31 preferably have a curvature such that the angular velocity of said cams is proportional to the linear velocity of the plungers 46 and as this curvature may be determined by any one of several well known methods further comment in that regard is deemed unnecessary. However, considerable care and study must be given the selection of the proper radius of curvature of the shoulder portions *s* of the cams 31 since this portion determines the behavior of said cams during a critical period of rotation thereof.

It will be seen upon reference to Figures 6, 7

and 8 of the drawings that the maximum distance between the shoulder portions *s* of each of the cams 31 is necessarily greater than the distance between the innermost points on the peripheries of the rollers 51 and 52 carried by the plungers 46, and in the present design the former distance is less than the distance between the centers of rotation of said rollers. Further, the circular heel portions *h* of the cams 31 have a diameter that is equal to the distance between the peripheries of the plunger rollers 51 and 52.

The principal objective in the design of the contour of the cams 31 and particularly the shoulder portions *s* thereof is to obtain a marked decrease in the angular velocity of said cams as they approach the rest position and also to eliminate any possibility of rebound when the cams reach such rest position. In the present instance, these objectives are obtained by designing the cams 31 so that the periphery of the shoulder portions *s* thereof approaches but does not become tangent to any radial line *r* drawn through the center of rotation of said cams 31 as shown in Figure 7, and by further designing the cams so that the periphery of said shoulder portions *s* is intercepted by any such radial line *r* at but a single point therealong.

It will be observed particularly with reference to Figures 7 and 8 of the drawings that the radius of curvature of the shoulder and heel portions *s* and *h* respectively of the cams is such that the periphery of said cams in the region of the point of contact approaches a relation parallel to the direction of movement of the plungers with the result that with a given tolerance the angular play of the cams is minimized, and that part of each of the rollers 51 and 52 which is in contact with the cam is permitted to pass a short distance below the center of rotation of said cams thus affording maximum precision in the ultimate positioning of the cams at all times since any wear, play or looseness between the shaft 8 and its bearings or the cams 31 and rollers 51 and 52 is compensated for by the opposing forces provided by contact of the rollers 51 and 52 with opposite sides of said cams and thus forcibly opposing possible carryover of the cams beyond their final rest positions.

To set each cam 31 in proper position upon the shaft 8 so as to bring the receiving circuit into resonance with the particular station represented by its associated plunger 46, the locking member 37 is loosened with respect to said shaft 8 as above described to release compression upon the cams 31 to an extent sufficient to permit them to be rotated upon the shaft 8 by the application of positive force against the compression afforded by the spring 42 which continues to exert sufficient pressure upon said cams to otherwise hold them in position. The stop 17 on the frame plate 7 is provided primarily to afford a strong rigid abutment to limit rotation of the shaft 8 in one direction and against which the locking member 37 may be loosened with respect to said shaft 8 without danger of possible damage to the movable plates of the condenser 2 which might otherwise occur were rotation of the shaft 8 limited solely by the extent of rotation of the movable plates of the condenser. After the locking member 37 has been loosened as described, the receiving set is turned on and the plunger 46 selected to represent a desired station is depressed to engage and actuate its associated cam 31 into operative rest position after which the receiving set is manually tuned to that station to position said cams 31 and shaft 8 in the proper circumferential relation with respect to each other so that the receiving circuit may be brought into resonance with said selected station at each subsequent depression of the plunger or at least until said cam 31 may be adjusted to a different position upon said shaft.

The other cams 31 may then be similarly adjusted upon the shaft 8 according to the particular station to be represented by their associated plungers 46 and until all of the cams are thus set the compression afforded by the spring 41 is sufficient to maintain each cam in the position to which it may be adjusted circumferentially of the shaft 8. When any or all of the cams 31 have been adjusted circumferentially of the shaft 8 as aforementioned, the locking member 38 is tightened upon the shaft 8 which is moved to its other limit of rotation provided by the stop 16 on the frame plate 7 which affords a strong rigid abutment against which the locking member 37 may be forcibly tightened with respect to the shaft 8 without danger of possible damage to the movable plate assembly of the tuning condenser 2. In the same manner, the cams 31, or any of them, may be reset from time to time as desired.

From Figures 6, 7 and 8 of the drawings it will be observed that the construction and arrangement of the cams 31 and rollers 51 and 52 carried by each associated plunger is such that in the final rest or tuning position of each cam the long axis thereof lies in the direction of movement of its plunger 46 which in the present instance is vertical with respect to the radio receiver and its cabinet 1.

Generally the plungers 46 will be permitted to return immediately to their inoperative outward positions under the influence of the springs 49 as soon as the cams 31 have been actuated thereby into final rest or tuning positions. However, in certain installations such as in automobiles, small boats, airplanes and the like where vibration may be sufficient to jar the cams 31 from final rest or tuning position in the event that they are not held in such position by the rollers 51 and 52 carried by the plungers, a suitable lock or latch mechanism may be provided whereby the plungers 46 are held in inward cam positioning relation at least during such period that it is desired they remain in such tuning position.

In the present instance such locking mechanism for the plungers 46 comprises a latch member 53 which is common to all of said plungers and pivotally mounted in the frame structure of the device as indicated at 54. A leaf spring 55 constantly urges the latch member 53 in a counterclockwise direction with respect to Figures 6 and 8 of the drawings into the path of the plungers 46 with the result that as the latter reach the limit of inward movement and the cams 31 reach final rest or tuning position said leaf spring 55 causes the latch member 53 to engage a notch 56 in each plunger 46.

By providing a common latch member according to the above description depression of any plunger 46 may be employed to release or unlock any other plunger previously depressed with the result that when a plunger 46 is depressed to tune the radio receiver it will remain locked in that position until another plunger is depressed and the latch 53 actuated thereby against the spring 55 out of engagement with the notch 56 of the first plunger thus allowing its spring 49

to return it to inoperative position. Such other plunger may then be released or moved fully inward to engage the latch 53 with its notch 56 so as to lock said other plunger and its cam in tuning position where it will be held by said latch 53 until still another plunger is depressed a sufficient distance to engage and release the latch from the notch 56 of the plunger thus held.

While a particular embodiment of the invention has been herein illustrated and described, it is not intended that the invention be precisely limited to that form of device, but that changes and modifications in construction and arrangement may be embodied or incorporated therein within the scope of the annexed claims.

I claim:

1. In a device of the character described, a shaft, a cam mounted on said shaft for rotation therewith, said cam having a curved periphery, a manually operable member having a stroke of predetermined fixed length associated with said cam, a pair of actuating elements carried by said member and arranged to engage the associated cam at opposite sides of the axis of rotation of the cam to rotate the same and said shaft into a predetermined position, the curvature of the cam bearing such relation to the stroke of said member and the location and distance between the actuating elements carried thereby that as said cam approaches final rest position, said actuating elements contact the cam at opposite sides thereof and below its center of rotation to insure positive accurate positioning thereof in said final rest position.

2. In a radio receiving set having as its tuning element at least one rotatable member provided with a shaft, a device for tuning said element comprising a cam shaft operatively connected to the shaft of the tuning element, a plurality of cam elements mounted on said shaft for rotation therewith, said cam elements each having a curved periphery, a manually actuable member associated with each of said cams, and a pair of actuating elements carried by each member and arranged to engage the associated cam at opposite sides of the axis of rotation of said cam to rotate the same, said cam shaft and tuning element into a predetermined position, the curvature of said cams bearing such relation to the stroke of the members and the location and distance between the actuating elements carried thereby that as the cams approach final tuning position, said actuating elements contact said cams at opposite sides thereof and below the center of rotation of the cams to insure positive accurate positioning thereof into tuning position.

3. In a radio receiving set having as its tuning element at least one rotatable member provided with a shaft, a device for tuning said element comprising a cam shaft operatively connected to the shaft of the tuning element, a plurality of cam elements mounted on said shaft for rotation therewith, said cam elements each having a curved periphery, a manually actuable member for each of said cams, a pair of actuating elements carried by each member and arranged to engage the associated cam at opposite sides of the axis of rotation of said cam to rotate the same, said cam shaft and tuning element into a predetermined position, the curvature of said cams bearing such relation to the stroke of said members and the location and distance between the actuating elements carried thereby that as the cams approach final tuning position, said actuating elements contact said cams at opposite sides thereof and below the center of rotation of the cams to insure positive accurate positioning thereof into tuning position, and means associated with each member tending to urge the same into inoperative relation with respect to said cams.

4. In a radio receiving set having as its tuning element at least one rotatable member provided with a shaft, a device for tuning said element comprising a cam shaft operatively connected to the shaft of the tuning element, means for positively restricting rotation of the cam shaft between predetermined limits, a plurality of cam elements mounted on said shaft for rotation therewith, said cam elements each having a curved periphery, a manually actuable member for each of said cams having a stroke of predetermined fixed length, and a pair of actuating elements carried by each member and arranged to engage the associated cam at opposite sides of the axis of rotation of said cam to rotate the same, said cam shaft and tuning element into a predetermined position, the curvature of the cams bearing such relation to the stroke of the members and the location and distance between the actuating elements carried thereby that as the cams approach final tuning position, said actuating elements contact said cams at opposite sides thereof at points below the center of rotation of the cams to insure positive accurate positioning thereof into tuning position.

5. In a radio receiving set having as its tuning element at least one rotatable member provided with a shaft, a device for tuning said element comprising a cam shaft operatively connected to the shaft of the tuning element, a plurality of cam elements mounted on said shaft for independent angular adjustment thereon, said cam elements each having a curved periphery, means for securing said cams for rotation with said cam shaft in any adjusted position and for freeing said cams with respect to said shaft to permit adjustment of the cams thereon, a manually actuable plunger for each of said cams, a pair of rolls carried by each plunger and arranged to engage the associated cam at opposite sides of the axis of rotation of said cam to rotate the same, said cam shaft and tuning element into a predetermined position, the curvature of said cams bearing such relation to the stroke of the plungers and the location and distance between the rolls carried thereby that as the cams approach final tuning position, said rollers engage the cams at opposite sides thereof at points below the center of rotation of the cams to insure positive accurate positioning thereof into tuning position, and a spring actuated latch member arranged to engage a notch in each plunger as it reaches the limit of its operative stroke to hold said plunger in that position.

6. In a radio receiving set having as its tuning element at least one rotatable member provided with a shaft, a device for tuning said element comprising a cam shaft operatively connected to the shaft of the tuning element, means for positively restricting rotation of the cam shaft between predetermined limits, a plurality of cam elements mounted on said shaft for independent angular adjustment thereon, said cam elements each having a curved periphery, means for securing said cams for rotation with said cam shaft in any adjusted position and for freeing said cams with respect to said shaft to permit adjustment of the cams thereon, a manually actuable plunger for each of said cams having a

stroke of predetermined fixed length, a pair of rolls carried by each plunger and arranged to engage the associated cam at opposite sides of the axis of rotation of said cam to rotate the same, said cam shaft and tuning element into a predetermined position, the curvature of said cams bearing such relation to the stroke of the plungers and the location and distance between the rolls carried thereby that as the cams approach final tuning position, said rollers engage the cams at opposite sides thereof at points below the center of rotation of the cams to insure positive accurate positioning thereof into tuning position, and a spring actuated latch member arranged to engage a notch in each plunger as it reaches the limit of its operative stroke to hold said plunger in that position.

7. In a radio receiving set having as its tuning element at least one rotatable member provided with a shaft, a device comprising a cam shaft operatively connected to the shaft of the tuning element, a plunger constructed and arranged to move along a path passing through the axis of said cam shaft, a pair of spaced rollers carried by said plunger, and a cam on the cam shaft arranged for rotation by depressing the plunger, said cam having a nose portion arranged for contact by only one of said rollers to rotate the cam substantially uniformly as said plunger is depressed, a shoulder portion having a rapidly decreasing but single-valued radius to reduce the rate of rotation of said cam, and a heel portion arranged to seat a substantial portion of each of the rollers when the plunger is in its final rest position, the portion of said rollers in contact with said heel portion of the cam being below the axis of rotation of the cam shaft.

8. In a device of the character described, a shaft, a cam having a curved periphery mounted on said shaft for rotation therewith, a manually operable member, a pair of actuating elements carried by said member and arranged to engage the cam at opposite sides of its axis of rotation to rotate the same and said shaft into a predetermined position, said cam comprising spaced shoulder portions having a single valued radius which rapidly decreases from a maximum distance between said shoulder portions greater than the space between said actuating elements, and a heel portion having a radius substantially equal to the space between the actuating elements cooperatively associated with said shoulder portions whereby a marked decrease in the angular velocity of said cam as it approaches rest position is effected.

9. In a device of the character described, a shaft, a cam having a curved periphery mounted on said shaft for rotation therewith, a manually operable member, a pair of actuating elements carried by said member and arranged to engage the cam at opposite sides of its axis of rotation to rotate the same and said shaft into a predetermined position, said cam comprising spaced shoulder portions having a singled valued radius which rapidly decreases from a maximum distance between said shoulder portions greater than the space between said actuating elements, and a heel portion having a radius substantially equal to the space between the actuating elements cooperatively associated with said shoulder portions and merging therewith in a sector which is approximately tangent to a line drawn through the center of rotation of the cam whereby a marked decrease in the angular velocity of said cam as it approaches rest position is effected.

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