

March 3, 1931.

E. A. BOHLMAN

1,794,752

MULTIPLE CONTROL

Original Filed May 22, 1926 2 Sheets-Sheet 1

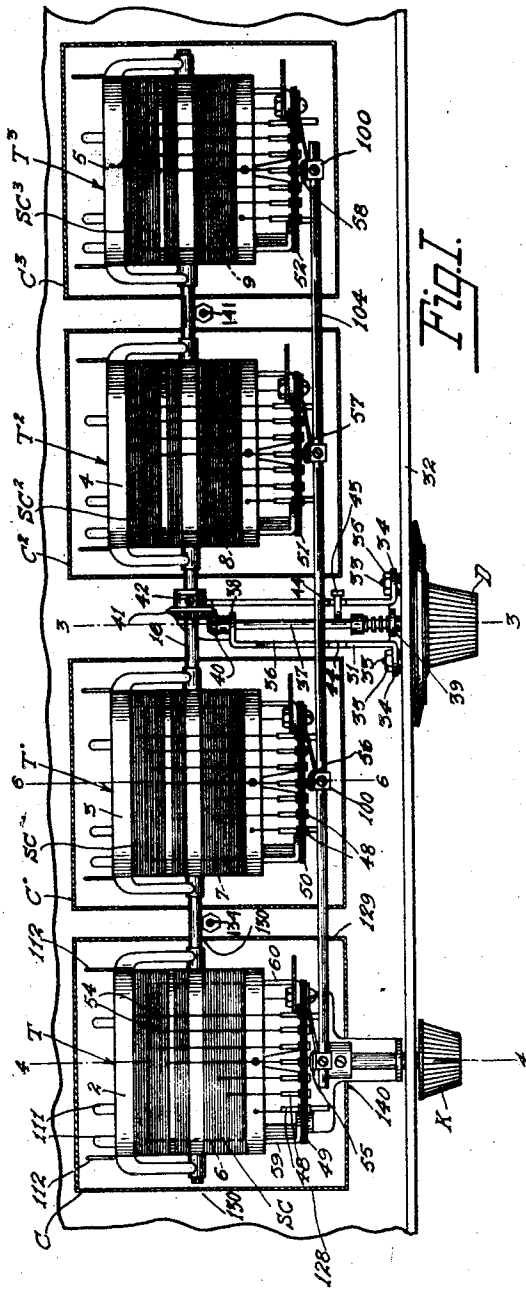


Fig. 1.

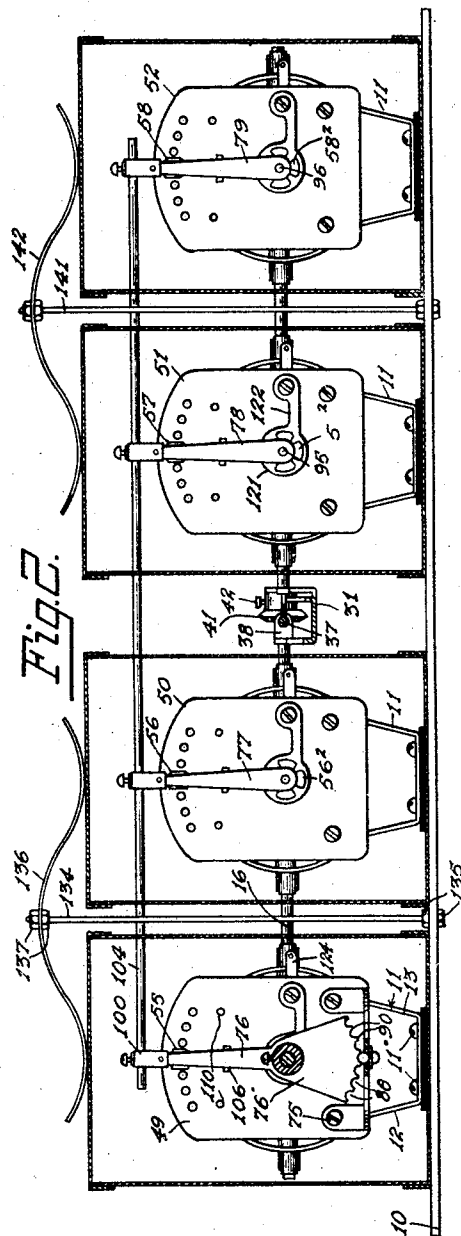


Fig. 2.

Inventor:
Ernest A. Bohlman.
By S. A. Yanoshewski.
Attorney.

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Original Filed May 22, 1926 2 Sheets-Sheet 2

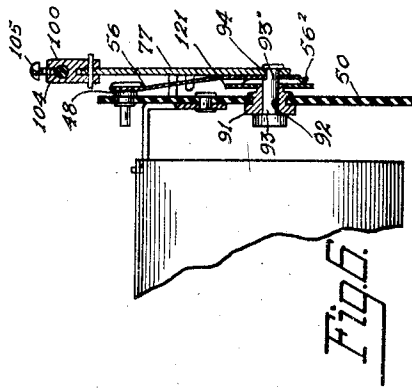
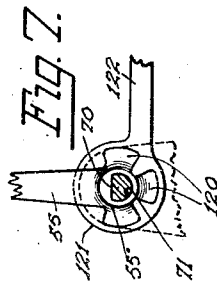


Fig. 6.



ZZ

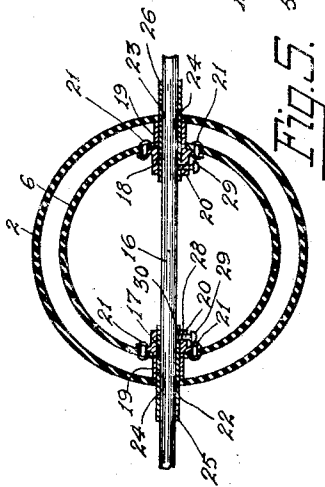


Fig. 5.

Fig. 4.

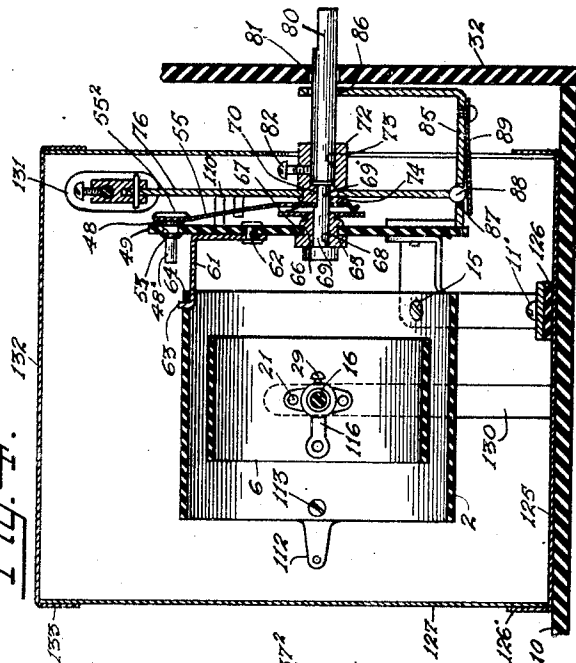
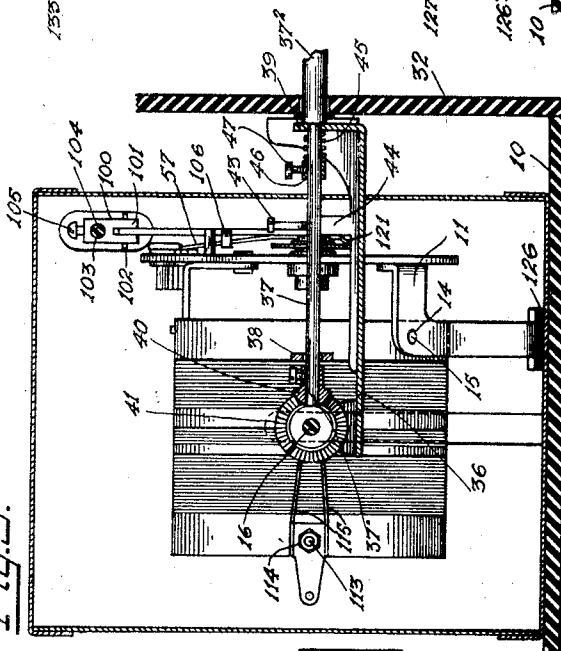


Fig. 5.



Inventor:
Ernest A. Bohlman.
By J. A. Jundt
Attorney.

UNITED STATES PATENT OFFICE

ERNEST A. BOHLMAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

MULTIPLE CONTROL

Original application filed May 22, 1926, Serial No. 110,899. Divided and this application filed September 19, 1927. Serial No. 220,333.

This is a divisional application of my co-pending application Serial Number 110,899, filed May 22, 1926, now Patent Number 1,710,720.

5 My invention relates to tuning couplers or transformers as are used in wireless telegraph or telephone receiving systems, and resides in a novel method of construction and operation of the same.

10 A feature of my invention resides in a multiple control arrangement for such devices.

Another feature of my invention has to do with the manner in which the coils are 15 mounted and associated with one another, and the construction and control of the apparatus by which the inductances of the secondaries of the transformers or couplers are varied in steps by means of a single control 20 arrangement.

Another feature of my invention has to do with the manner in which the inductance within the steps is varied by means of a separate single control unit.

25 Another feature of my invention has to do with the manner in which the contact or wiper arms for varying the inductance of the transformers by steps are associated with the control arrangement.

30 A still further feature of my invention is the manner in which the rotary supports within the stator supports are held in position, and the novel means which are provided for leading the terminal ends of rotary 35 coils to terminals which are adapted to receive connections from an external circuit.

A further feature of my invention is the novel shielding means which are provided 40 for shielding the transformers and the means for securing the same in position.

A still further feature of my invention is the provision of a novel wiper arrangement 45 in association with a conducting element to provide means for connecting the wiper with an external circuit.

The above features as well as others not specifically pointed out will be more fully 50 described and explained in the following specification and for a more complete under-

standing of my invention reference may be had to the accompanying drawings in which like references in the several views denote like parts and in which:

Fig. 1 is a top view of the apparatus comprising my invention in association with a 55 mounting panel and mounting base.

Fig. 2 is a front view of Fig. 1 with the mounting panel removed and the front of the shielding members cut away. 60

Fig. 3 is a sectional view along the line 3—3 of Fig. 1 which clearly illustrates the means for controlling the rotor elements of the transformers.

Fig. 4 is a sectional view along the line 65 4—4 of Fig. 1 which clearly illustrates the means that controls the wipers which engage contacts associated with the tapped secondaries of the transformers.

Fig. 5 is a sectional view through one of the transformers to illustrate the means for 70 carrying the terminals of the rotor winding to external terminals.

Fig. 6 is a sectional view along the line 75 6—6 of Fig. 1.

Fig. 7 is a fragmentary view of the wiper and arm of a switch unit illustrating their association with the shaft to which they are secured.

Referring now particularly to Fig. 1 the 80 devices or transformers T, T', T², T³ are each provided with a cylindrical frame or stator tube 2, 3, 4 and 5 respectively and mounted within the stator tubes are rotatable cylindrical frames or rotor tubes 6, 7, 8 and 9 85 shown in dotted lines in Fig. 1. The stator coils, 2, 3, 4 and 5 are mounted upon a base board 10 by brackets and as each of the stator coils is mounted in a similar manner a description of one will suffice. A U-shaped 90 bracket 11 is provided with diverging legs 12 and 13 which are provided with tapped orifices 14, and screws 15 which pass through suitable orifices in the stator tube 2 near its peripheral edge have threaded engagement 95 with the tapped orifices 14 in the respective legs 12 and 13 of the bracket 11 to secure the stator tube 2 to the bracket 11, the brackets 11 being in turn secured to the base board 10 by means of screws 11'. 100

The rotor tubes 6, 7, 8 and 9 are supported on a rod 16 of suitable insulation material such as bakelite and as the rotor elements are supported on the rod 16 in a similar manner a detailed description of one will suffice. The rotor element or tube 6 is provided with a pair of orifices 17 and 18 diametrically opposite which are adapted to receive the sleeve extensions 19 of a pair of bushings 20 secured to inner circumferential face of the tube 6 by means of rivets 21. The stator tube 2 is provided with a pair of orifices 22 and 23 diametrically opposite and in alignment with orifices 24 which extend through the sleeve extensions 19 of the bushings 20. The orifices 22 and 23 in the stator tube 2 and the orifices 24 in the bushings 20 are of the same size and are in alignment, and they are adapted to receive sleeves 25 and 26 which are of a size to receive the supporting rod 16.

The bushings 19 of the rotor tube 6 are provided with tapped orifices 28 which are adapted to receive screws 29 the ends of which pass through orifices 30 in the sleeves 25 and 26 to permit the same to engage the rod 16 to rigidly secure the rotor tube 6 to the rod 16. The sleeve extensions 19 of the bushings 20 protrude through the diametrically opposite orifices 17 and 18 an equal distance so that the distance between the respective ends of the sleeve extensions 19 is approximately that of the inner diameter of the stator tube 2, so that the ends of these sleeve extensions 19 when the rotor 6 is positioned in the stator tube 2 on the rod 16 engage the inner circumferential face of the stator tube 2 and prevent longitudinal movement of the rotor tube 6 on the supporting rod 16. The rod 16 passes through the respective sleeves 25 and 26 associated with each of the other rotor tubes 7, 8 and 9, and these rotor tubes 7, 8 and 9 are secured to the rod 16 by set screws 29 as described in connection with rotor tube 6 and as the rod 16 is rotated the rotor tubes 6, 7, 8 and 9 which are secured thereto by the set screws 29, are simultaneously rotated. The transformers T , T' , T^2 and T^3 are of the 90 degree coupler type, so that the rotor tubes 6, 7, 8 and 9 may be rotated 90 degrees or until they are at right angles to the axis of the stator tubes 2, 3, 4 and 5.

A bracket 31 secured to the panel 32 by means of screws 33 which pass through suitable orifices in the panel 32 and extended portions 34 of the bracket 31 have threaded engagement with nuts 35 which secures the bracket 31 to the panel 32. The bracket 31 extends rearwardly from the panel 32 between the transformers T' and T^2 and is provided with an integrally formed portion 36 extending upward at right angles from the bracket 31 and is provided with an orifice through which the rod 16, which supports the rotor tubes 6, 7, 8 and 9, extends. A shaft 37 rotatably supported in integrally formed

extended portions 38 and 39 of the bracket 31 has secured to its one end 37' a bevel gear 40 which meshes with a bevel gear 41 secured to the rod 16 by means of a set screw 42. Through the medium of the shaft 37 and the bevel gear 40 secured thereto and the bevel gear 41 on the rod 16 simultaneous rotation of the shaft 37 and rod 16 is accomplished.

The other end 37² of the shaft 37 extends through an orifice in the panel 32 and has secured to its protruding end a graduated dial D adapted to rotate the shaft 37 and through the medium of the gears 40 and 41 and rod 16 the rotor tubes 6, 7, 8 and 9 are rotated simultaneously. The dial D is provided with suitable graduations and a suitable mark is placed upon the front of the panel 32 to indicate the degree of rotation of the rotor elements. A stop in 43 secured to the shaft 37 and angular extensions 44 on the bracket 31 cooperate to prevent excessive rotation of the shaft 37. A coil spring 45 is placed around the shaft 37 with one end resting against the extended portion 39 of the bracket 31 and its other end resting against a collar 46 adapted to be rigidly secured to the shaft 37 by means of a set screw 47. The collar 46 may be slid longitudinally along the shaft 37 to permit the tension or compression of the coil spring 45 to be adjusted and this spring 45 causes the bevel gear 40 on the shaft 37 to be held in mesh with the bevel gear 41 on the rod 16 to prevent any lost motion between the rod 16 and the shaft 37 and to also provide frictional means to maintain the rotor elements in any adjusted position.

The stator coils SC, SC', SC² and SC³ are tapped and these taps are led to contacts 48 mounted on panels 49, 50, 51 and 52, and as all of the panels are of similar construction and arrangement the description of one will suffice for a clear explanation of all. The panel 49 associated with the stator coil SC is rectangular in shape and of suitable insulating material such as bakelite and is provided with suitable orifices 53 equally spaced apart which are adapted to receive contacts 48. The contacts 48 are provided with reduced portions 48' which extend through the orifices 53 to which the taps or leads 54 from the tapped stator coil SC are fastened by suitable means such as solder. The contacts 48 are secured in the orifices 53 in the panel 49 in any suitable manner and are arranged in an arc of a circle, and a wiper arm 55 is adapted to pass over and engage the contacts 48. The wiper arms 55, 56, 57 and 58 are multiple controlled and adapted to be moved corresponding distances simultaneously, so that the inductances of the transformers T , T' , T^2 and T^3 may be varied by placing a different number of turns of wire composing the secondaries of the transformers in circuit. By using a multiple

control device the same number of turns will be used on each coil, and thus the most efficient results with the simplest operation will be obtained and the means for accomplishing this will now be described.

The panel 49 associated with the transformer T is located forward of the same and is secured to the integrally formed angular extensions 59 and 60 of the U-shaped bracket 11, which supports the stator tube 2, by means of screws 75 which pass through openings in the panel and have threaded engagement with tapped orifices in the extensions 59 and 60. Additional securing means for the panel 49 in the form of a bracket 61 is secured to the same by means of a rivet 62 and is provided with an integrally formed pin member 63 which extends through an orifice 64 in the stator tube 2 to rigidly secure the upper portion of the panel 49 against movement. A bushing 65 provided with a reduced portion 66 is inserted into a suitable orifice 67 in the panel 49 and the reduced portion 66 in the orifice 67 extends slightly beyond the face of the panel 49 and is upset or spun over to secure the bushing 65 to the panel. The bushing 65 is provided with a central orifice 68 which is adapted to receive a stub shaft 69 which extends through this orifice 68, and the protruding end 69' of the shaft 69 has a portion cut away to form a flat face 70. A bushing 72 is provided with a circular orifice 73 in its one end and with an orifice 74 in its other end shaped to conform with the formed end 69' of the shaft 69 which extends into this shaped orifice 74. The end 69' of the shaft 69 protrudes slightly into the circular orifice 73 of the bushing 72 and this protruding end is staked over to secure this bushing 72 to the shaft end 69'.

A shaft 80 extends through an orifice 81 in the front panel 32 into the orifice 73 in the bushing 72, and a set screw 82 having threaded engagement with a suitable tapped orifice in the bushing 72 engages this shaft 80 to rigidly secure the same in the bushing 72. The wiper 55 is provided with a dished portion 55' having an orifice 71 of a size and shape to fit over the formed end 69' of the shaft 69 and this dished portion 55' of the wiper 55 when positioned on the stub shaft 69 rests between the bushing 65 in the panel 49 and the face of an arm 76 secured to the bushing 72. It is readily apparent that as the shaft 80 is turned through the medium of a knob K secured to the end protruding through the panel 32 the bushing 72 and the stub shaft 69 secured to the bushing 72 and the wiper 55 which is supported on the stub shaft 69 are rotated as a whole causing the free end 52' of the wiper 55 to engage successive contacts 48, as it is rotated from left to right and vice versa, through the medium of the shaft 80. The arm 76 secured to the bushing 72 is also rotated and this movement

of the arm 76 is for purposes as will presently be described. A bracket 85 secured to the panel 49 by the screws 75 is provided with an upwardly extended portion provided with an orifice 86 through which the shaft 80 extends and serves as a bearing when the same is rotated and the bushing 65 secured to the panel 49 and through which the stub shaft 69 extends serves as a bearing for the shaft 69 when it is rotated through the agency of the shaft 80 as just described. To prevent any overrun of the free end 55' of the wiper 55 as it passes from one contact 48 to the next and also produce a snap action as the wiper 55 passes from one contact 48 to the next, the arm 76 is provided with a downwardly extending portion 76' provided with a plurality of notches 86 in its arcuate shaped edge equal in number to the contacts 48 secured to the panel 49.

The bracket 85 secured to the plate 49 as already described is provided with an orifice 87 which is adapted to receive a ball bearing 88. A leaf spring 89 secured at its one end to the bottom face of the bracket 85 has its free end engaging the ball bearing 88 which rests in the orifice 87 to maintain the ball bearing 88 in engagement with the notches 86 in the arm 76. The ball bearing 88 cooperates with the notches in the extended portion 76' of the arm 76 and as the shaft 80 is rotated the arm 76 also rotates causing a tooth 90 formed by two adjacent notches 86 to engage the ball bearing 88 and force it down against the normal tension of the spring 89 and as the arm continues its rotation the ball 88 passes the tooth 90 and acts upon the next notch 86 under the influence of the spring 89 so as to give a quick snap action to the wiper 55 and arm 76 as the wiper 55 passes from one contact to the next.

The wipers 56, 57 and 58 associated with the transformers T', T² and T³ are rotatably supported in a manner similar to that described in connection with the wiper 55 of the transformer T and a description of one will suffice to give a clear understanding of all. The bushing 91 is secured to the panel 50 by staking its protruding end and is provided with a central orifice 92 which receives a stub shaft 93. The stub shaft 93 is provided with a flat portion 94 and the wiper 56 and arm 77 are provided with orifices shaped to permit them being slipped on the end 93' of the stub shaft 93, and the end of the stub shaft 93 protruding slightly beyond the face of the arm 77 is staked over to secure the wiper 56 and arm 77 to the stub shaft 93. The wipers 57 and 58 and arms 78 and 79 associated with the transformers T² and T³ are secured to stub shafts 95 and 96 in a similar manner and the wipers 55, 56, 57 and 58 and arms 76, 77, 78 and 79 are rotated simultaneously through means to be presently described.

A link 100 provided with a bifurcated end

101 is associated with the free ends of each of the arms 76, 77, 78 and 79 and straddle the same and are pivotally secured thereto by means of pivot pins 102. Each link 100 is provided with an orifice 103 which are adapted to receive a rod 104. Set screws 105 having threaded engagement with suitable tapped orifices in the ends of the links 100 engage the rod 104 to rigidly secure the rod 104 to the links 100 to connect the rod 104 with the arms 76, 77, 78 and 79 associated with the wipers 55, 56, 57 and 58. It is readily apparent that when the shaft 80 is rotated through the agency of the knob K secured to the same, the arm 76 secured to the bushing 72 to which the shaft 80 is secured is rotated, and through the agency of the links 100 which connect the arms 76, 77, 78 and 79 to the connecting rod 104 the movement of the arm 76 is transmitted to the arms 77, 78 and 79 to simultaneously move them.

The arms 76, 77, 78 and 79 are provided with depending legs 106 which are so spaced apart so as to span the wipers 55, 56, 57, and 58. The arm 76 is associated with the stub shaft 69 as before described and as the arms 77, 78 and 79 are secured to the stub shafts 93, 95 and 96 as before described the movement of the arms causes rotation of the stub shafts 93, 95 and 96. The wipers 55, 56, 57 and 58 are secured to the stub shafts and as the stub shafts are rotated by the arms secured thereto the wipers 55, 56, 57 and 58 also move to cause the free ends of the wipers to move from one contact to the next. A pair of stop pins 110 secured to each of the panels 49, 50, 51 and 52 are provided to limit the movement of the wipers from left to right and vice versa, these stops 110 of course being engaged by the respective edges of the arms 76, 77, 78 and 79.

Terminals 111 secured to the stator tubes 2, 3, 4 and 5 provide means for securing the terminals of the windings of the stator coils SC and also provide means for connecting the external conductors of an electrical circuit. A pair of terminals 112, 112 secured to the stator tubes 2, 3, 4 and 5 by means of screws 113 and nuts 114 are provided with integrally formed parallel spring arms 115 the free ends of which engage respectively the sleeves 25 and 26 which extend into the bushings 20 which support rotor tubes 6, 7, 8 and 9 on the rod 16. The bushings 20 are provided with integrally formed terminals 116 to which the terminal windings of the rotor coil RC are secured. The bushings 20 and sleeves 25 and 26 which extend into the bushings 20 are made of suitable conducting material and contact each other so that the winding terminals of the rotor coil RC are provided with a conducting path including the respective bushings 20 and sleeves 25 and 26 and the arms 115 of the respective terminals 112 secured to the stator tubes. External conduc-

tors may be secured to the terminals 112 and thus connect the terminal windings of the rotor coils RC to an external circuit.

The wipers are provided with integrally formed dished semicircular portions 55', 56', 57' and 58' and are split into sections 120 which are bent down to engage disks 121 which are provided with orifices of a size to fit on the reduced portions of the bushings secured to the panels 49, 50, 51 and 52. The disks 121 are provided with extended portions 122 which are secured to the panels by means of suitable screws and are so formed that when the disks 121 are positioned on the bushings between the face of the panels and the bent sections 120 of the wipers the same are placed under tension to firmly engage these portions 120 of the wipers to provide rubbing contacts between the disks 55', 56', 57' and 58' and the wipers. The extended portions 122 of the disks 121 are associated with terminals 124 to which external conductors are connected and through the agency of the extensions 122 and the disks 121 which are in contactual engagement with the wiper disks current is thus carried to the wipers.

The respective transformers T, T', T² and T³ are shielded and for this purpose I provide containers or shields C, C', C² and C³ constructed of suitable metal such as copper and as each one is a similar construction a description of one will suffice. The container C comprises a base 125 secured to the sub panel 10 by means of screws 11' which also secure the brackets 11 to the base board 10. A suitable strip of insulation 126 is placed between the bracket 11 and the base 125 to insulate the bracket 11 from the base 125. The base 125 is provided with upturned edges 126' and a square shaped tube or shell 127 is adapted to surround the transformer T and rests on the base 125 inside of the upturned edges 126' of the same. The opposite walls 128 and 129 of the shell 127 are provided with aligned oblong slots 130 through which the rod 16 which supports the rotor elements R, R', R² and R³ extends. Aligned oblong orifices 131 in the opposite walls 128 and 129 permit the passage of the rod 104 which connects the arms 76, 77, 78 and 79 together. A cover 132 with depending edges 133 sets on the shell 127, and with the shell 127 and base 125 as a whole form a container or shield C for the transformer T. A rod 134 secured to sub panel 10 by means of nuts 135 extends upward between the containers C and C' and a spring clamping member 136 provided with an orifice through which the rod 134 extends engages the covers 132 of the respective containers or shields C and C'. A nut 137 having threaded engagement with the end of the rod 134 is turned down against the clamping member 136 to place the same under tension to hold the cover and shell in position against

movement. The shield C in addition is provided with a slot 140 through which the bracket 85 and shaft 80 extend. The containers or shields C', C² and C³ are of similar construction and the containers C² and C³ are also maintained in position by means of a rod 141 and clamping member 142. The shields C, C', C² and C³ shield the transformers T, T', T² and T³ as is well understood.

The knob K is rotated to change the inductance of the windings in comparatively coarse steps while the dial D operates to vary the inductance of the secondaries within the steps of inductance between the taps.

The bevel gears which connect the shaft 16 to the shaft 44 have a 2 to 1 ratio so that the dial D moves 180 degrees for a 90 degree movement of the rotor elements. By this method a fine adjustment of the rotor elements may be made for a coarser adjustment of the dial D.

While I have described a preferred embodiment of my invention I do not however wish to be limited to the exact structure as shown but aim to cover all that comes within the spirit and scope of the appended claims.

Having described my invention what I claim is new and desire to secure by Letters Patent of the United States is:

1. A device of the character described including a wiper and an arm supported on a rotatable shaft, said arm having a pin secured thereto, a mounting panel having a plurality of contact points secured thereto, said wiper having an orifice adapted to receive said pin secured to said arm and being adapted to engage said contacts, a split end portion for said wiper, a member associated with said wiper having one end secured to said panel and its other end under tension to contact with said portion of said wiper, means integrally formed with said arm and cooperating with spring pressed means for maintaining the said wiper in engagement with any selected contact.

2. A device of the character described including a mounting panel and a plurality of contacts supported thereon, a wiper and an arm supported on a rotatable shaft on said panel, means secured to said arm and engaging said wiper to assure the rotation of said wiper, said wiper adapted to engage said contacts, a split end for said wiper, a conducting member associated with said wiper having one end secured to said panel and its other end under tension engaging said split portion of said wiper, an arcuate shaped member integrally formed with said arm, a bracket secured to said panel and spring pressed means in said bracket cooperating with notches in said arcuate shaped member to maintain said wiper in engagement with any selected contact.

3. A device of the character described including a mounting panel and a plurality of

contacts supported thereon, a wiper and an arm supported on a rotatable shaft, means secured to said arm and engaging said wiper to assure the rotation of said wiper, a dished end for said wiper, a current conducting member associated with said wiper having one end secured to said panel and its other end under tension engaging said dished split portion of said wiper for contact purposes, an arcuate shaped depending member for said arm, a bracket secured to said panel, a ball member resting in an orifice in said bracket, notches in the depending member of said arm, and spring means for pressing said ball member in said notches to maintain said wiper in engagement with selected contacts.

4. A device of the character described including a plurality of mounting panels each having a plurality of contacts, a wiper and an arm for each panel and a shaft supported by each panel to which said wipers and arms are secured, means secured to said arm and engaging said wiper to assure the rotation of said wiper, pivoted links secured to said arms, a control member associated with the shaft of one of said wipers and arms, means extending through said links and secured thereto to cause movement of all of said arms to cause movement of said wipers to engage said contacts when said control member is rotated, and means associated with said one of said arms to maintain said wipers in engagement with selected contact points.

5. A device of the character described including a plurality of mounting panels, each having a plurality of contacts, a wiper and an arm for each panel and a shaft supported by each panel to which said wipers and arms are secured, means secured to said arm and engaging said wiper to assure the rotation of said wiper, pivoted links secured to said arms, means extending through aligned orifices in said links and secured thereto to link said arms together, and a control member associated with one of said arms to cause movement of said one arm which through the agency of said means secured to said links causes the simultaneous movement of said arms and wipers, said wipers engaging successive contacts on said panels.

6. A device of the character described including a plurality of mounting panels each having a plurality of contacts, a wiper and an arm for each panel, a shaft supported by each panel to which said wipers and arms are secured, means secured to said arm and engaging said wiper to assure the rotation of said wiper, connecting links secured to said arms, aligned orifices in said connecting links adapted to receive a connecting rod, means for securing said rod to said links, a control shaft connected to a shaft of one of said wipers and arms to cause the movement of said arm and wiper which causes the simultaneous operation of said arms and wipers by

means of said link and connecting rod to cause said wipers to simultaneously engage corresponding contacts in each set of contacts on said panels.

5 7. A device of the character described including a plurality of contact plates, wipers rotatably supported by said contact plates, wiper control members, control devices pivotally secured to said wiper control members, a
10 control shaft associated with one of said wiper control members, and a rod extending through said control devices for effecting operation of said contact wipers when said control shaft is rotated, and metal housing
15 members enclosing said contact plates provided with orifices through which said rod extends.

8. A device of the character described including a plurality of contact plates, wipers
20 rotatably supported by said contact plates, wiper control members, control devices pivotally secured to said wiper control members, a control shaft associated with one of said wiper control members, and a rod extending
25 through said control devices for effecting operation of said contact wipers when said control shaft is rotated, and metal housing members enclosing said contact plates provided with orifices through which said rod
30 extends, and yielding means for holding covers on said metal housing members.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 31st day of August, A. D. 1927.

ERNEST A. BOHLMAN.