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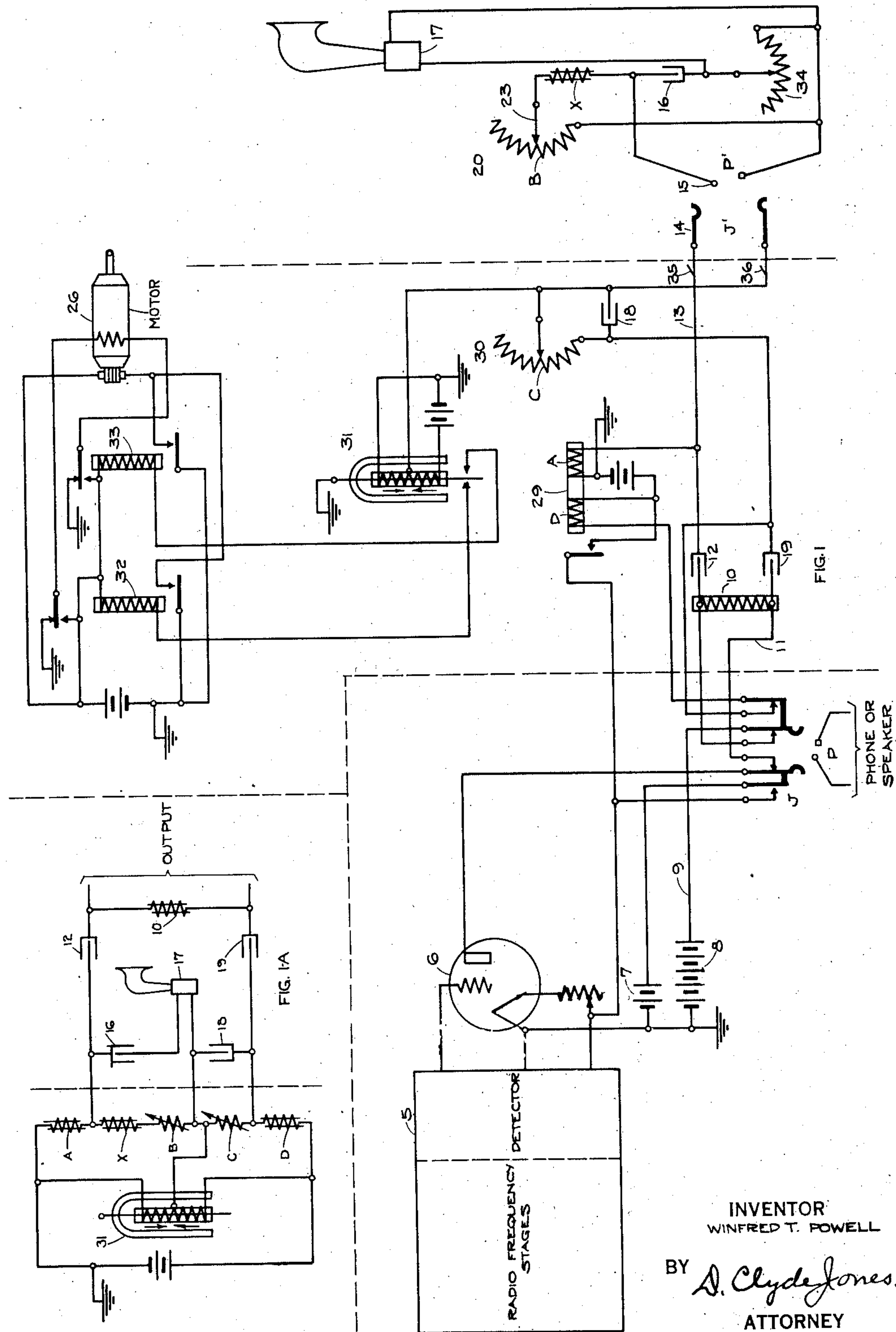
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METHOD AND APPARATUS FOR REMOTELY CONTROLLING RADIO RECEIVING SYSTEMS

Filed Oct. 15, 1925

3 Sheets-Sheet 1



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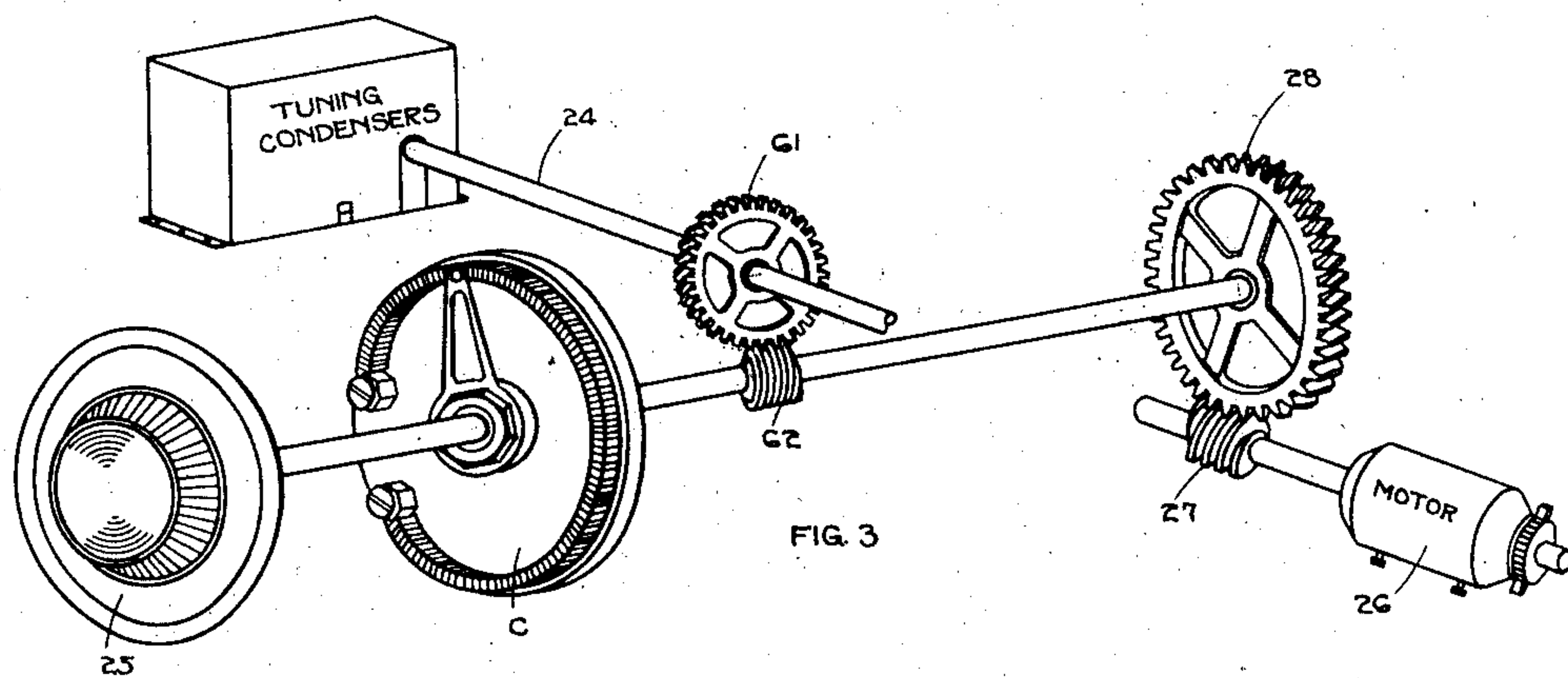
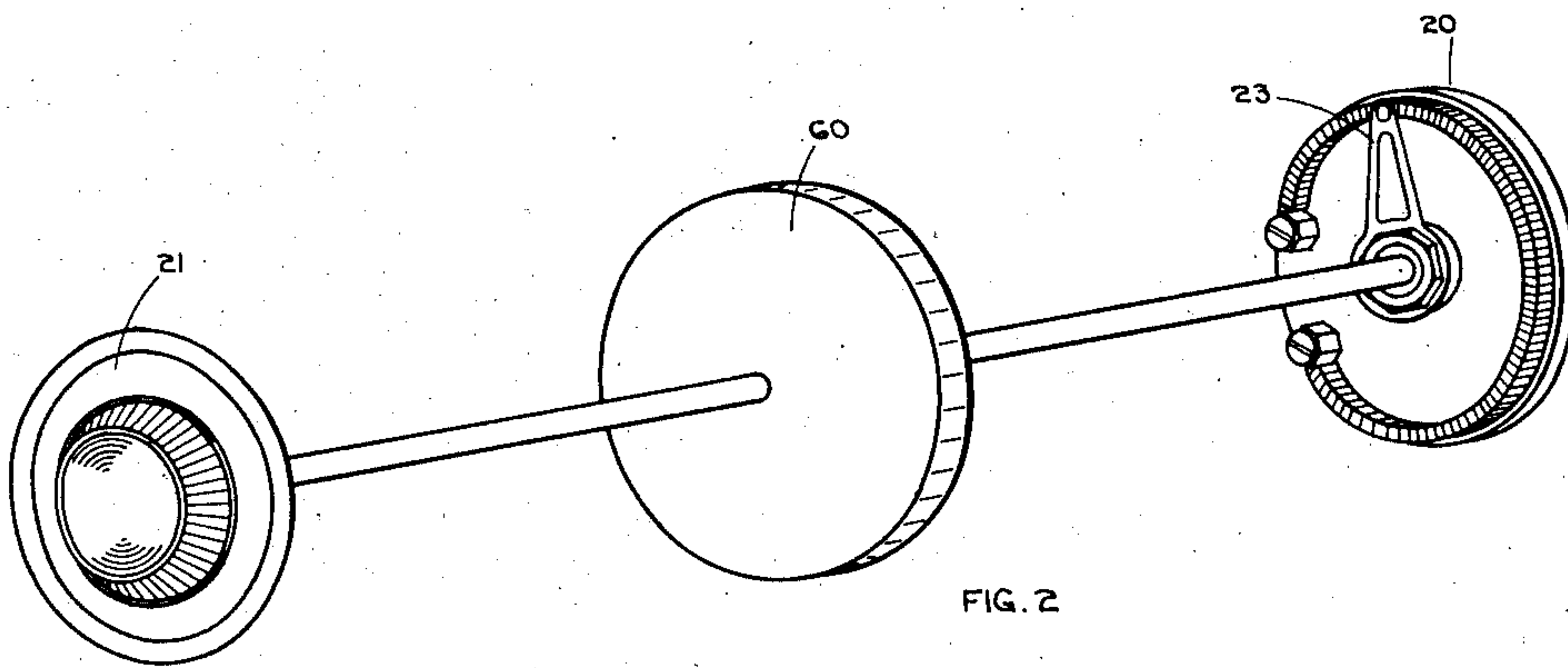
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3 Sheets-Sheet 2



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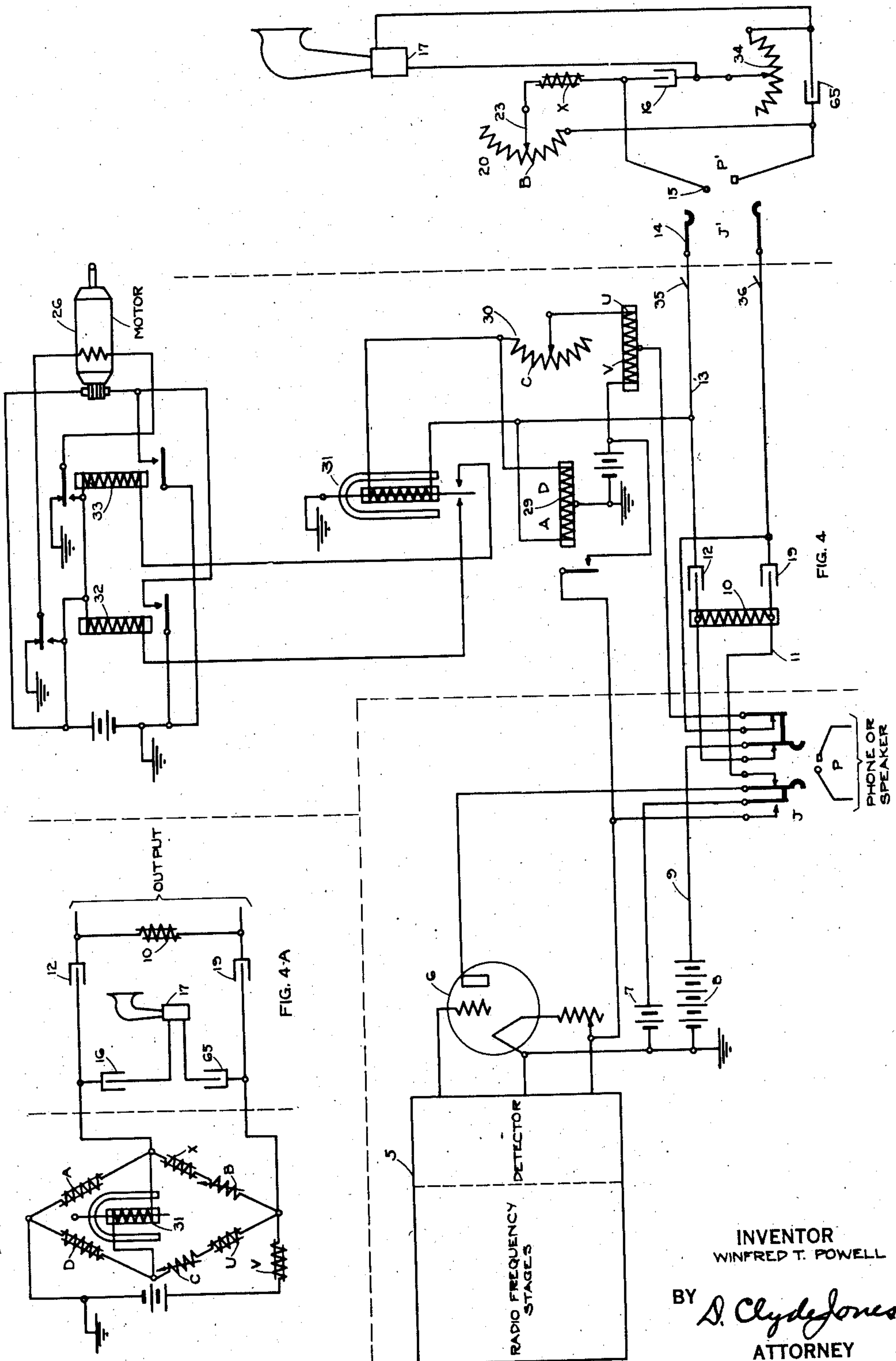
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METHOD AND APPARATUS FOR REMOTELY CONTROLLING RADIO RECEIVING SYSTEMS

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3 Sheets-Sheet 3



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METHOD AND APPARATUS FOR REMOTELY CONTROLLING RADIO RECEIVING SYSTEMS

Application filed October 15, 1925. Serial No. 82,611.

This invention relates to radio receiving systems and more particularly to such systems to be used in radio broadcasting.

At the present time radio equipment for the reception of broadcast programs is located in the best rooms of the home with the consequent requirement that it must be carefully designed and finished to harmonize with the other furniture of the room in which it is placed. At this time it is also necessary for the operation of the set, to employ sources of energy in which certain harmful acids take some part, with the result that the floors and rugs may be damaged thereby.

It is frequently desirable to have the received program reproduced in different rooms of the home, but to accomplish this result, it is necessary to employ a long cord between the receiver and the loud speaker, so that the loud speaker may be carried to any desired room and when it becomes necessary to change the adjustment of the radio set, in order to bring in another program, it is necessary to walk to the room in which the receiver is located.

In accordance with the present invention it is proposed to employ an arrangement, by which a radio receiver located at a distant point may be remotely controlled. Such an arrangement permits the radio receiver to be housed in an inexpensive cabinet located in the cellar or attic and in addition to this, the most efficient arrangement of parts from an engineering and maintenance stand-point may be employed without any considerations of whether the proportions of the set harmonize with other pieces of furniture.

One of the main features of the present invention resides in the method of remotely adjusting a radio receiving system and checking the accuracy of adjustment of said system.

Another feature of the invention resides in the provision of means whereby a radio receiving system may be selectively adjusted from a remote point and whereby the accuracy of such adjustment may be readily checked.

An additional feature of the invention resides in the provision of a remotely controlled radio receiving system having a plurality of

outlets remotely placed with respect to each other and having means associated with each of said outlets whereby the radio receiving system may be selectively adjusted.

A further feature of the invention includes a radio receiving system arranged to be selectively adjusted from any one of several control stations and in which one station is given preference over another, that is, one station may selectively adjust the radio receiving system to the exclusion of the remaining station or stations.

These and other features will appear from the detailed description and appended claims.

Referring to the drawings, Fig. 1 diagrammatically represents a multi-stage tuned radio-frequency radio receiver of which only the last audio stage is shown in detail. Near the center of this figure, there is shown remotely controlled mechanism associated with the radio receiver, by which the various tuning adjustments are effected. At the right of the dotted line, there is indicated the loud speaker or reproducer, preferably of the portable type, having associated therewith means for controlling the adjusting mechanism associated with the radio receiver.

Fig. 1^A is a simplified showing of the circuits of Fig. 1.

Fig. 2 is a view of the controlling means located at the loud speaker.

Fig. 3 represents the controlling mechanism located at the radio set.

Fig. 4 is a slightly modified form of the invention of Fig. 1 in which a Wheatstone bridge arrangement controls the setting of the radio set.

Fig. 4^A is a simplified showing of the circuits of Fig. 4.

Referring to Fig. 1, 5 represents a multi-stage tuned radio-frequency amplifier and detector, in which a single tuning shaft 24 (Fig. 3) is employed for varying the adjustment of the tuning condensers of the several stages and detector. The output circuit of the detector is electrically connected to the input circuit of an audio amplifier, the vacuum tube of which is designated 6. Well-known A and B batteries designated 7 and 8 are employed to supply suitable operating

energy for the several vacuum tubes. The output circuit of the vacuum tube 6 extends to the contacts of the jack J, which has contacts so arranged that when the plug P of a loud speaker located adjacent to the set, is inserted into engagement with said contacts, the remote control equipment appearing at the right of the dotted line of Fig. 1 is disconnected, and the manual control of said tuning condensers including dial 25 at the receiver, is employed. When, however, the remote control equipment is to be employed, the B battery is connected from its positive pole, by conductor 9, normal contacts of the jack J through the impedance coil 10, conductor 11, and normal contacts of the jack J to the plate of the vacuum tube. The signal energy in the output circuit, however, is transmitted to the remotely located loud speaker 17 through condenser 12, conductor 13, tip 14 of the jack J' and tip 15 of the plug P', to the condenser 16 and the loud speaker 17 through the ring contacts of the plug and jack as mentioned, condensers 18 and 19 in series to the plate circuit previously referred to. In this portion of the description, it has been assumed that the radio receiver was previously tuned to receive the desired program.

It will now be assumed that it is desired to change the tuning of the radio receiver, by means of remote control. In order to accomplish this result, a rheostat 20 controlled by a dial 21 (Fig. 2) or other suitable adjusting means is located adjacent the loud speaker or may be mounted in the base thereof, to provide a compact portable device. On the shaft of the rheostat there may be mounted a stations indicator 60, which is in the form of a cylinder, on the periphery of which there is space for making a record of the adjustments necessary for receiving various stations. To bring about the desired adjustment of the remotely located radio receiver, the dial 21, is rotated to adjust the arm 23 of the rheostat 20.

It has been pointed out that the radio receiver, which has several stages, is preferably tuned to the frequency of the incoming signal by condensers mounted on the same shaft, such as 24, which shaft may be rotated through gear 61 and worm 62 by a dial 25, when the receiver is not remotely controlled or by a motor 26 when the remote control arrangement is employed. The shaft of motor 26, it will be understood, is provided with a worm drive member 27 cooperating with gear 28 to perform the same adjustment accomplished manually by the dial 25. It will be understood that the pitch of the worm 27 is such that when the dial 25 is turned either to the right or to the left the gear 28 cooperating with this worm may likewise turn the motor 26. If desired suitable clutch mechanism may be provided whereby the gear

28 will not be turned when the dial 25 is operated manually. One arrangement by which this may be accomplished is to mount the gear 28 frictionally on its shaft so that when the dial 25 is manually operated the load including the motor 26 and the worm 27 is sufficient to overcome this friction and the gear 28 turns on its shaft. However, when the motor 26 is operated, the gear 28 frictionally engages the shaft to turn it since the load on this shaft is not great enough to overcome the mentioned frictional engagement of gear 28 with its shaft.

In order to cause the motor 26 to turn the shaft 24 in either direction, suitable controlling circuits are located at the receiver and are represented between the dotted lines in Fig. 1, while the remote control equipment at the loud speaker is shown at the right of this figure. The controlling circuits include a relay 29, the resistance of whose winding D is equal to the resistance of the right hand winding A, plus the resistance of the coil X, at the loud speaker. When the resistance B of the rheostat 20 is equal to the resistance C of the rheostat 30 at the radio set, there will be an equal potential drop across each winding of the relay 31, since the resistance of winding D is equal to the resistance of the winding A, plus the resistance of coil X, as previously described. The relay 31 is a polarized differential relay, so that under the conditions just stated, it will not move its armature in either direction, because the current through one winding is equal to and opposite to that of the other. If the resistance B at the rheostat 20 is increased by turning the dial 21 in a clockwise direction, the potential drop across the upper winding of relay 31 is increased and its armature is operated in one direction, for example, to the left. This will close a circuit for the winding of relay 32, whereas, if the resistance B of rheostat 20 is decreased by turning the dial 21 in a counter-clockwise direction, the potential drop across the upper winding of relay 31 is decreased and its armature is moved to the right to close a circuit for the winding of relay 33. With the relay 32 thus operated, a circuit is closed for operating the motor 26 in such a direction that it increases the resistance of rheostat C and when a sufficient amount of such resistance is added, so that the resistance of B is equal to C, relay 31 is restored to its normal position and the motor 26 is stopped with the radio set adjusted to receive the desired program.

When the relay 33 is operated, a circuit is closed for operating the motor 26 in such a direction that the resistance of C is reduced and when it is reduced to a point where it equals the resistance B of rheostat 20, relay 31 is restored to its normal condition and the motor 26 is stopped.

It will be noted that the output circuit of

the radio set is connected through the condensers, 12, 16, 18 and 19 to the loud speaker and these condensers are of sufficient capacity to transmit audio frequency signals effectively. The coil 10, which is bridged across the output circuit allows the plate current from the plate battery 8 to be connected to the plate of the vacuum tube 6, but the impedance of the coil is high, so that it will not shunt any appreciable amount of the audio signaling current.

In this receiver it is proposed to operate all the vacuum tubes at their rated maximum efficiency and for controlling the volume a second rheostat 34 at the loud speaker may be shunted across its actuating unit or connected in series as desired, to furnish satisfactory volume control.

The broken leads 35 and 36 indicate that the output circuit may be connected in multiple to other jacks located in various rooms of the home, so that the loud speaker may be carried from one room to another and connected to any of these jacks to receive the program in the room desired.

Fig. 1^A is a schematic showing of the circuit arrangement of Fig. 1 with certain parts such as motor 26 omitted.

Fig. 4 shows a modified form of the invention in which a Wheatstone bridge controlling arrangement is used. The parts of the circuits of Fig. 4, which are the same as corresponding parts of Fig. 1 have been designated by the same reference characters. The impedance coils, rheostats and relays of this arrangement are for the same purposes as similar parts in the circuits of Fig. 1. Referring to the schematic arrangement, shown in Fig. 4^A, it will be seen that by making the direct current resistance of A equal to D and U equal to X, the bridge will be balanced and no current will flow through relay 31, when the rheostats B and C have the same amount of resistance introduced into their associated bridge arms. Increasing the resistance B, by means of the dial 21, causes the relay 31 to operate in the proper direction to rotate the motor 26 in such a direction that more resistance C of the rheostat 30 is introduced into the bridge. The decreasing of the resistance B at the remote control stage will cause the relay 31 to operate in the opposite direction, which causes the motor to reverse and to reduce the resistance C. It will thus be seen that the stations indicator at the receiver set will follow the stations indicator at the loud speaker. In the present modification, the relay 31 is a single wound polarized relay, instead of being a differentially wound polarized relay, as shown in Fig. 1.

In the systems of Figs. 1 and 4 the circuit arrangement including the jacks or outlets J and J', is so arranged that when a program is being received through jack or out-

let J the other jacks or outlets are disabled. Since with the plug P inserted in jack J the controlling network for the relay 31, is interrupted at the outermost, right hand set of contacts at this jack. In this way jack or outlet J is given preference over the other outlets of the system.

The construction of relay 31 may be similar to that described in the Journal of the A. I. E. E. for March, 1925, in a paper by Fry and Gardner, which is sufficiently sensitive to operate on reversals of current as low as 1 milliamperere.

What I claim is:

1. In a radio receiver, detecting means having a variable tuning device, a vacuum tube amplifier associated with the output of said detecting means, an output circuit for said amplifier having a signal reproducer therein, mechanism for adjusting said tuning device, an electrically balanced circuit network for controlling said mechanism, and means at a remote point for disturbing the electrical balance of said circuit network to set said mechanism in operation.

2. In a signaling system, a series of variably tuned circuits, tuning means for said circuits, mechanism for adjusting said tuning means, an electrically balanced circuit arrangement for controlling said mechanism, means at a remote point for disturbing the electrical balance of said arrangement to set said mechanism in operation, and means controlled by the operation of said mechanism to restore the balance of said arrangement whereby said mechanism is brought to rest.

3. In a signaling system, a variably tuned circuit, tuning means for said circuit, a motor for operating said tuning means, a Wheatstone bridge arrangement, one of whose arms includes a variably controlled device at a remote point to control the balance of said bridge and to indicate a desired tuning of said circuit, a relay connected across conjugate arms of said bridge, said relay being operated by the unbalance of said bridge, said motor being set into rotation by the operation of said relay, and means controlled by said motor to restore said balance for deenergizing said relay when a predetermined tuning of said circuit is accomplished.

4. In a signaling system, a radio receiver provided with a tuning element, a motor for operating said tuning element, a signal reproducer, located at a remote point, a pair of conductors for connecting said signal reproducer to said radio receiver, a Wheatstone bridge arrangement having a pair of fixed impedance arms and a second pair of arms, each including a variable impedance, the impedance of one of said arms being adjusted by the operation of said motor, the other variable impedance being located at said signal reproducer and being connected in series with said pair of conductors, said last men-

tioned impedance being adjustable at will to disturb the balance of said bridge, and means connected across conjugated arms of said bridge to set said motor in operation when said bridge is unbalanced, whereby said motor varies said first mentioned variable impedance to restore the balance of said bridge, said means operating on the restoration of said balance to stop the operation of said motor.

5. In a signaling system, a radio receiver provided with a tuning element, a motor for operating said tuning element, a signal reproducer, located at a remote point, a pair of conductors for connecting said signal reproducer to said radio receiver, a Wheatstone bridge arrangement having a pair of fixed impedance arms and a second pair of arms, each including a variable impedance, the impedance of one of said arms being adjusted by the operation of said motor, the other variable impedance being located at said signal reproducer and being connected in series with said pair of conductors, said last mentioned impedance being adjustable at will to disturb the balance of said bridge, and a relay having a balanced armature connected across conjugated arms of said bridge to set said motor in operation when said bridge is unbalanced, whereby said motor varies said first mentioned variable impedance to restore the balance of said bridge, said relay operating on the restoration of said balance to stop the operation of said motor.

6. The method of remotely controlling a radio receiving system, which comprises establishing at a remote point an indication corresponding to a desired broadcasting station, automatically adjusting the tuning element of the radio receiving system in response to the establishing of said indication, to the frequency of the desired broadcasting station as indicated, and reproducing in discernible form at the remote point through said radio receiving system a signal transmitted from said desired broadcasting station whereby the accuracy of the tuning of said radio receiving system with respect to the station indication may be checked.

7. The method of remotely controlling a radio receiving system, which comprises establishing at a remote point an indication corresponding to a desired broadcasting station, automatically adjusting the radio receiving system by progressive rotation of the tuning element thereof in response to the establishing of said indication, to the frequency of the desired broadcasting station as indicated, audibly reproducing at the remote point through said radio receiving system a signal transmitted from said desired broadcasting station whereby the accuracy of the tuning of said radio receiving system with respect to the station indication may be checked, and

regulating the volume of the reproduced signal to prevent distortion thereof.

8. The method of remotely controlling a radio receiving system which comprises establishing at a remote point an indication corresponding to a desired broadcasting station, automatically adjusting the radio receiving system by an operation of the tuning element thereof in either direction of its movement in response to said establishment of the indication, to the frequency of the desired broadcasting station as indicated, and reproducing in audible form at a remote point through said radio receiving system a signal transmitted from said desired broadcasting station whereby the accuracy of the tuning of said radio receiving system with respect to the station indication may be checked.

9. In a radio receiving system, a plurality of radio amplifying networks and an associated detecting network linked together in cascade, tuning means for certain of said networks actuated from a common control, preselecting means at a remote point adjustable for establishing a desired station selection condition and indication, driving means directly controlled in response to the adjustment of said preselecting means for directly operating said common control to effect a desired adjustment of said tuning means to a predetermined position, and a signal reproducer linked to said detecting network and within range of said remote point for checking the accuracy of the adjustment of said tuning means.

10. In a radio receiving system, a plurality of radio amplifying networks and an associated detecting network linked together in cascade, tuning means for at least one of said networks, adjustable selecting means at a remote point for establishing a desired station selection condition and indication, driving means reversibly controlled in response to the adjustment of said selecting means for directly adjusting said tuning means, and a signal reproducer linked to said detecting network and within range of said remote point for checking the accuracy of the adjustment of said tuning means.

11. In a radio receiving system, a plurality of radio amplifying networks and an associated detecting network linked together in cascade, tuning means for certain of said networks, a manual control at said networks for selectively setting said tuning means, adjustable preselecting means at a remote point for establishing a desired station selection condition and indication, reversible driving means directly controlled in response to the adjustment of said preselecting means for directly adjusting said tuning means, and a signal reproducer linked to said detecting network and within range of said remote point for checking the accuracy of the adjustment of said tuning means.

12. In a radio receiving system, a plurality of radio amplifying networks and an associated detecting network linked together in cascade, tuning means for at least one of said networks, rotatably adjustable preselecting means at a remote point for establishing a desired station selecting condition and indication, reversible driving means directly controlled in response to the adjustment of said preselecting means and out of step therewith for directly setting said tuning means, and a signal reproducer linked to said detecting network and within range of said remote point for checking the accuracy of the adjustment of said tuning means.

13. In a radio receiving system, a plurality of radio amplifying networks and an associated detecting network linked together in cascade, tuning means for certain of said networks, an output circuit linked to said detecting network having a plurality of remotely placed outlets, means directly controlled through any of said outlets for selectively adjusting said tuning means, and signal reproducers connectible to said output circuit through said outlets whereby the adjustment of said tuning means may be checked.

14. In a radio receiving system, a plurality of radio amplifying networks and an associated detecting network linked together in cascade, tuning means for certain of said networks, adjusting means for said tuning means, an output circuit linked to said detecting network having a plurality of outlets remotely placed with respect to each other, means associated with each of said outlets for selectively controlling said adjusting means, signal reproducers connectible to said output circuit through said outlets whereby the adjustment of said tuning means may be checked, and means at one outlet for preventing adjustment of said tuning means from a second outlet.

15. In a radio receiving system, a plurality of radio amplifying networks and an associated detector network linked together in cascade, tuning means for certain of said networks, an output circuit linked to said detector network having a plurality of outlets remotely placed with respect to each other, controlling means associated with each of said outlets for selectively adjusting said tuning means, the controlling means associated with certain of said outlets including a series control circuit governed at one of said outlets, means at said last mentioned outlet for disabling said series control circuit whereby said last mentioned outlet is given preferential control over another outlet, and signal reproducers connectible to said output circuit through said outlets whereby the adjustment of said tuning means may be checked.

16. In a radio receiving system, a plurality of radio amplifying networks and an associated detecting network linked together in

cascade, tuning means for certain of said networks, adjustable selecting means at a remote point, movable clockwise and counterclockwise for establishing a desired station selection condition, driving means directly controlled in response to the adjustment of said selecting means and following the movement thereof for directly adjusting the tuning means, and a signal reproducer linked to said detecting network and within range of said remote point for checking the accuracy of the adjustment of said tuning means.

17. In a radio receiving system, a radio receiver including an output circuit, tuning means for said radio receiver, adjustable selecting means at a remote point for establishing a desired station selection condition and indication, a reversible motor directly controlled in response to the adjustment of said selecting means for directly reversibly adjusting said tuning means, and a signal reproducer linked to said output circuit and within audible range of said remote point for checking the accuracy of the adjustment of said tuning means.

In witness whereof, I hereunto subscribe my name this 6th day of October, A. D. 1925.

WINFRED T. POWELL.

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