March 24, 1936. B. O. BROWNE ET AL 2,034,708

REMOTE CONTROL APPARATUS

Filed April 28, 1934 3 Sheets-Sheet 1

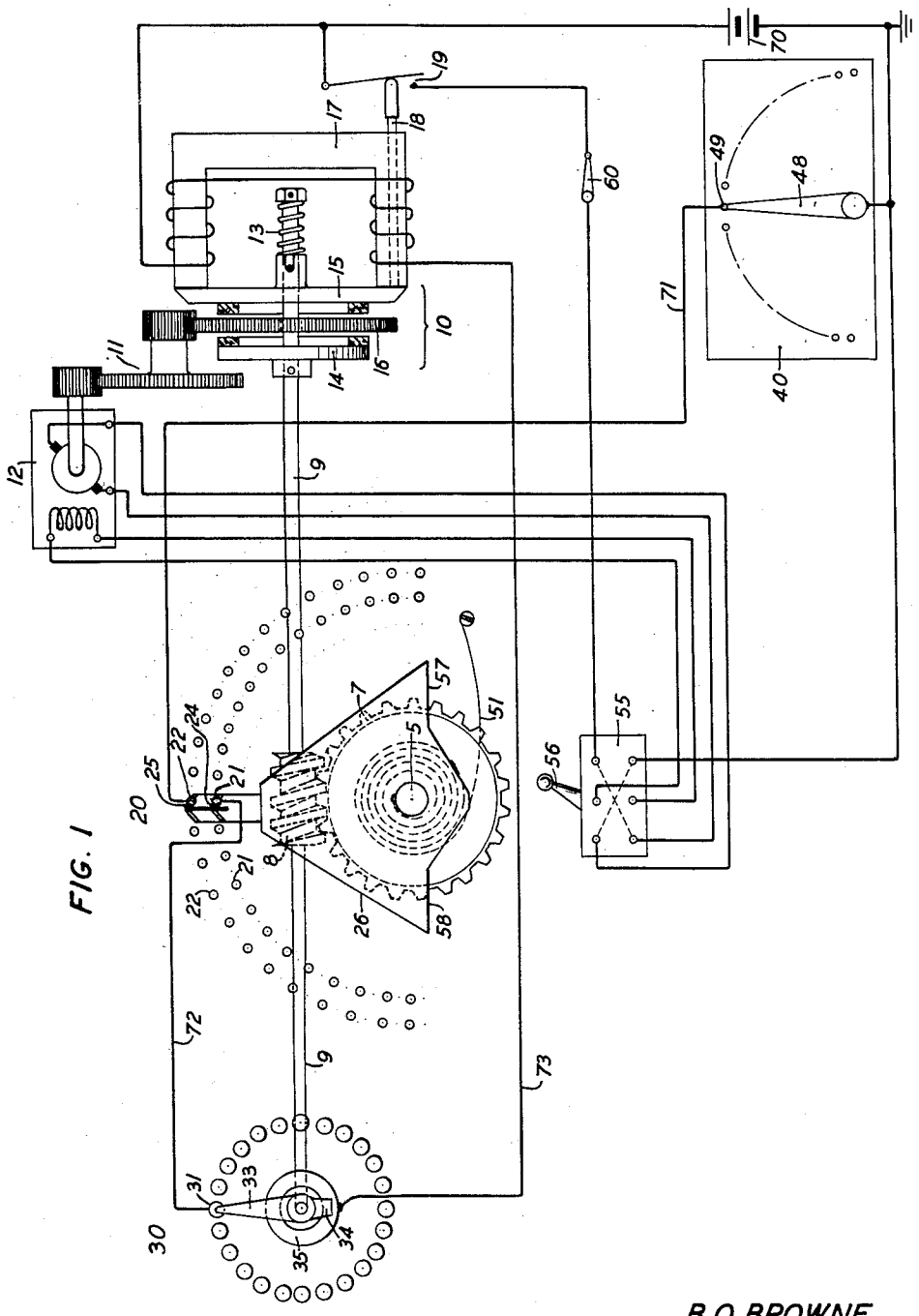

FIG. 1

INVENTORS B.O.BROWNE
H.MORRISON

BY G.H.Stevenson

ATTORNEY

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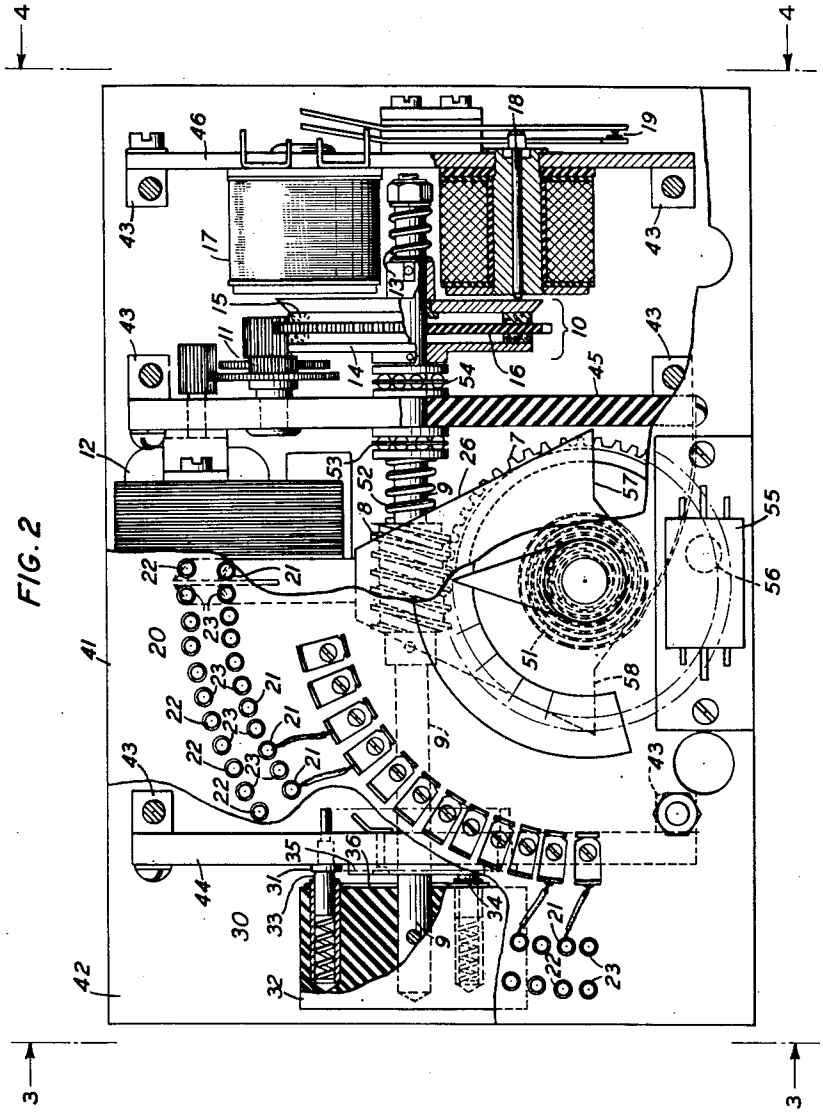
FIG. 2



INVENTORS: B.O.BROWNE
H.MORRISON

BY G W Stevenson

ATTORNEY

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FIG. 4

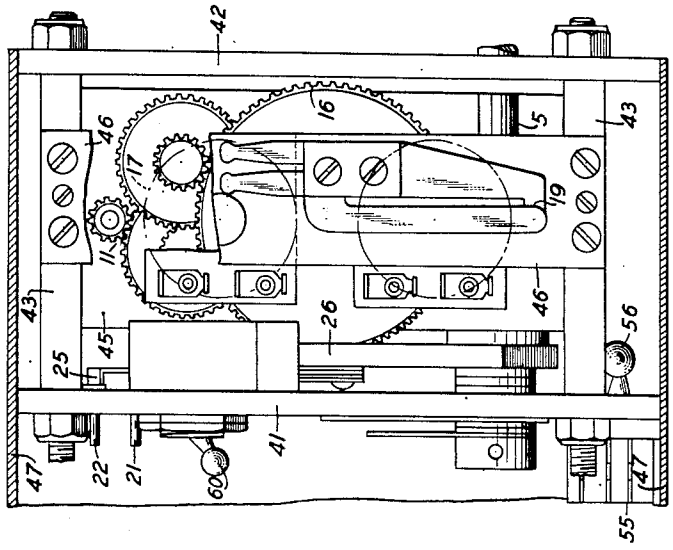
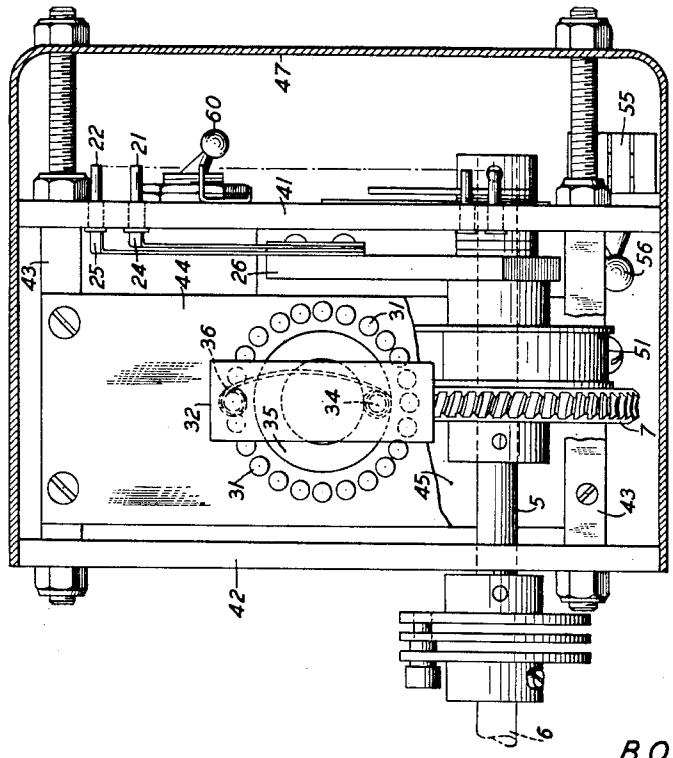


FIG. 3



INVENTORS B.O.BROWNE H.MORRISON

BY

G W Stevenson

ATTORNEY

Patented Mar. 24, 1936

2,034,708

UNITED STATES PATENT OFFICE

2,034,708

REMOTE CONTROL APPARATUS

Bennie O. Browne, Maplewood, and Howard Morrison, Orange, N. J., assignors to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application April 28, 1934, Serial No. 722,906

7 Claims. (Cl. 172—239)

This invention relates to remote control apparatus and particularly to apparatus for controlling the tuning of radio receivers or the like.

An object of the invention is to simplify and improve the accuracy of apparatus for remotely controlling the angular position of an instrument such as the tuning element of a radio receiver.

In a specific preferred embodiment of this invention comprising a remote control for operating the tuning condensers of a radio receiver, the mechanism is driven by an electric motor which is connected through a combination electromagnetic clutch and brake with a drive shaft carrying a worm. A worm gear coupled to the tuning condenser shaft is driven by the motor. A contact arm carried by the worm gear shaft is arranged to pass over and interconnect the contacts of a number of pairs of contacts spaced in an arc, corresponding to the movement of the condensers. The size of the contacts and contact arm are so proportioned that the arm is always in contact with one pair of contacts. A second contact arm is carried by the worm shaft and due to the different speeds of rotation of the two shafts, this contact arm will rotate through an arc including a number of contacts, as the other contact arm moves from one pair of contacts to another. This arrangement permits the use of two relatively small contact commutators or discs for providing the same degree of accuracy as could otherwise be obtained only by using a very large disc which would permit a large number of contacts to be mounted thereon. Thus, with a contact disc associated with the arm on the worm gear shaft having fifty contacts and a contact disc associated with the arm on the worm shaft having twelve contacts, the same effect is obtained as by using one disc having six hundred contacts.

Operation is obtained by using a multi-point or push button switch, one point of which is connected to one of the contacts of the desired pair of the first contact disc, the other of the pair being connected to that contact of the other contact disc corresponding to the desired position. When the two contact arms are in the position to contact with the corresponding contacts, a circuit is completed which operates the electromagnetic relay releasing the clutch and providing an electromagnetic braking action and at the same time operating a relay contact to open the driving motor circuit. If the control switch is moved to a different point, the electromagnetic brake will be released, the clutch engaged and the motor circuit completed causing the control mechanism to operate until it reaches the contact point corresponding to the chosen switch position. A reversing switch, operated when the condenser shaft reaches the limit of its movement, provides for the proper direction of rotation of the driving motor.

Since it is imperative that the tuning condenser always stop at exactly the same position for any one setting of the control switch no back lash between the worm and worm wheel can be allowed. Regardless of the direction in which the worm wheel is being moved the same side of the teeth of the wheel must always be in contact with the worm. This is brought about by the use of a spiral spring which always tends to rotate the worm wheel in one direction. Thus, for rotation in one direction the motor drives the worm wheel against the action of the spring and in the other direction the spring drives the worm wheel and tuning condenser while the motor-driven worm merely acts as a release mechanism to control the rate of motion.

The motor control mechanism is simplified by combining the brake, clutch and motor control switch in one electromagnetic relay structure.

The invention can be more readily understood by reference to the following detailed description in connection with the drawings which show one embodiment of the invention in a remote control unit designed for operating the tuning condenser of a radio receiver:

Fig. 1 is a simplified schematic showing of the mechanical and electrical arrangements of the complete apparatus.

Fig. 2 is a front elevation of the operating unit partly in section; and

Figs. 3 and 4 are end elevations partly in section taken along the lines 3—3 and 4—4, respectively, of Fig. 2.

Mechanical construction

The apparatus forming the operating unit is mounted on a framework comprising a front plate 41 and a rear plate 42 spaced by the six posts 43 to which are secured mounting plates 44, 45 and 46. The entire assembly is protected by a cover 47.

A shaft 5 is coupled to the shaft 6 of the tuning condenser (not shown) of a radio receiver. The shaft 5 carries a worm wheel 7 which meshes with a worm 8 carried by a shaft 9 journaled in the mounting plates 44 and 45. The shaft 9 is driven by an electrical motor 12 through the gear train 11 and the clutch 10.

A spring 13 holds the clutch in engagement by the action it exerts in clamping the last gear 16 of the gear train 11 between the cork faced plates

14 and 15 which are keyed to the shaft 9. The clutch is released by the action of the electromagnet 17 which attracts the plate 15 against the action of the spring 13 releasing the pressure between the plates 14 and 15 and the faces of the gear 16. The energization of the electromagnet not only acts to release the clutch but the attraction of the plate 15 also produces a braking action stopping the shaft 9 and consequently the tuning mechanism. A pin 18 extends through a hole in one pole piece of the electromagnet 17 and is operated by the disc 15 to open the contacts 19 for controlling the motor circuit.

The position at which the worm wheel 7 and thus the tuning condenser stops is controlled by two multi-contact switches or commutators 20 and 30 and a control switch 40 which is located at the control position. The complete system including the electrical connections as shown typically in Fig. 1 provides for stopping the tuning condenser at any one of six hundred equally spaced positions around the complete one hundred and eighty degree arc of motion of the condenser as will be described in detail.

The switch 20 comprises fifty pairs of contacts 21—22 mounted in the plate 41 in a one hundred and eighty degree arc corresponding to the movement of the tuning condenser with brushes 24 and 25 riding over them. Spaced between adjacent pairs of contacts 21—22 are pins 23 which are of similar construction to the contacts and provide a surface on which the brushes 24 and 25 ride. An arm 26 of insulating material fixed to the shaft 5 carries the brushes 24 and 25 which are electrically connected together so as to cross-connect one pair of the contacts 21—22 in each position. The contacts 21—22 and the brushes 24 and 25 are so proportioned that the brushes are always in contact with one or another of the pairs of contacts.

The switch 30 has twenty-four contacts 31 mounted in the plate 44. A block of insulating material 32 fixed to the shaft 9 carries a brush type contactor 33 which slides over the contacts 31. A second brush 34 also carried by the block 32 and interconnected to the brush 33 by the strap 36 makes continuous contact with a ring 35 mounted on the plate 44.

The reduction ratio between the speed of the worm 8 and the worm wheel 7 which drives the brushes of the switch 20 is such that the brush 33 makes one complete revolution while the brushes 24 and 25 are passing over two of the contact pairs 21—22. In other words, the brush 23 passes over twelve of the contacts 31 for each contact pair 21—22 covered by the brushes 24 and 25. An interconnection between the contacts of the switches 20 and 30 controls the stopping of the condenser shaft as will be described later.

Since the exact position of the operating shaft 5 is determined by the switch 30 and since it is imperative that the condenser always stop at exactly the same position for any one setting, no back lash between the worm 8 and the worm wheel 7 can be permitted. This result is accomplished by the use of the spiral spring 51 to keep the same side of the teeth of the worm wheel 7 in contact with the worm 8 regardless of the direction of rotation. This spring 51 has one end attached to the shaft 5 and the other to the plate 45 so that it always tends to rotate the worm wheel 7 in one direction. Thus, for rotation in one direction the motor drives the worm wheel 7 against the action of the spring 51 and in the other direction the spring 51 drives the worm wheel 7—the motor-driven worm merely acting as a release mechanism to control the rate of motion and the stopping position. A spiral spring 52 and thrust bearings 53 and 54 take up the force exerted on the shaft 9.

A reversing switch 55 is provided for reversing the direction of rotation of the motor 12 when the shaft 5 reaches either limiting position of the tuning condenser. The switch 55 is operated by the action of the shoulder 57 or 58 of the arm 26 on the operating handle 56.

Operation

The action of the apparatus may be readily understood from a description of the process of setting up a tuning position (when attached to a radio receiver). With the cover 47 removed and the motor shut off and switch 60 open, the block 32 may be used as a knob permitting the tuning condenser to be tuned by hand. The knob is turned until the desired station is properly tuned in. A connection 71 (Fig. 1) is then made from the contact 49 of the operating switch 40 which it is desired to use for this particular station to the contact 22 of the pair 21—22 upon which the brushes 24 and 25 are resting. A second connection 72 is made from the contact 21 of the same pair to that one of the contacts 31 upon which brush 33 is resting. A circuit is thus formed from the grounded terminal of battery 70 through the arm 48 and contact 49, connection 71, contact 22, switch arms 24 and 25, contact 21, connection 72, contact 31, brushes 33 and 44, ring 35, connection 73 and the coil of electromagnet 17 back to battery 70. This circuit will operate the electromagnet 17 attracting the plate 15 to release the clutch 10 and lock the shaft 9 by the braking action and open the motor circuit at the contact 19.

If the arm 48 of the control switch is now moved to another contact, the circuit through the switches 20 and 30 to the electromagnet 17 is opened, so that the clutch will engage and the motor circuit be closed at contact 19 (the shut-off switch 60 having been previously closed). The motor 12 will then drive the unit until another set of similarly established connections closes the circuit and releases the clutch.

In order to avoid confusion only one circuit is shown in the diagram, it being understood that there will be as many similar circuits as there are desired tuning positions.

The direction of rotation of the apparatus is reversed when the shaft 5 reaches either limiting position of the tuning condenser by the action of the shoulders 57 or 58 in operating the reversing switch 55.

While the switch 40 is shown as a multi-contact switch, it may be a multi-button switch of the locking type, or if it is desired to reduce the number of connections between the operating unit and the control position, a selector may be used in place of the switch 40 and operated from a distance by a dial of the telephone type.

What is claimed is:

1. A remote control for a radio receiver or the like comprising an instrument shaft, a main selector having a contact arm and a plurality of pairs of contacts so arranged that the arm will always be in contact with a pair of contacts to connect them together, an auxiliary selector comprising a contact arm and a plurality of contacts, gear means interconnecting said contact arms so that the second contact arm covers a

number of contacts while the first contact arm is on one pair of contacts, and a plurality of control circuits each interconnecting a pair of contacts of the main selector and a predetermined contact of the second selector to stop the instrument shaft at a definite position.

2. In a remote control system for a radio receiver or the like having an instrument shaft to be controlled, a driving motor, a clutch, a drive shaft arranged to be driven by said motor through said clutch, a worm carried by said drive shaft, a second shaft connected to said instrument shaft, a worm wheel carried by said second shaft and meshing with said worm, a first multi-contact switch having a switch arm carried by said second shaft, and a plurality of contacts, said arm being arranged to contact one of said contacts for each position, a second multi-contact switch having a plurality of contacts and a switch arm carried by the drive shaft so that the arm will pass over a number of contacts as the switch arm of the first multi-contact switch passes over each contact, and a control circuit for each desired position of the instrument shaft arranged to release the clutch when the two contact arms are on the respective contacts corresponding to the desired position of the instrument shaft.

3. In a remote control system for a radio receiver or the like having an instrument shaft to be controlled, a driving motor, a clutch, a drive shaft arranged to be driven by said motor through said clutch, a brake for said drive shaft, a worm carried by said drive shaft, a second shaft connected to said instrument shaft, a worm wheel carried by said second shaft and meshing with said worm, a first multi-contact switch having a switch arm carried by said second shaft and a plurality of contacts, said arm being arranged to contact one of said contacts for each position, a second multi-contact switch having a plurality of contacts and a switch arm carried by the drive shaft so that the arms pass over a number of contacts as the switch arm of the first multi-contact switch passes over each contact, and a control circuit for each desired position of the instrument shaft arranged to release the clutch and operate the brake when the contact arms are on the respective contacts corresponding to the desired position.

4. In a remote control system for a radio receiver or the like having an instrument shaft to be controlled, a driving motor, a drive shaft arranged to be driven by said motor, a worm carried by said drive shaft, a second shaft connected to said instrument shaft, a worm wheel carried by said second shaft and meshing with said worm, a first multi-contact switch having a switch arm carried by said second shaft, and a plurality of pairs of contacts so arranged that said switch arm is always in contact with one of said pairs of contacts to interconnect such pair of contacts, a second multi-contact switch having a plurality of contacts and a switch arm carried by the drive shaft so that the arm will pass over a number of contacts as the switch arm of the first multi-contact switch passes over each pair of contacts, and a control circuit for each of a plurality of desired positions of the instrument shaft including in series one of said pairs of contacts of said first multi-contact switch and a contact of said second multi-contact switch and arranged to stop the rotation of the instrument shaft when the circuit is completed.

5. In a remote control system for a radio receiver or the like having an instrument shaft to be controlled, a driving motor, a combination electromagnetic clutch and brake, a drive shaft driven by said motor through said clutch, a worm carried by said drive shaft, a second shaft connected to said instrument shaft, a worm wheel carried by said second shaft and meshing with said worm, a first multi-contact switch having a switch arm carried by said second shaft, and a plurality of pairs of contacts, said arm being arranged to interconnect a pair of contacts in each position, a second multi-contact switch having a plurality of contacts and a switch arm carried by the drive shaft so that the arm will pass over a number of contacts as the switch arm of the first-multi-contact switch passes over each pair of contacts, and a control circuit comprising a series circuit including a control element, one contact of a pair of contacts of the first switch, a second contact of said pair, and a contact of said second switch and arranged when completed to operate the combination brake and clutch to release the clutch and apply the brake to the drive shaft.

6. A combination according to claim 5 and a spring attached to said second shaft so that for rotation in one direction the worm turns the worm wheel against the action of the spring and for rotation in the other direction the spring drives the worm wheel.

7. In a remote control for an instrument shaft designed to be driven through an arc of less than three hundred and sixty degrees, a worm wheel carried by said shaft, a drive shaft, a worm carried by said drive shaft and meshing with said worm wheel, means carried by said drive shaft for determining a desired position of said instrument shaft, and a spring attached to said instrument shaft so that for rotation in one direction the motor turns the worm wheel against the action of the spring and for rotation in the other direction the spring drives the worm wheel, and means for reversing the direction of rotation of said motor when said instrument shaft reaches either limit of its arc of rotation.

BENNIE O. BROWNE.
HOWARD MORRISON.