June 1, 1943. J. A. VAN LAMMEREN ET AL 2,320,808

WIRELESS RECEIVING SET

Filed June 22, 1940 2 Sheets-Sheet 1

Fig. 1

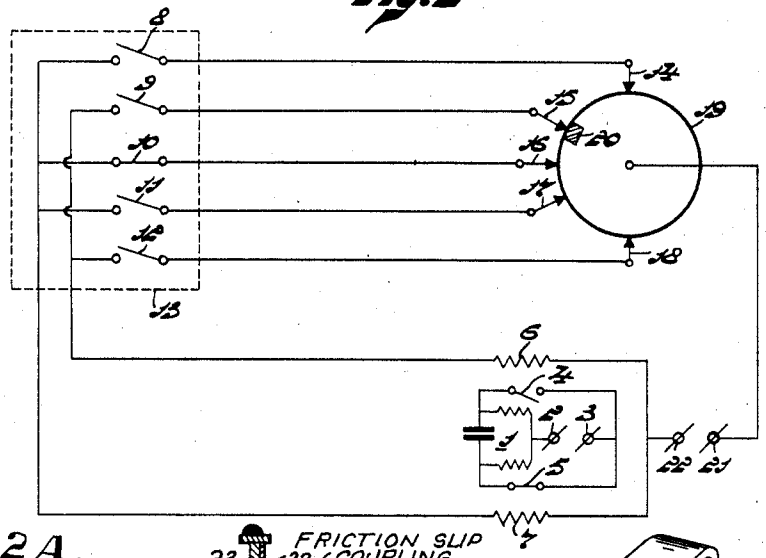

Fig. 2A.

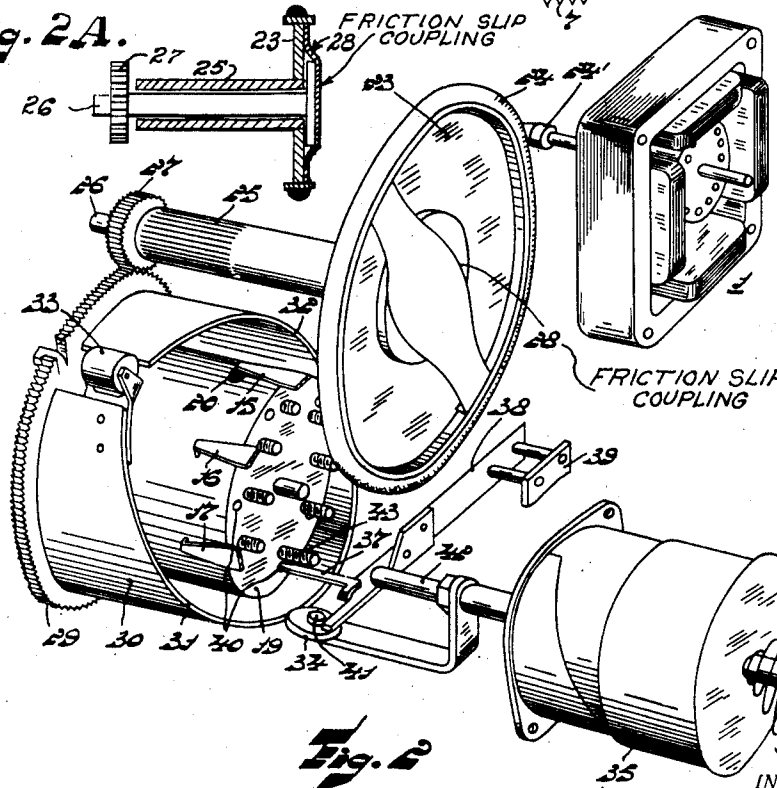

Fig. 2

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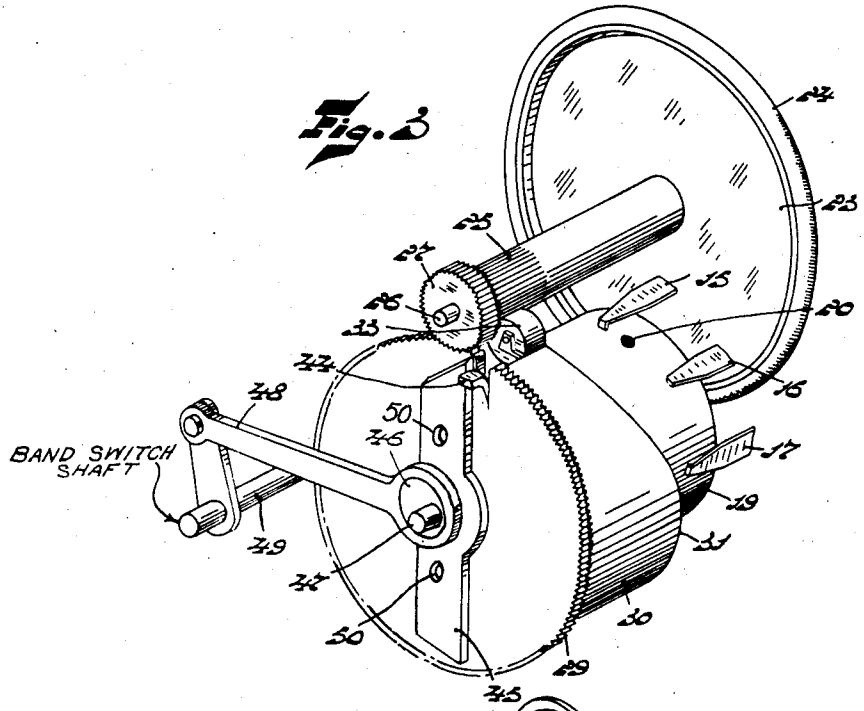
Fig. 3



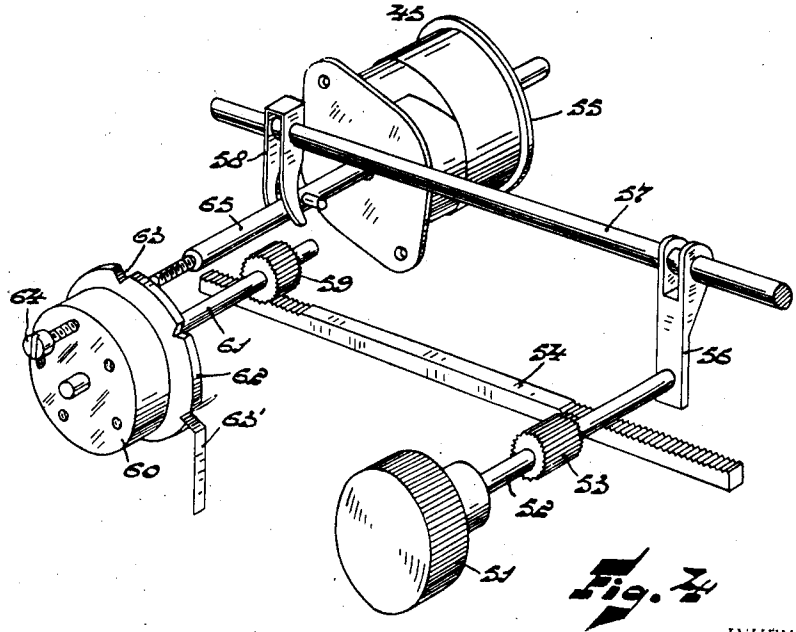


Fig. 4

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UNITED STATES PATENT OFFICE

2,320,808

WIRELESS RECEIVING SET

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Application June 22, 1940, Serial No. 341,826
In the Netherlands June 5, 1939

10 Claims. (Cl. 250—40)

This invention relates to a wireless receiving set one or more adjustable members of which, particularly tuning members, are adapted to be automatically moved into a number of predetermined positions.

In existing constructions of this kind the adjustment of one or more adjustable members, particularly tuning members, is effected, for example, by means of a set of push-buttons each of which is provided with a stop. These stops are adjustable and act at various points of the members to be adjusted or of a constructional element which transmits the drive of the push-buttons to the members to be adjusted.

These constructions involve the disadvantage that the accuracy with which the said members are adjusted depends on the point at which the stops act. The accuracy of adjustment obtainable is consequently not the same for all of the push-buttons. Thus, for example, in a construction in which a sliding-electrode condenser is operated by a set of push-buttons acting at different points of a plate secured to the shaft of the sliding-electrode condenser greater accuracy will be ensured by the push-buttons that act most closely to the shaft of the condenser than by the push-buttons which act on the circumference of the plate since the plate exhibits a sag which increases towards the circumference. The reduced accuracy of the latter push-buttons is particularly inconvenient when in the case of band-spread reception in the short-wave region the tuning means have to be adjusted accurately to the centre of a frequency band.

The invention has for its object to provide a construction having greater accuracy than existing constructions.

According to the invention this object is achieved by causing the predetermined positions of the adjustable members to be determined by a number of stops which for the purpose of operating the adjustable members are moved into such a position as to act continuously at the same point of the adjustable members.

In a suitable embodiment of the invention the stops are secured to a movable, preferably rotary, body which is moved into the desired position by selection of a given adjustment.

In this case it is preferable that the member to be adjusted should be temporarily displaced on passing to another of the predetermined positions in such manner that any contact with the stops is impossible.

If the member to be adjusted is operated by a sliding movement the shiftable part of the member to be adjusted can be moved out of contact with the stops by rotation of a helical contact-surface.

In order that the invention may be clearly understood and readily carried into effect it will now be described more fully with reference to the accompanying drawings, in which

Fig. 1 shows a circuit arrangement adapted to be used in accordance with the invention for moving the members to be adjusted, into the correct position by means of an electric motor.

Fig. 2 shows a mechanical construction embodying the invention.

Fig. 2*a* is a detail partly in section of the driving means and the friction slip coupling shown in Fig. 2.

Fig. 3 shows the same mechanical embodiment from the other side.

The device shown in Fig. 4 permits of the liding-electrode condenser being moved by hand into a number of predetermined positions.

Referring to Fig. 1, **1** designates an electric motor supplied from an alternating-current circuit connected between terminals **2** and **3**. This motor is adapted to rotate in two directions. For this purpose two switches or relay contacts **4** and **5** are provided which are operated respectively by relays **6** and **7** either of which corresponds to either of the directions of rotation.

A set of press-buttons **8, 9, 10, 11, 12** which may be housed in the receiver and also in a remote-control casing **13** permits of energising the relay **6** or the relay **7** at will. Each of the press-buttons is connected to one of the contact springs **14, 15, 16, 17, 18** which slide over a disc **19** having an insulated point **20**.

If, for example, the press-button **10** is depressed an auxiliary circuit is closed through the press-button **10**, the spring **16**, the disc **19**, a source of voltage connected between the terminals **21** and **22** and the relay **7**. The source of voltage may be formed for example by a winding on the supply transformer provided in the receiver. Thus the disc **19** may be at earth potential and the press-buttons do not operate with dangerously high voltages. The relay **7** connects the motor **1** into circuit by means of the contact **5**. The motor **1** operates the members to be adjusted and thus moves the disc **19** into such a position that the insulated point **20** comes below the spring **16**. The relay **7** loses its energisation and the motor **1** stops.

Fig. 2 shows how in this manner a sliding-electrode condenser can be adjusted by a motor.

Similar parts are designated in Fig. 2 and following figures by the same reference numerals.

When a press-button, for example the press-button designated 10 in Fig. 1, which corresponds to the contact spring 16 is depressed an auxiliary current flows through this contact spring 16 and the disc-shaped rotary body 19 which results in the motor 1 being connected into circuit. The motor 1 starts to rotate and thus drives the wheel 23, which is provided with a rubber band 24, by means of a cone 24' secured to the motor shaft due to the fact that the armature is pulled into the field. The wheel 23 is seated on a hollow shaft 25 which surrounds a shaft 26 on which is seated a gear wheel 27. Intermediate the shafts 25 and 26 is a friction coupling 28. Due to the friction coupling 28 the shaft 26 and the gear wheel 27 seated thereon is driven by the wheel 23. The gear wheel 27 meshes with a large gear wheel 29. This gear wheel 29 has mounted on it a body 30 having two oppositely directed helical contact surfaces 31 and 32. Intermediate the two ends of these contact surfaces a small roller or friction wheel 33 is arranged in such manner that it rolls over the cylindrical circumference of the body 19. The off position of the roller is diametrically opposed to the shaft 25 in relation to the shaft of the gear wheel 29. As the gear wheel 29 is driven the roller 33 moves upwards, a roller 34 riding at the same time upon the helical contact surfaces 31. This roller 34 is secured to a sliding-electrode condenser 35 and moves the latter against the action of a spring 36 into the extreme position. When this position is reached the roller 33 occupies its uppermost position and thus engages the hollow shaft 25. The gear wheel 29 cannot rotate further and the friction coupling 28 starts to slip. The shaft 25 transmits its movement to the roller 33 which in turn drives the body 19 which has hitherto been stationary. This body, which is possessed of an insulated point 20, starts to rotate until the auxiliary current which flows through this body and the contact spring 16 is interrupted due to the fact that the insulated point 20 reaches this contact spring. At this moment the motor is cut out of circuit, permitting the cone drive 24' mounted on the motor shaft to move out of engagement with the drive wheel 23. Subsequently, by any suitable means, (not shown), the gear wheel 29 and the helical cam member 30 carried thereby are returned to their initial or "off" position previously mentioned. (A substantially similar arrangement of gear wheel, helical cam member and roller is disclosed in the Patent Number 2,312,035, indicated respectively at 17, 24 and 27 in Fig. 2, and which are returned to their initial position under the action of spring means (not shown), page 2, lines 42–43.) In the return to the aforesaid "off" position the roller 34 will travel along the helical cam surface 31 to the low part of the cam 30 adjacent the roller 33, permitting the condenser 35 to return under the action of the spring 36 until the condenser shaft abuts the selected position determining screw 43. Thus an opportunity is afforded for a small wedge-shaped plate 37 which is secured by a blade spring 38 to a part 39 of the chassis to penetrate into a recess 40 of the body 19 so that the body 19 is mechanically subjected to fine adjustment and is prevented from rotating.

The plate 37 was previously lifted by the shaft 41 to which the roller 34 is secured. The sliding-electrode condenser moves back until its shaft 42 engages the screw 43 in the body 19 which acts as a stop. The body 19 is possessed of a number of such screws which are arranged parallel to the shaft and at equidistance therefrom and all of them project over a different length corresponding to different automatically adjustable stations. When one of the press buttons such as 9 or 12 is operated to rotate the motor 1 in the other direction the helical contact-surface 32 becomes operative and the roller 33 engages the other side of the hollow shaft 25. Similarly, the body 19 turns in the reverse direction but also until the insulated point 20 comes below the current-carrying contact-spring 16. The two directions of rotation of the motor may be made available in addition, for example, for the change of the wavelength range. This will be set out more fully by reference to Fig. 3.

Fig. 3 is a front elevation of the mechanism shown in Fig. 2. The gear wheel 29 comprises an extension 44 which during the movement of the gear wheel 29 describes a path from the lowermost position to the position shown with the direction of rotation assumed in the preceding figure. When the gear wheel 29 is driven the other way the extension 44 describes a path from the lowermost position to the position which is the mirror image of the position shown. In front of the gear wheel 29 is arranged a lever 45 journalled centrally and provided with an eccentric 46. The lever 45 is free to rotate about the shaft 47 to which gear wheel 29 is secured in so far as the extension 44 does not constitute a hampering thereof.

If the lever 45 occupied the position shown at the very beginning of the movement of the gear wheel 29 it would not be displaced. If on the contrary the lever differed at the beginning of the movement of the gear wheel 29 by 180° from the position shown it would have been moved into the position shown by the extension 44. This position is therefore a characteristic of the direction of rotation assumed in Figs. 2 and 3. A characteristic of the reverse sense of rotation is a position of the lever 45 which differs by 180° from that shown. Depending on the direction of rotation of the gear wheel 29 the eccentric 46 can therefore occupy two positions differing by 180°. Associated with the eccentric 45 is an eccentric rod 48 coupled to a shaft 49. This shaft, which may occupy two positions depending on the initial direction of rotation of the gear wheel 29, operates a wavelength switch (not shown) for the change of two wavelength ranges. The lever 45 has formed in it two apertures 50 for adjusting the desired station by means of a screw driver. In the position shown in Fig. 3 the body 19 is driven by the hollow shaft 25 by the intermediary of the roller 33. As soon as the insulating point 20 reaches the contact spring 16 the motor stops.

Fig. 4 shows a device by means of which the sliding-electrode condenser can be moved by hand into a number of predetermined positions. For this purpose the hand-knob 51 is first depressed so that a gear wheel 53 seated on the spindle 52 of the said knob engages a toothed rack 54 and a sliding-electrode condenser 55 is moved into an extreme position by the intermediary of the shaft 52, a stop 56, a shaft 57 and a fork 58. The stop 56 and the fork 58 are rigidly secured to the shaft 57.

The knob 51 is then rotated. The toothed

rack **54** is thus displaced and drives a gear wheel **59** which is secured, to the same shaft **61** as a body **60**. This body **60** is possessed of a collar **62** in which indentations **63** are formed by means of which the body **60** can be locked in a number of predetermined positions with the aid of a spring **63'**. The body **60** is possessed of a number of screws arranged parallel to its axis and at equidistance therefrom, one of these screws being designated **64**. These screws may be adusted to different active lengths by means of a screw driver and serve as stops for the shaft **65** of the sliding-electrode condenser **55**. When the screw corresponding to the desired station is turned so that it is in alignment with the shaft **65** the knob **51** is released so that the sliding-electrode condenser moves back until the shaft **65** engages the screw **64** in which position the condenser will assume the predetermined desired adustment.

In the case of short-wave band-spread reception the device described above may be used for tuning to the centre of a narrow frequency band. In this case the knob **51** may also be rigidly coupled to band-spread tuning means not shown. If, for example, as is often the case with motor car radio receivers, the adjusting knob **51** and the sliding-electrode condenser **55** are capable of moving relatively to each other to a certain extent the two movements which in the embodiment described are transmitted by the toothed rack **54** and the shaft **57** may be performed by means of a hauling cable.

What we claim is:

1. In radio receiving apparatus or the like of the type having a variable controlling instrumentality provided with an axially adjustable element which is movable between two extreme positions, a spring device for yieldingly forcing the adjustable element toward one of said extreme positions, a cam and cam follower device, an electric motor for operating said cam, means for connecting the cam follower to said adjustable element, said cam being so shaped that in the operation thereof to a predetermined position, the adjustable element is moved to its other extreme position against the force of the spring device, an adjustable carrier having mounted thereon a plurality of stop members representing desired intermediate positions of said adjustable element, each of said stop members being adapted to be positioned in the path of said adjustable element by selective operation of said carrier, a coupling gear mounted on said cam and movable therewith, said coupling gear acting to couple the motor to said carrier so as to operate the carrier upon adjustment of said cam to said predetermined position, a plurality of selectively operable means one for each of said stop members, each of said selectively operable means acting upon operation to control the operation of the motor and thereby effect the movement of said cam to said predetermined position thereby coupling the motor to said carrier and effecting the movement of said carrier to a position wherein the stop corresponding to the operated selectively operable means is placed in the path of said adjustable element.

2. In radio receiving apparatus having an adjustable controlling element which is movable between two extreme positions, a spring element for yieldingly forcing the adjustable element toward one of said extreme positions, a cam and cam follower device, an electric motor for operating said cam, means for connecting the cam follower to said adjustable element, said cam being so shaped that in the operation thereof to a predetermined position the adjustable element is moved to its other extreme position against the force of the spring element, an adjustable carrier, a plurality of stop members representing a desired intermediate position of said adjustable element mounted on said carrier, each of said stop members being adapted to be positioned in the path of said adjustable element by operation of said carrier, means effective upon adjustment of said cam to said predetermined position for coupling the motor to said carrier so as to operate the carrier, a plurality of selectively operable means one for each of said stop members, each of said selectively operable means acting upon operation to effect the movement of said cam to said predetermined position through operation of the motor to thereby couple the motor to said carrier, and means effective upon coupling the motor to said carrier for adjusting said carrier to a position wherein the stop corresponding to the operated selectively operable means is placed in the path of said adjustable element.

3. In radio receiving apparatus having a variable tuning instrumentality of the type provided with an adjustable element which is movable between two extreme positions, a spring element for yieldingly forcing the adjustable element toward one of said extreme positions, a cam and cam follower device, an electric motor for operating said cam, means for connecting the cam follower to said adjustable element, said cam being so shaped that in the operation thereof to a predetermined position the adjustable element is moved to its other extreme position against the force of the spring element, an adjustable carrier having mounted thereon a plurality of adjustable stop members representing desired intermediate positions of said adjustable element, each of said stop members being adapted to be positioned in the path of said adjustable element by operation of said carrier, a coupling wheel mounted on said cam and movable therewith, said coupling wheel acting to couple the motor to said carrier so as to operate the carrier upon adjustment of said cam to said predetermined position, a plurality of selectively operable means one for each of said stop members each of said selectively operable means acting upon operation to effect the movement of said cam to said predetermined position through operation of the motor thereby coupling the motor to said carrier and effecting the movement of said carrier to a position wherein the stop corresponding to the operated selectively operable means is placed in the path of said adjustable element, and means acting upon movement of said carrier to said last named position for stopping the motor and effecting the movement of said adjustable element from said last named extreme position toward its other extreme position an extent determined by the adjustment of the stop placed in its path.

4. In radio apparatus having a variable controlling instrumentality of the type provided with an axially adjustable element which is movable between two extreme positions, a spring element for yieldingly forcing the adjustable element toward one of said extreme positions, a cam and cam follower device, an electric motor, a slip clutch for connecting the motor to said cam, means for connecting the cam follower to said adjustable element, said cam being so shaped

that in the operation thereof to a predetermined position the cam follower causes the movement of the adjustable element to its other extreme position against the force of the spring element, an adjustable carrier having mounted thereon a plurality of adjustable stop members representing desired intermediate positions of said adjustable element, each of said stop members being adapted to be positioned in the path of said adjustable element by operation of said carrier so as to limit the return movement of said adjustable element from said last named extreme position, a coupling gear device mounted on said cam and movable therewith, said coupling gear device acting to couple the motor to said carrier so as to operate the carrier upon adjustment of said cam to said predetermined position and prevent further movement of said cam from said predetermined position while the motor is in operation, a plurality of selectively operable motor control means one for each of said stop member, each of said selectively operable control means acting upon operation to effect the movement of said cam to said predetermined position thereby coupling the motor to said carrier and effecting thereby the movement of said carrier to a position wherein the stop corresponding to the operated selectively operable means is placed in the path of said adjustable element, means for breaking the motor circuit and thereby stopping the operation of the motor when said position of the cam is reached, and means acting upon stoppage of the motor for effecting the movement of the cam out of said predetermined position thereby releasing said adjustable element from said last named extreme position, said spring element effecting the return of said adjustable element toward its other extreme position to an extent determined by the adjustment of the particular stop placed in its path.

5. In radio signalling apparatus having an adjustable element, a cam and cam follower device, an electric motor for operating said element, a centering pin for centering said adjustable element in any one of several predetermined positions, means for connecting the cam follower to said centering pin, said cam being so shaped that in the operation thereof to a predetermined position, the centering pin is rendered ineffective when said cam is in said predetermined position, means for coupling the motor to said adjustable element, a plurality of selectively operable means each representing one of said predetermined positions of the adjustable element, each of said selectively operable means acting upon operation to effect the movement of said cam to said predetermined position thereby rendering said centering pin ineffective and thereafter effecting the movement of said adjustable element to the predetermined position corresponding to the operated selectively operable means, means for stopping the motor when said position is reached and means effective upon stopping the motor for rendering said centering pin effective to center and hold the adjustable element accurately in the selected predetermined position.

6. In radio receiving apparatus having an adjustable element which is movable between two extreme positions, a cam and cam follower device, an electric motor, a slip clutch for connecting said cam to said motor, a centering pin for centering said adjustable element in any one of several predetermined positions, means for connecting the cam follower to said centering pin, said cam being so shaped that in the operation thereof to a predetermined position, the centering pin is rendered ineffective when said cam is in said predetermined position, means mounted on said cam and movable therewith for coupling the motor to said adjustable element upon adjustment of said cam to said predetermined position and maintaining said cam in said position while said motor is in operation, a plurality of selectively operable means one for each of said predetermined positions of the adjustable element, each of said selectively operable means acting upon operation to effect the movement of said cam to said predetermined position thereby coupling the motor to said adjustable element and rendering said centering pin ineffective, and means effective upon coupling the motor to said adjustable element for effecting the movement of said adjustable element to the position corresponding to the operated selectively operable means, means for stopping the motor when said position is reached and means effective upon stopping the motor for rendering said centering pin effective to center and hold the adjustable element accurately in the selected predetermined position.

7. In radio signalling apparatus having an adjustable controlling element, a multi-position switch, an electric motor, a switch operating device connected for operation by said motor and arranged to operate the multi-position switch to one of its positions when it is brought to one predetermined position and the switch to another of its positions when said switch operating device is brought to another predetermined position, means operable with said switch operating means for coupling the motor to said adjustable controlling element upon adjustment of said switch operating means to either of said predetermined positions, a first group of selectively operable devices each thereof representing a desired position of said adjustable controlling element and each acting upon operation to effect the movement of said switch operating means to one of said predetermined positions to thereby operate said switch to the corresponding position and couple the motor to said adjustable element, a second group of selectively operable devices each thereof representing a desired position of said adjustable controlling element and each acting upon operation to effect the movement of said switch operating means to the other of its predetermined positions thereby operating the switch to the corresponding position and coupling the motor to said adjustable element, and means rendered effective upon coupling the motor to said adjustable element through operation of any one of said selectively operable devices for effecting the movement of said adjustable element to the position represented by the operated selectively operable device.

8. In radio signalling apparatus having an adjustable controlling element, a multi-position switch, a reversible electric motor, a switch operating device connected for operation by said motor and arranged to operate the multi-position switch to one of its switch positions when the motor by operation in one direction adjusts the switch operating device to a predetermined position and the switch to another of its positions when the motor by operation in the other direction adjusts said switch operating device to another predetermined position, means operable with said switch operating means for coupling the motor to said adjustable controlling element

upon adjustment of said switch operating means to either of said predetermined positions, a selectively operable device acting upon operation to operate the motor in one direction and thereby effect the movement of said switch operating means to the corresponding one of said predetermined positions to thereby operate said switch to the corresponding position and couple the motor to said adjustable element and means rendered effective upon coupling the motor to said adjustable element for effecting the movement of said adjustable element to a predetermined position, a second selectively operable device acting upon operation to operate the motor in the opposite direction and thereby effect the movement of said switch operating means to the other of its predetermined positions thereby operating the switch to its corresponding position and coupling the motor to said adjustable element and means rendered effective upon coupling the motor to said adjustable element for effecting movement of said adjustable element to a predetermined position.

9. In radio apparatus having a variable tuning instrumentality of the type provided with an adjustable element which is movable between two extreme positions, a spring element for yieldingly forcing the adjustable element toward one of said extreme positions, a multi-position wave band switch, a cam and cam follower device, a reversible electric motor, a slip clutch for connecting the motor to said cam, means for connecting the cam follower to said adjustable element, said cam being so shaped that in the operation there to either of two predetermined positions the cam follower causes the movement of the adjustable element to its other extreme position against the force of the spring element, means operable with said cam for operating said switch to one position when said cam is operated to one of the said predetermined positions and to another position when said cam is operated to the other of said predetermined positions, an adjustable carrier having a plurality of adjustable stop members representing desired intermediate positions of said adjustable element, each of said stop members being adapted to be positioned in the path of said adjustable element by operation of said carrier and thereby limit the return movement of said adjustable element from said last named extreme position, a coupling device operable with said cam and arranged so as to couple the motor to said carrier to provide for operating the carrier upon adjustment of said cam to either of said two predetermined positions and prevent further displacement of said cam from either of said positions while the motor is in operation, a plurality of selectively operable motor control means, one for each of said stop members, each of said selectively operable means acting upon operation to operate the motor in one direction and effect the movement of said cam to one of said predetermined positions thereby operating the wave band switch to the corresponding positions and effecting the coupling of the motor to said carrier, said motor acting upon coupling thereof to said carrier to adjust said carrier to a position wherein the stop corresponding to the operated selectively operable means is placed in the path of said adjustable element, means for stopping the operation of the motor when said position of the cam is reached, and means effective upon stoppage of the motor for effecting the movement of the cam out of said predetermined position thereby releasing said adjustable element from said last named extreme position whereby said spring element effects the return of said adjustable element toward its other extreme position to an extent determined by the adjustment of the particular stop placed in its path.

10. The arrangement described in claim 9 wherein the adjustable carrier is provided with an additional set of adjustable stop members representing desired intermediate positions of said adjustable element and arranged to be positioned in the path of the adjustable element by the selective operation of said carrier, an additional plurality of selectively operable motor control means, one for each of said additional adjustable stop members, each of said additional selectively operable means acting upon operation to operate the motor in the opposite direction and thereby effect the movement of said cam to the other of said predetermined positions so as to operate the wave band switch to the corresponding position and effect the coupling of the motor to said carrier, said motor acting upon coupling thereof to said carrier to adjust said carrier to a position wherein the stop corresponding to the operated one of said additional selectively operable means is placed in the path of said adjustable element, means for stopping the motor when said position of the cam is reached and means effective upon stoppage of the motor for effecting the movement of the cam out of said last named predetermined position thereby releasing said adjustable element from said last named extreme position whereby said spring element effects the return of said adjustable element toward said other extreme position to an extent determined by the adjustment of the particular stop placed in its path.

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