Dec. 18, 1928.

1,695,390

A. F. SANFORD

RADIO APPARATUS

Filed Dec. 17, 1925

5 Sheets-Sheet 1

Fig. 1.

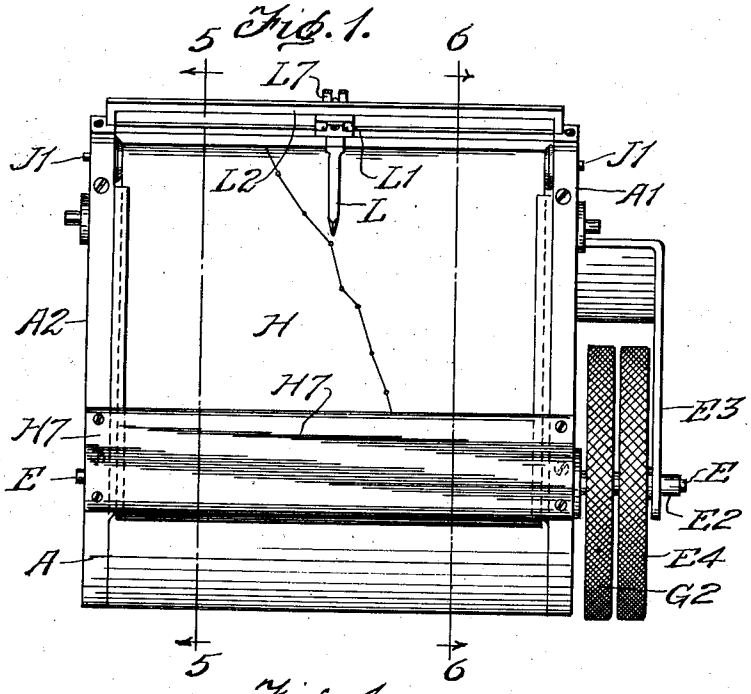
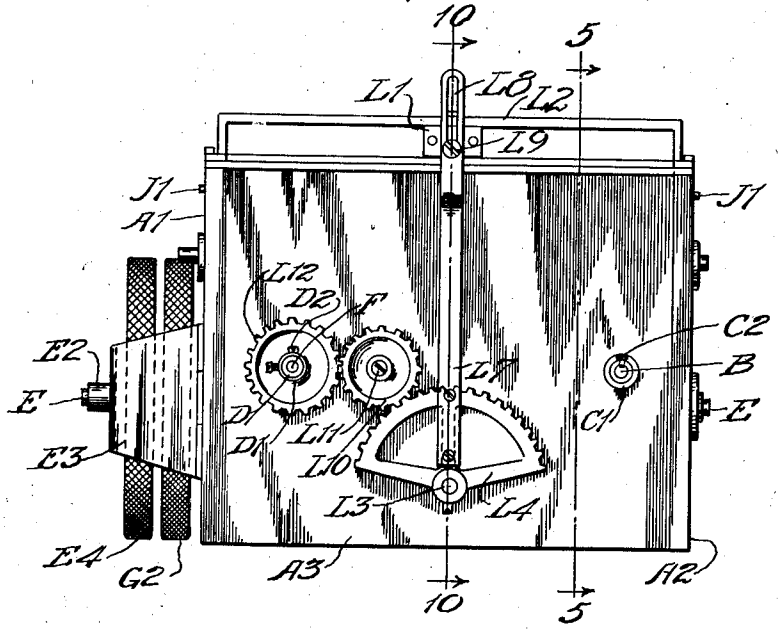


Fig. 4.



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BY Alfred F. Sanford

Cyrus Keller,

ATTORNEYS.

Dec. 18, 1928.

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RADIO APPARATUS

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5 Sheets-Sheet 2

Fig. 2.

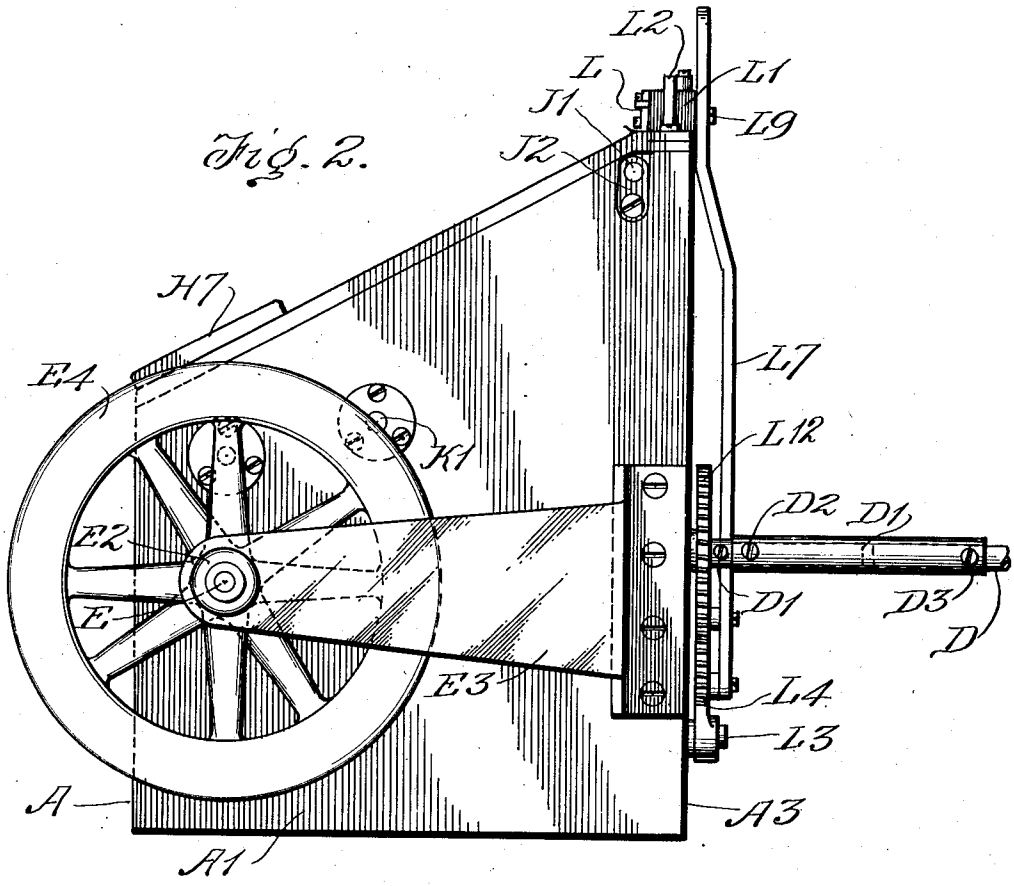
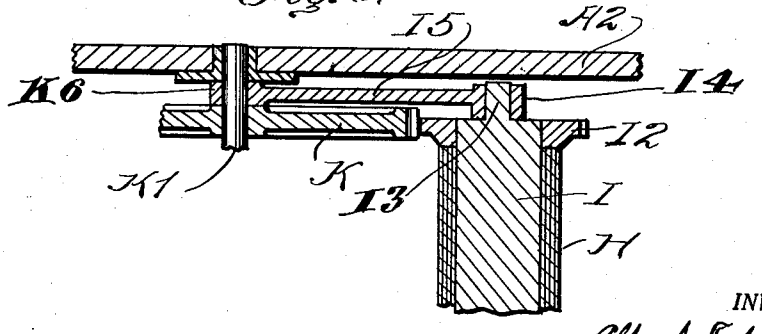


Fig. 8.



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Dec. 18, 1928. 1,695,390

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RADIO APPARATUS

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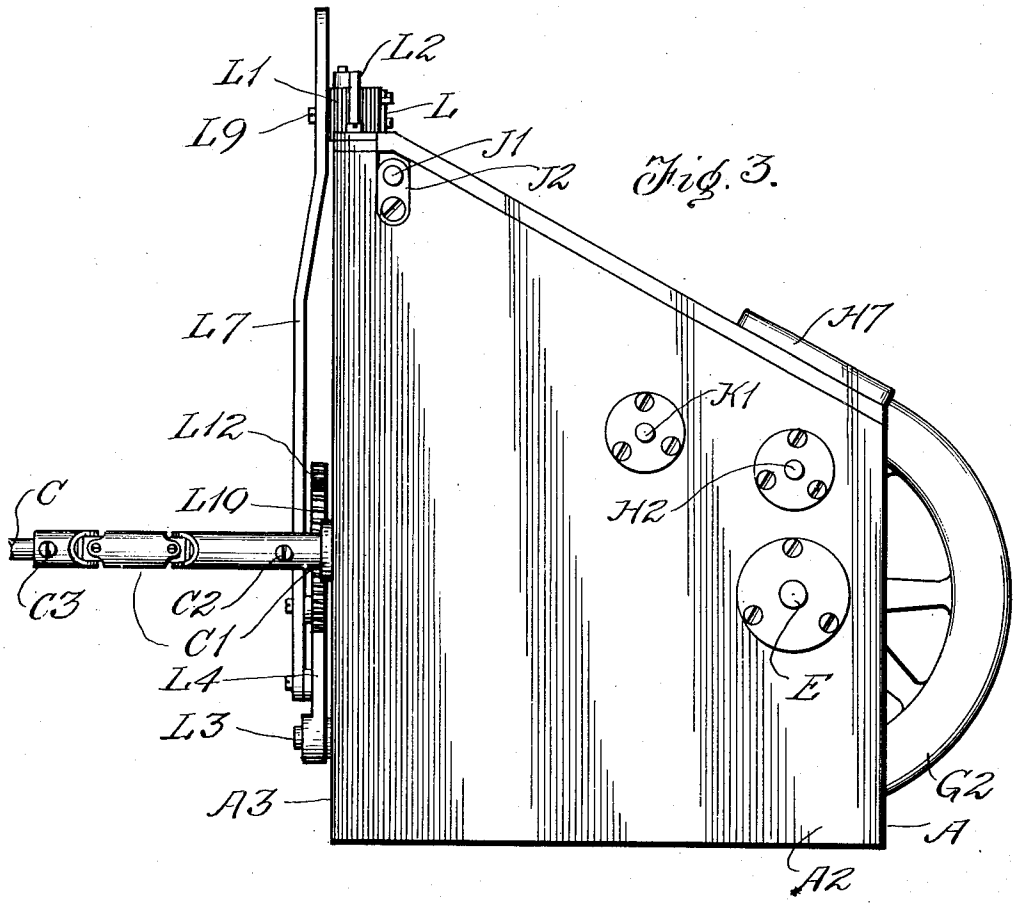


Fig. 3.

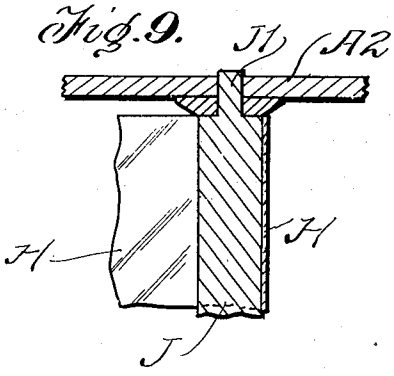


Fig. 9.

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1,695,390

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RADIO APPARATUS

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5 Sheets-Sheet 4

Fig. 5.

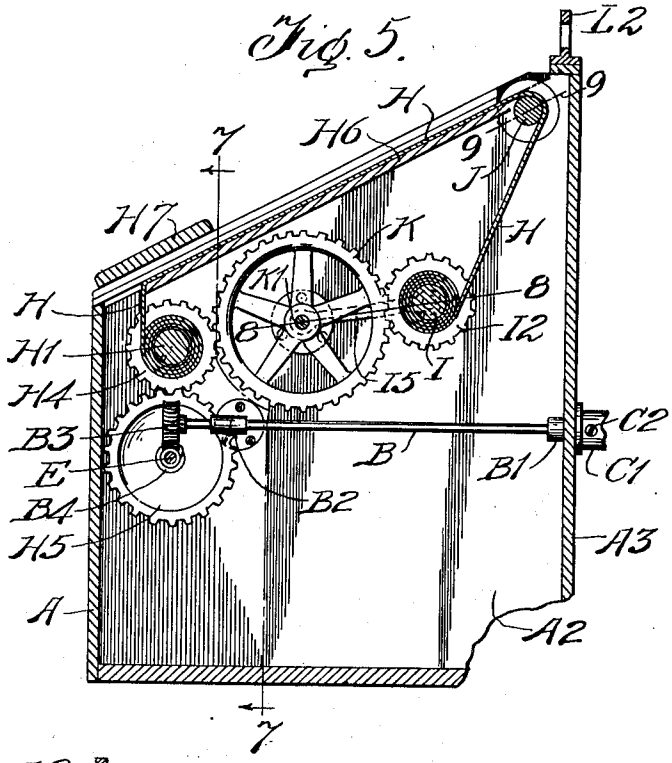
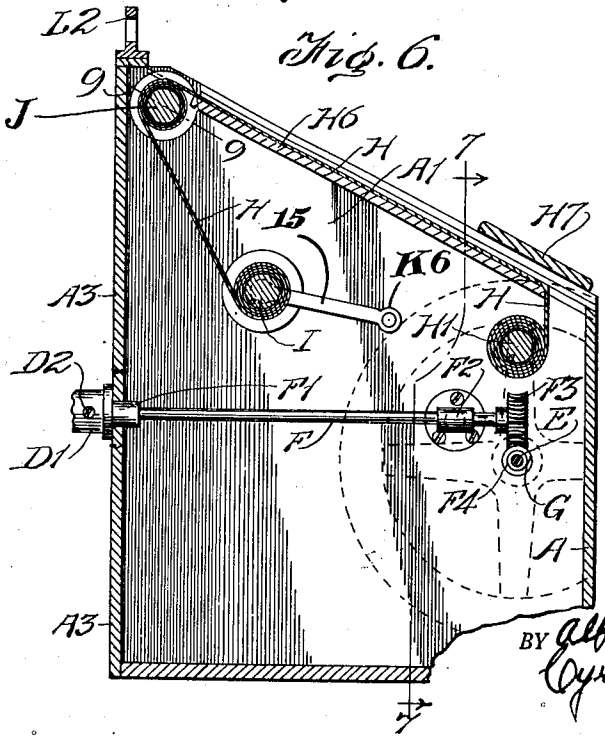


Fig. 6.



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Dec. 18, 1928. 1,695,390

A. F. SANFORD

RADIO APPARATUS

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Fig. 7.

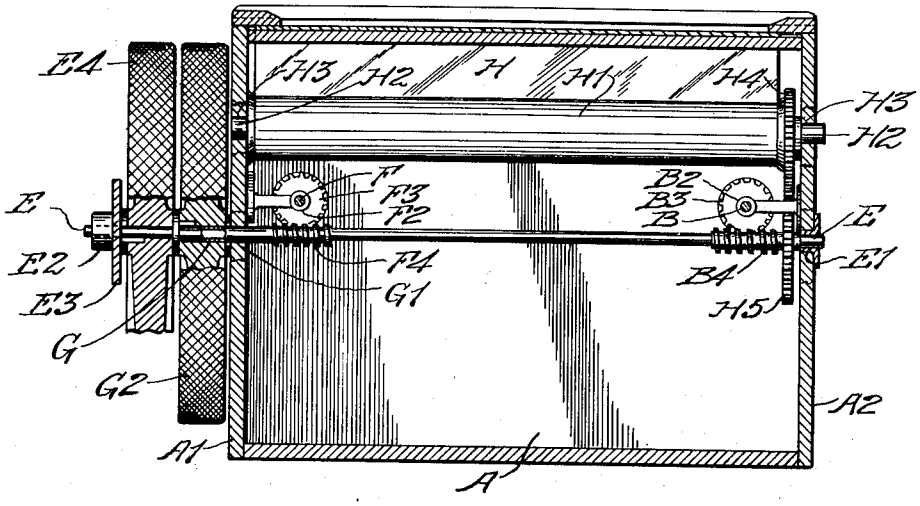


Fig. 11.

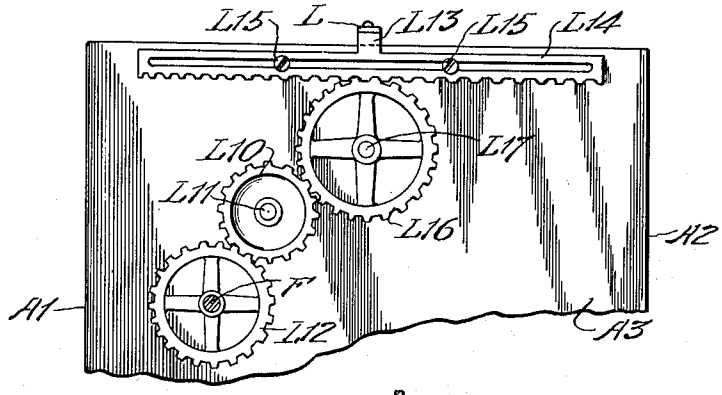
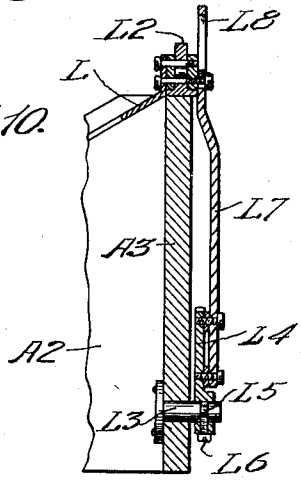


Fig. 10.



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Patented Dec. 18, 1928. 1,695,390

UNITED STATES PATENT OFFICE.

ALFRED F. SANFORD, OF KNOXVILLE, TENNESSEE.

RADIO APPARATUS.

Application filed December 17, 1925. Serial No. 76,099.

This improvement relates generally to apparatus used to receive from radio sending stations and particularly to radio-receiving apparatus in which provision is made for forming a record of positions of parts of the apparatus when the apparatus has been brought into tune with the sending apparatus located at a chosen sending station.

In the form shown by the accompanying drawings, my apparatus is organized for actuating two tuning shafts, driving mechanism being present for turning each tuning shaft independently of the other. The apparatus also includes a record member in the form of a sheet which is moved longitudinally simultaneously with the turning of one of the tuning shafts. A pointer is placed near said sheet and travels transversely to the direction of movement of the sheet and simultaneously with the turning of the other tuning shaft. For bringing the apparatus into tune with a chosen sending station, the tuning shaft turning mechanisms are actuated until the apparatus is found to be in tune with the sending station. This turning of the tuning shafts is accompanied automatically by movement of the sheet into a new position and by movement of the pointer into a new position relative to the sheet.

Now the operator makes a record on the sheet with reference to the pointer. If thereafter the sheet and the pointer have been moved into other positions and it is desired to again find the sending station previously found, it is only necessary to actuate the driving mechanism to move the sheet to bring the guide record into the previous position relative to the transverse path of the pointer and to actuate the pointer moving mechanism until the pointer is again in the former relation with the record on the sheet. These records are to include the name or the initials or the wave-length number or other designation identifying the sending station.

Thus bringing the sheet and the pointer into original positions involves turning the tuning shafts into the positions which they held when said record was made.

In the accompanying drawings,

Fig. 1 is a front view of the apparatus looking obliquely downward and rearward perpendicularly to the face of the record sheet;

Fig. 2 is an elevation of the right hand end of the apparatus;

Fig. 3 is an elevation of the left hand end of the apparatus;

Fig. 4 is a rear elevation;

Fig. 5 is an upright section on the line, 5—5, of Figs. 1 and 4, looking in the direction of the arrows;

Fig. 6 is an upright section on the line, 6—6, of Fig. 1, looking in the direction of the arrows;

Fig. 7 is an upright section on the line, 7—7, of Figs. 5 and 6, looking in the direction of the arrows;

Fig. 8 is a horizontal section on the line, 8—8, of Fig. 5;

Fig. 9 is a section on the line, 9—9, of Fig. 5;

Fig. 10 is an upright section on the line, 10—10, of Fig. 4;

Fig. 11 is a rear elevation showing another form of means for shifting the pointer.

Referring to the drawings, A is the front wall; A^1 is the right hand end wall; A^2 is the left hand end wall; and A^3 is the rear wall.

A shaft, B, is placed horizontally and parallel to and near the left hand end wall, A^2, and rests in a bearing, B^1, in the rear wall, A^3, and in a bearing, B^2, in the form of a bracket seated on the left hand end wall, A^2. The rear end of the shaft, B, extends into one end of a universal coupling, C^1. A set-screw, C^2, secures the coupling to the shaft. The tuning shaft, C, extends into the other end of the coupling and is secured therein by means of a set-screw, C^3. On the forward end of the shaft, B, in front of the bearing, B^2, is a worm wheel, B^3, which meshes with a worm, B^4, on the drive shaft, E, the left hand end of which rests in a bearing, E^1, in the left hand wall, A^2, and the right hand end of which rests in a bearing, E^2, formed in a bracket, E^3, which is seated on the outside of the right hand end wall, A^1. Between that bracket and the wall, A^1, and close to the bracket is a hand wheel, E^4. This wheel is fixed on said shaft and is preferably made with a large rim giving the wheel sufficient weight to impart to the wheel the quality of a fly wheel, in order that momentum will tend to continue movement of the wheel when it has been put into motion.

By turning this wheel, the drive shaft, E,

and the worm, B^4, are turned. Thus the worm turns the worm wheel and that wheel turns the shaft, B, and the coupling, C^1, and the coupling turns the tuning shaft, C. By using the large hand wheel, E^4, and the worm, B^4, and the worm wheel, B^3, slight turning movement of the shaft, B, and the tuning shaft, C, result from a larger movement of the perimeter of the hand wheel.

Near the right hand end of the apparatus, a horizontal shaft, F, is placed parallel to the right hand end wall, A^1, and rests in a bearing, F^1, on the rear wall, A^3, and in a bearing, F^2, in the form of a bracket on the right hand end wall, A^1. The rear end of the shaft, F, extends into one end of the tuning shaft coupling, D^1, and is secured thereto by means of a set screw, D^2. The tuning shaft, D, extends into the other end of the coupling member and is secured thereto by means of a set-screw, D^3.

On the forward end of the shaft, F, at the front of the bearing, F^2, is a worm gear wheel, F^3, which meshes with a worm, F^4, on a sleeve, G, which loosely surrounds the shaft, E, and rests in a bearing, G^1, seated on the right hand end wall, A^1. Between the hand wheel, E^4, and the wall, A^1, a similar hand wheel, G^2, is fixed on the sleeve, G, whereby said hand wheel and said sleeve and the worm, F^4, may turn in unison independently of the turning of the drive shaft, E. Thus turning the hand wheel, G^2, will cause the turning of the worm, F^4, and the worm wheel, F^3, and the shaft, F. The turning of the shaft, F, will cause the turning of the tuning shaft coupling, D^1, and the tuning shaft, D. By using the large hand wheel, G^2, and the worm gearing, a slight turning of the shaft, F, and the tuning shaft coupling and the tuning shaft will involve a much larger peripheral movement of the hand wheel. This hand wheel is preferably a duplicate of the hand wheel, E^4, as to size and weight.

H is a long sheet of paper, preferably mounted on cloth to afford durability. The drawings show this sheet as wide as the space between the end walls, A^1 and A^2. One end of this sheet is attached to the first winding roller, H^1, located at the front of the apparatus and having end journals, H^2, resting in bearings, H^3, in the end walls.

In the rear part of the apparatus is a second winding roller, I, parallel to the roller, H^1. The other end of the sheet, H, is attached to this second winding roller. In the upper, rear part of the apparatus is an idle guide roller, J, having journals, J^1, resting in bearings, J^2, on the end walls, A^1 and A^2. The sheet, H, passes from the roller, H^1, upward and rearward and across the idle guide roller, J, and thence downward to the second winding roller, I.

On the left hand end of the roller, H^1, is a spur gear wheel, H^4. This spur gear wheel meshes with an idle spur gear wheel, K, mounted loosely on a shaft, K^1, fixed in bearings, K^2, in the walls, A^1 and A^2.

The spur gear wheel, K, meshes with a spur gear wheel, I^2, fixed on the adjacent end of the second winding roller, I. Each end of the roller, I, has a journal, I^3, which extends into a bearing, I^4, in a link, 15. The other end of said link has a bearing, K^6, loosely surrounding the shaft, K. At the left hand end of the apparatus, the link, I^5, is between the wall, A^2, and the gear wheel, K. By means of these three gear wheels, motion is transmitted from the first winding roller, H^1, to the second winding roller, I.

The second roller, I, is suspended by the links, I^5, and the part of the sheet, H, which extends downward from the roller, J. The links, I^5, being pivoted on the shaft, K^1, which is the axis of the wheel, K, it follows that the second roller, I, may move upward and downward in a path which is concentric to the shaft, K^1, whereby the gear wheel, I^2, of the roller, I, is kept in mesh with the idle wheel, K.

It will now be seen that rotation of the first winding roller, H^1, will transmit motion through the idle spur gear wheel, K, to the second winding roller, I, so that the latter roller will turn in unison with the winding roller, H^1, but in the opposite direction. It will also be seen that such rotation will cause the winding of the sheet on one roller while the sheet is correspondingly unwound from the other roller, the amount wound on one roller becoming larger and smaller on the other. By then reversing the rotation of the roller, H^1, this winding and unwinding will be reversed. To avoid slack in the sheet and keep the sheet under uniform tension, the winding roller, I, is suspended as described, so that it will apply its weight to the part of the sheet, H, which extends downward from the guide roller, J.

Between the first winding roller, H^1, and the guide roller, J, a plate, H^6, of wood or other suitable material is supported by the end walls immediately below the sheet, H, in position to serve as a rest or foundation for the sheet when writing is being placed upon the sheet. Above the wall, A, a board or plate, H^7, extends horizontally across the apparatus and has its ends secured to the end walls, A^1 and A^2. This plate constitutes a hand rest to be used by the operator when making records on the sheet, H, as will be described further on.

The first winding roller, H^1, is driven from the main drive shaft, E, by means of a spur gear wheel, H^5, surrounding and fixed to the shaft, E.

From the foregoing it will be seen that when the hand wheel, E^4, is turned for turn-

ing the tuning shaft, C, the winding roller, H^1, will also be turned, whereby the sheet, H, is moved.

On the upper part of the rear wall, A^3, is a slotted bar or frame, L^2, which forms a guide-way for a slide block, L^1, on the front of which is supported rigidly a pointer, L, reaching forward and downward close to the upper face of the sheet, H. By moving this slide block along the slide way, the pointer, L, is moved parallel to the face of the sheet and transversely to the course traversed by the sheet. On the lower part of the rear face of the wall, A^3, is a horizontal stub axle, L^3, around which extends loosely the hub of a segment gear, L^4. On this axle is a circumferential channel, L^5. A screw, L^6, extends through the hub of the segment gear into said channel, whereby the hub is held on the axle. An arm, L^7, is secured to the segment gear in the upright position and radially to said shaft and has in its upper end a longitudinal slot, L^8, which receives a stud, L^9, extending rearward from the rear face of the slide block, L^1. The segment gear, L^4, meshes with an idle spur gear, L^{10}, which is mounted on a stub axle, L^{11}. That idle gear meshes with a spur gear wheel, L^{12}, surrounding and fixed to the shaft, F, which, as already described, is driven from the worm on the sleeve, G, and which shaft bears the tuning shaft coupling, D^1.

It will now be seen that while the sleeve, G, is being turned for turning the shaft, F, the gearing between the shaft, F, and the arm, L^7, will cause that arm to move toward the right or the left, according to the direction of rotation of the sleeve, G, and carry with it horizontally the slide block, L^1, and the pointer, L.

The purpose of the universal coupling, C^1, is to adapt the apparatus to be coupled to an already-constructed apparatus in which the two tuning shafts are not spaced from each other precisely the distance between the shafts, B and F. It will be understood that this apparatus may be built for attachment to radio receiving apparatus already built, or the apparatus may be constructed as a part of a receiving apparatus. In the latter case, the universal coupling will not be needed.

Attention is invited to the fact that the sheet, H, and the pointer, L, move in transverse directions. In operation, the operator turns either the wheel, E^4 or G^2, until the tuning shaft controlled by that wheel has been brought into tuned position. If the wheel controlling the sheet, H, is first turned, that sheet will then be in a new position relative to a horizontal line extending along the lower end of the pointer. When the wheel controlling the pointer has ben turned for bringing the corresponding tuning shaft into tuned position, the pointer, L, will have moved horizontally and transversely to the movement of the sheet, H, into a new position. Then any desired record of the then relative positions of the sheet and the pointer is made on the sheet. This may be done by making any convenient mark on the sheet at or in relation with the lower end of the pointer. This may be a dot or a circle. Adjacent the dot or circle may be placed the symbol, name, and wave length of the sending station with which the apparatus has been brought into tune.

If the apparatus is to brought into tune with another sending station, the wheels, E^4 and G^2, are again turned until the associated tuning shafts have been brought into tune with the chosen sending station or with any sending station found by thus turning these wheels. Then a record of the positions of the sheet and pointer are made as before. If the station then found is not known, its wave length may be noted on the sheet.

In this manner any number of sending stations, having wave lengths within the range of the receiving apparatus, may be found and records thereof made.

Variation in wave length will change the position of the pointer in its horizontal path. Thus records of stations found will be on a diagonal course which can be emphasized by joining the record dots or circles or similar marks by a line, as indicated on Fig. 1. The inclination of this line will vary with the ratio of velocity between the pointer and the sheet. If the sheet is long, it must be arranged to move faster than if the sheet is short. In other words, the sheet should move its length while the pointer traverses its course. If the ratio of movement of the pointer and the sheet is maintained, the record line will be straight. In the particular form illustrated by the drawings, the rate of movement of the sheet varies because of the winding and unwinding on the rollers. That variation will cause some variation in the course of the record line.

It will now be observed that the apparatus contains two or a plurality of tuning shafts or shafts concerned with tuning, also a record sheet and means intervening that sheet and one tuning shaft for causing simultaneous movement of that shaft and the sheet, the movement of the sheet being limited to one course, also a pointer extending over the sheet, means intervening the pointer and the other shaft for causing simultaneous movement of the shaft and the pointer, the movement of the pointer being parallel to the sheet and transverse to the movement of the sheet. Thus the apparatus is adapted to receive a single record indicating the positions of the two tuning shafts when the apparatus is in tune with some sending station, and provision is thus made for again bring-

ing the apparatus into tune with the same station by actuating the mechanism to again move the sheet and the pointer to cause the record and the pointer to meet or assume former relation.

The hand wheels, E^4 and G^2, are placed side by side and made of the same size in order that one hand of the operator may engage and at the same time turn both wheels in the same direction until the sheet and the pointer have nearly attained the desired positions, after which each wheel is to be turned independently until precise positions of the sheet and the pointer have been attained. Thus the shifting of the sheet and the pointer, and the corresponding turning of the tuning shafts, may be hastened. Such movement may be further hastened by taking advantage of the fly wheel action when these wheels are given a rapid movement.

The upper part of the apparatus is made slanting. To this two advantages attach: More of the sheet is exposed to view, and the sheet and the foundation, H^6, under the sheet, and the hand rest, H^7, are in more convenient position for writing on the sheet and for viewing the sheet and the pointer.

In Fig. 11, there is shown another form of mechanism for carrying the pointer, L. In that form the pointer is supported on an extension, L^{13}, rising from the gear rack, L^{14}, which is slotted and is supported by two screws, L^{15}, extending horizontally through the slot of the rack bar and into the rear wall, A^3, whereby they are held rigidly to permit endwise slipping of the rack bar. A spur gear wheel, L^{16}, is supported on a stub shaft, L^{17}, extending horizontally rearward from the wall, A^3. The idle spur gear wheel, L^{10}, of Fig. 4, is moved upward to continue meshing with the spur gear wheel, L^{12}, and also with the spur gear wheel, L^{16}. With the turning of the wheel, L^{12}, the wheels, L^{10} and L^{16}, are turned, and the latter carries the rack gear endwise. That causes the movement of the pointer transversely to the sheet, H.

In the form shown by Fig. 4, the distance between the axis of the arm, L^7, and the stud, L^9, varies with the movement of said arm whereby the block, L^1, is shifted horizontally. This variation in engagement between the arm and the block causes a change of ratio between the movement of the pointer, L, and the movement of the sheet, H. In the form shown by Fig 11, there is no such variation, the transmission of motion from the wheel, L^{12}, to the rack bar L^{14}, and the block, L^3, and the pointer, L, being constant.

The line or course along which records are made with reference to the pointer may be termed the "resonance" line. If the pointer and the record sheet are moved to keep the pointer on that line, the two tuning members will be kept in "resonance" with each other and thus adapted to receive, successively, all wave lengths from the shortest to the longest within the capacity of the apparatus. This makes it feasible to hunt or test for sending stations operating on any wave lengths within the range of the receiving set, such hunting or testing being carried on by moving the record sheet and the pointer in such manner as to keep the pointer on the "resonance" line. If the wave length of a sending station not previously recorded is known, that station may be definitely or approximately found by reference to wave length records on the "resonance" line. For example, if the wave length of the new station is 245, and the sheet already bears records for 240 and 250 wave lengths, then the sheet and the pointer are to be moved to bring the pointer on the "resonance" line midway between those two wave length records. If that positioning of the pointer does not bring accurate tuning with the new station, slight adjustment of the sheet and pointer will bring that result.

It is to be observed that the record sheet is to be long enough for travel simultaneously with the movement of the associated tuning member through its range of movement, and that the travel of the pointer should time fully with the movement of the associated tuning member through its range, and that the width of the record sheet should at least equal the range of travel of the pointer. The record sheet may be longer and wider than required for the above-mentioned movements. As already herein indicated, a large record surface is desirable, because that affords room for conveniently noting many sending stations.

It is to be understood that mention of the tuning shafts herein is to include any tuning member. It is also to be understood that mention of the pointer herein is to include any indicating member operating in connection with the record sheet in the manner described.

I claim as my invention,

1. In a radio receiving apparatus, the combination of two members concerned with tuning, and to be set with reference to each other and with reference to wave lengths coming from a sending station, a movable record sheet, means operatively connecting the sheet and one tuning member for simultaneous movement, a pointer extending over the sheet, and means operatively connecting the pointer with the other tuning member for simultaneous movement, the movement of the pointer being transverse to the direction of movement of the sheet, substantially as described.

2. In a radio receiving apparatus, the combination of two shafts concerned with tuning, a record sheet, means including rollers

operatively connecting the sheet and one shaft for simultaneous movement, a pointer extending over the sheet, and means operatively connecting the pointer with the other shaft for simultaneous movement, the movement of the pointer being transverse to the direction of movement of the sheet, substantially as described.

3. In a radio receiving apparatus, the combination of two shafts concerned with tuning, a record sheet, means operatively connecting the sheet and one shaft for simultaneous movement, said means including winding rollers one of which is supported by the sheet, a pointer extending over the sheet, and means operatively connecting the pointer with the other shaft for simultaneous movement, the movement of the pointer being transverse to the direction of movement of the sheet, substantially as described.

4. In a radio receiving apparatus, the combination of two shafts concerned with tuning, a record sheet, means operatively connecting the sheet and one shaft for simultaneous movement, said means including rollers one of which engages the sheet for drawing the sheet to prevent slack in the sheet, a pointer extending over the sheet, and means operatively connecting the pointer with the other shaft for simultaneous movement, the movement of the pointer being transverse to the direction of movement of the sheet, substantially as described.

5. In a radio receiving apparatus, the combination of a member concerned with tuning, a record sheet, two winding rollers, and gearing in operative relation with said tuning member and with said rollers, one of the rollers being held to permit bodily movement in a path concentric to the axial line of one of the gearing members, substantially as described.

6. In a radio receiving apparatus, the combination of a shaft concerned with tuning, a record sheet, two winding rollers, and gearing in operative relation with said shaft and with said rollers, one of the rollers being held to permit bodily movement in a path concentric to the axial line of one of the gearing members, substantially as described.

7. In a radio receiving apparatus, the combination of a record-member, two shafts concerned with tuning a driving member, means connecting said drivig member and the record member for moving the record member in one direction, worm gearing joining said driving member and one of said shafts, another driving member, and worm gearing connecting said member and said shaft, substantially as described.

8. In a radio receiving apparatus, the combination of a record-member, two shafts concerned with tuning, a driving member, means connecting said driving member and the record member for moving the record member in one direction, worm gearing joining said driving member and one of said shafts, another driving member on the axial line of the first driving member, and worm gearing connecting said member and said shaft, substantially as described.

9. In a radio receiving apparatus, the combination of a record-member, two shafts concerned with tuning, a driving member, means connecting said driving member and the record member for moving the record member in one direction, a wheel on said member, worm gearing joining said driving member and one of said shafts, another driving member, a wheel on said member, and worm gearing connecting said member and said shaft, substantially as described.

10. In a radio receiving apparatus, the combination of a record-member, two shafts concerned with tuning, a driving member, means connecting said driving member and the record member for moving the record member in one direction, a wheel of fly-wheel form on said driving member, gearing joining said member and one of said shafts, another driving member, a wheel of fly-wheel form on said member, and gearing connecting said member and the other of said shafts, substantially as described.

11. In a radio receiving apparatus, the combination of a record-member, two shafts concerned with tuning, a driving member, means connecting said driving member and the record member for moving the record member in one direction, a wheel of fly-wheel form on said driving member, worm gearing joining said member and one of said shafts, another driving member, a wheel of fly-wheel form on said member, and worm gearing connecting said member and the other of said shafts, substantially as described.

12. In a radio receiving apparatus, the combination of two shafts concerned with tuning, a driving member, gearing joining said member and one of said shafts, another driving member, gearing connecting said member and said shaft, a record member in operative relation with one of said driving members, and a pointer in operative relation with the other driving member, substantially as described.

13. In a radio receiving apparatus, the combination of two shafts concerned with tuning, a driving member, worm gearing joining said member and one of said shafts, another driving member, worm gearing connecting said member and said shaft, a movable record sheet in operative relation with one of the driving members, and a movable pointer in operative relation with the other driving member, substantially as described.

14. In a radio receiving apparatus, the combination of a record-member, a shaft

concerned with tuning, a driving member transverse to the direction of said shaft, means connecting said driving member and the record member for moving the record member in one direction, and worm gearing between said shaft and said driving member, substantially as described.

15. In a radio receiving apparatus, the combination of two members concerned with tuning, a record sheet, means operatively connecting the sheet and one tuning member for simultaneous movement, a pointer extending over the sheet, a pointer support, and means operatively connecting said support with the other tuning member for simultaneous movement, the movement of said support and the pointer being transverse to the direction of movement of the sheet, substantially as described.

16. In a radio receiving apparatus, the combination of a tuning member, a record sheet, means for supporting the sheet and exposing it to view in sloping position, means operatively connecting the sheet and the tuning member for simultaneous movement, a pointer extending over the sheet, a second tuning member, and means operatively connecting the pointer with the second tuning member for simultaneous movement, the movement of the pointer being transverse to the direction of movement of the sheet, substantially as described.

17. In a radio receiving apparatus, the combination of two members concerned with tuning, a record sheet, means positively connecting the sheet and one tuning member for simultaneous movement, a pointer extending over the sheet, a member supporting the pointer and slidable transversely to the course of movement of the sheet, an oscillating arm for sliding said supporting member, means intervening the oscillating arm and the other tuning shaft for simultaneous movement.

18. In a radio receiving apparatus, the combination of two independently turnable tuning members, a record sheet, means including rollers positively connecting the sheet and one of said tuning members for simultaneous precisely-maintained relative movement, and movable indicating means in operative relation with the other tuning member and the record sheet.

19. In a radio receiving apparatus, the combination of two independently turnable tuning members, a record sheet, means for supporting the sheet and exposing it to view for sloping position, means positively connecting the sheet and one of said tuning members for simultaneous precisely-maintained relative movement, and a movable indicating means in operative relation with the other tuning member and the record sheet.

20. In a radio receiving apparatus, the combination of a member concerned with tuning, two rollers one of which is suspended, a record sheet mounted on said rollers, said suspended roller serving to keep the record sheet under tension, and means positively connecting said rollers and said tuning member for simultaneous movement.

In testimony whereof I have signed my name this 14th day of December, in the year one thousand nine hundred and twenty-five.

ALFRED F. SANFORD.