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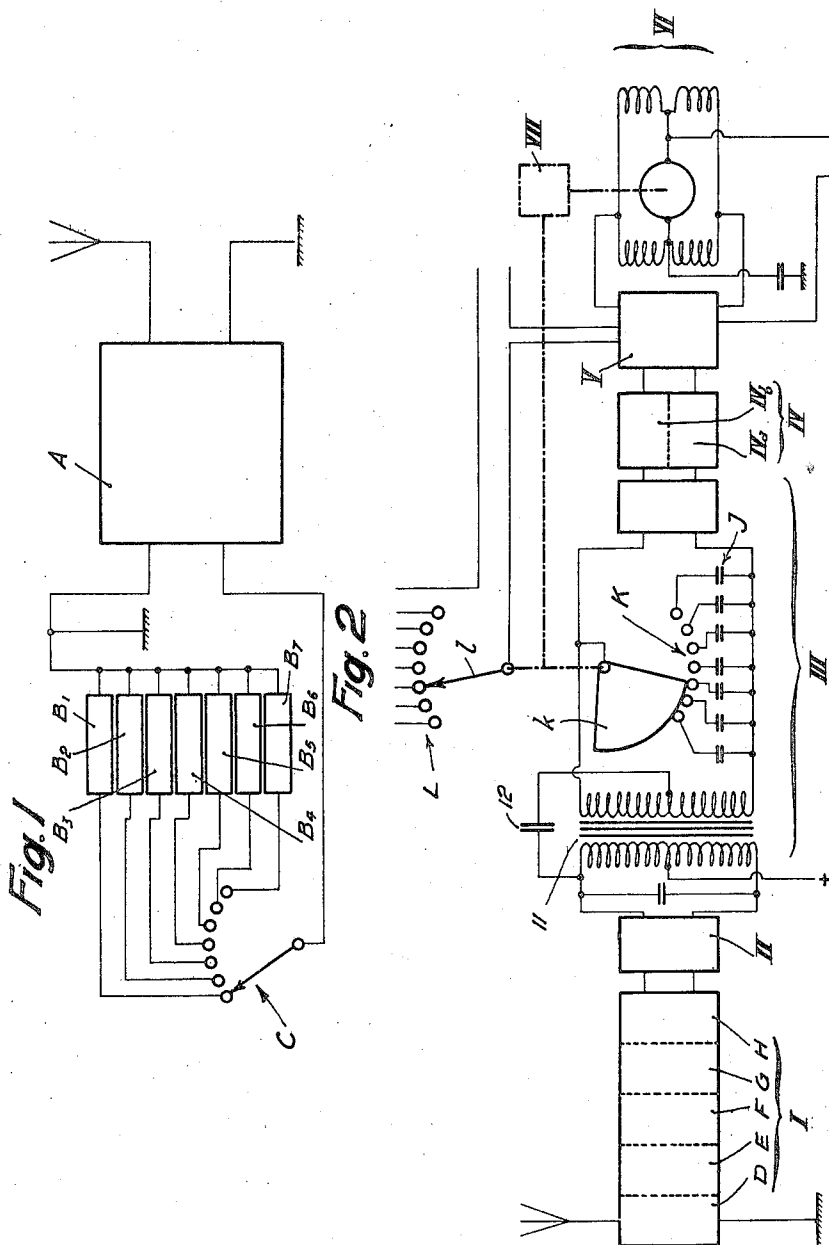
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2,830,241

TELECONTROL DEVICE

Filed July 20, 1955

4 Sheets-Sheet 1



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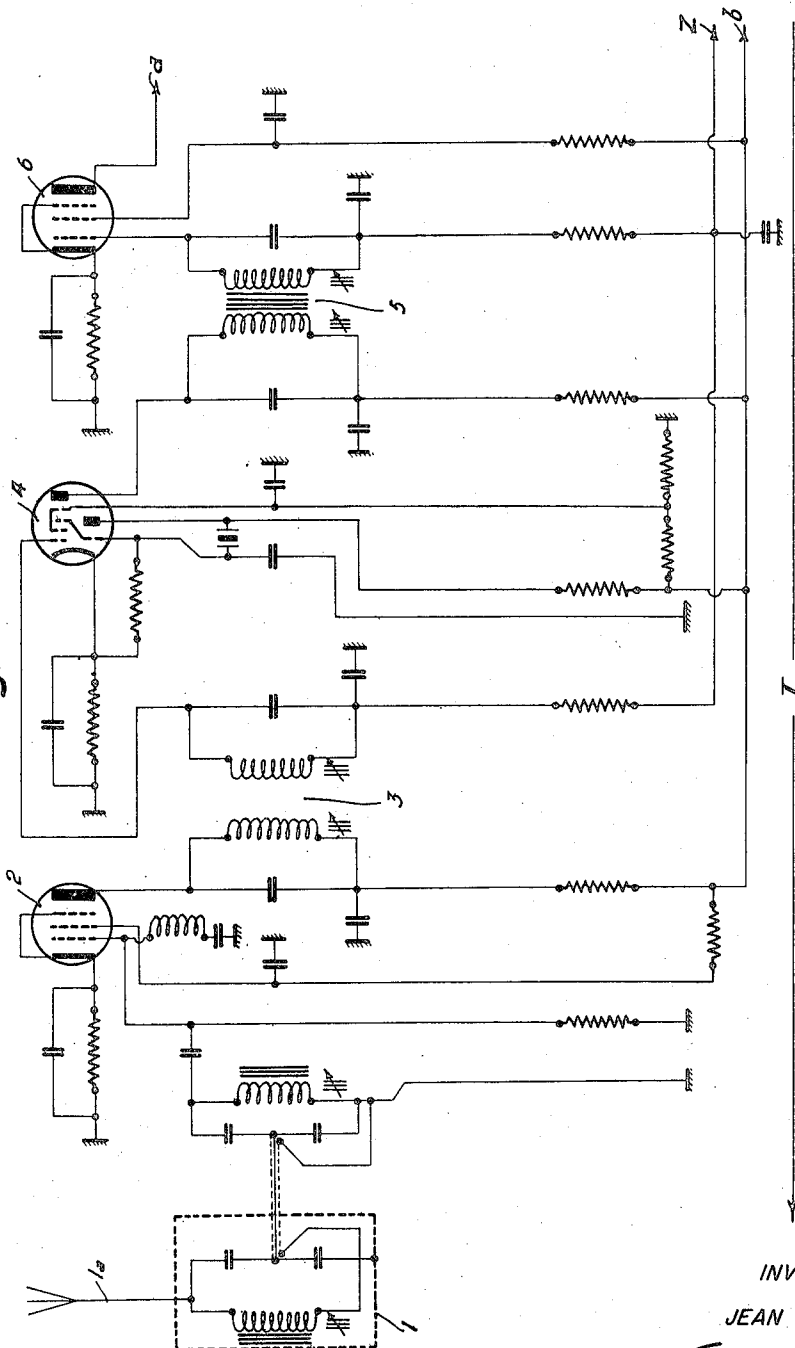
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Fig. 3



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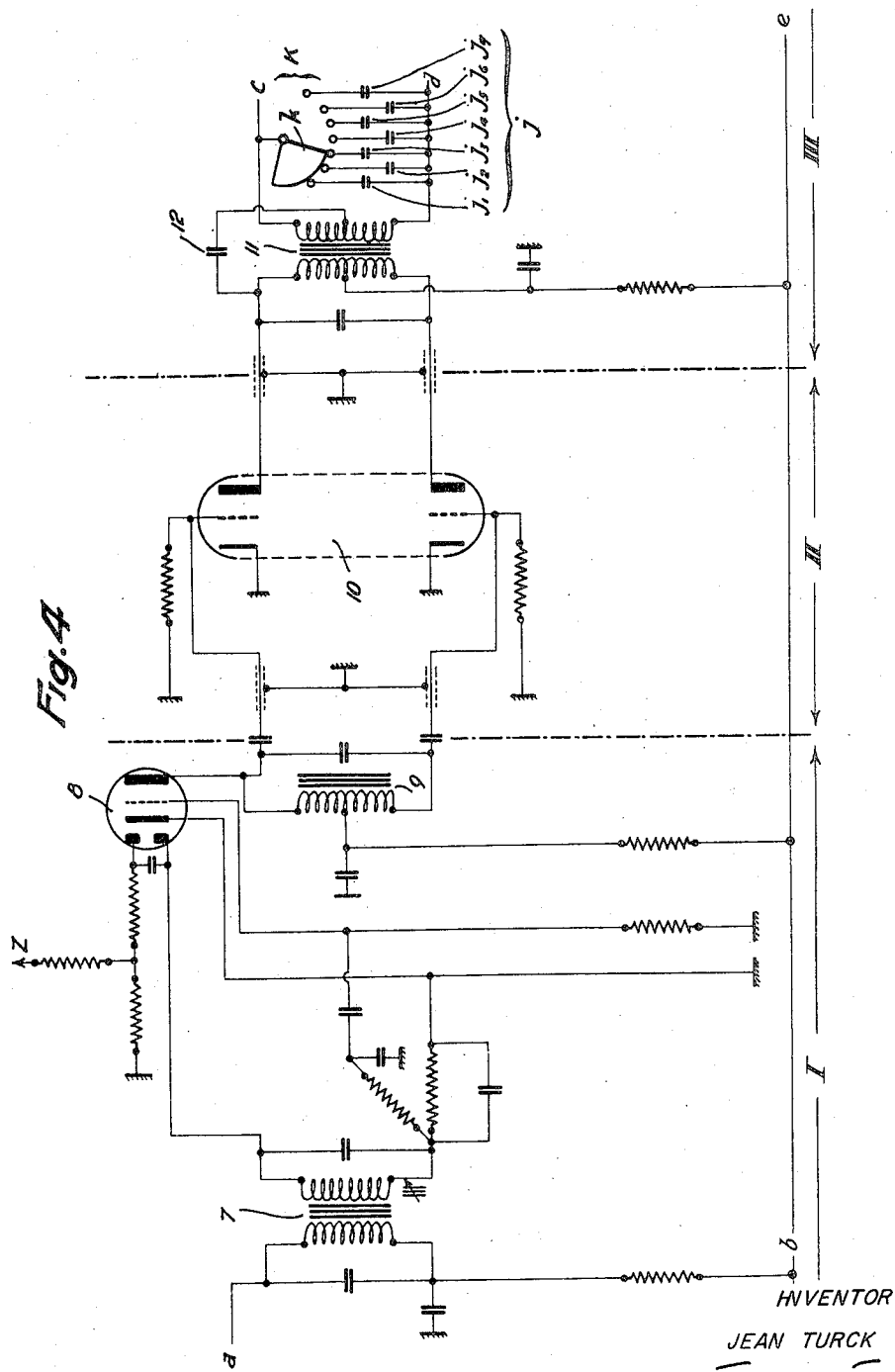
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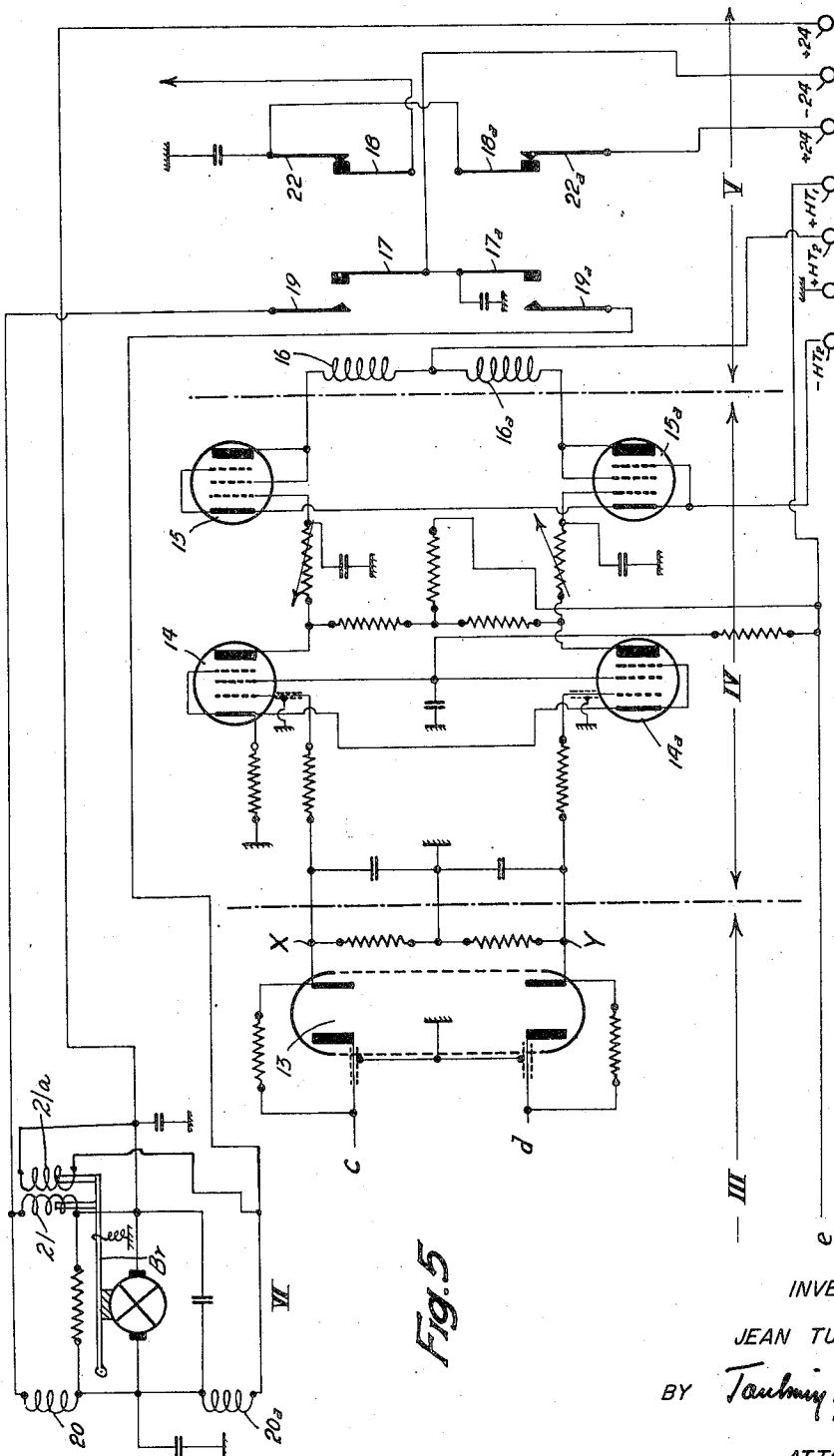


Fig. 5

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TELECONTROL DEVICE

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8 Claims. (Cl. 318—16)

This invention relates to a telecontrol device so designed as to permit, by the emission of control signals of different frequencies, of bringing a moving component (for instance the moving contact of a switch) placed at a distance from the point of emission of said signals, into selected positions, each of which corresponds to a determined frequency of a control signal.

The new device is characterized by the fact that, as the sender is arranged so as to emit signals each of which is characterized by a well-determined frequency modulation, the receiver comprises a frequency detector which, through a switch successively making circuits with differently tuned frequencies, the number of which corresponds to that of the positions to be given to the moving telecontrolled component, can be set on each of the various frequencies produced, and controls the switching-on and switching-off of an electric motor positively connected to the brush of the switch associated with the frequency detector, on the one hand, and to the said moving component, on the other hand, the arrangement being such that for each signal emitted at a given frequency, the moving components of the receiver (moving brush of the switch of the frequency detector and moving telecontrolled component coupled with said brush), tend to come into a position for which no control voltage occurs at the output terminals of the frequency detector and for which the electric motor is therefore out of action.

In a preferred embodiment of this device, the latter is more particularly characterized by the following features and combinations thereof:

The frequency detector receiving circuits with differently tuned frequencies consist in a fixed coil (preferably the secondary winding of the transformer of the frequency detector) and in a series of condensers which are successively put in circuit by means of the switch;

The electric motor is of the dual rotation type and to this end, it comprises two armature windings each of the supply circuits of which is controlled by a contactor relay which is itself controlled from one of the output terminals of the frequency detector;

A direct current amplifier chain connects each output terminal of the frequency detector to the corresponding contactor relay;

Each of the contactor relays also controls an electromagnetic brake of the motor, the said brake being arranged so that its windings are energized when the motor windings themselves are energized and so that the brake operates when its windings are not excited;

When the moving component to be remote-controlled is the brush of a switch, the circuit of this brush is controlled by either of the two contactor relays associated with the frequency detector, so as to be cut off during the displacements of the said brush;

When the signals are transmitted by radio-electric channel, the sender comprises as many generators of the control frequencies for modulating the said sender as there are positions on which the telecontrolled component

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is to be set, it being possible to put each of these generators in circuit by a control contactor such as a switch;

In front of the frequency detector, the receiver comprises a symmetrical amplitude limiter to which the signals corresponding to the control frequencies are applied after detection.

Other features and characteristics of the invention appear in the following description which relates to a specimen embodiment of a telecontrol device, the said example being given merely by way of illustration and said embodiment being diagrammatically shown in the accompanying drawing in which:

Fig. 1 is a simplified diagram of the radio telecontrol sender;

Fig. 2 is a diagram of the outline of a telecontrol receiver device;

Figs. 3, 4 and 5 show the detailed wiring diagram of the receiving device assembly of Fig. 2 (points *a* and *b* on the left side of Fig. 4 correspond to points *a* and *b* on the right side of Fig. 3 and points *c*, *d*, and *e*, on the left side of Fig. 5 correspond to points *c*, *d* and *e* on the right side of Fig. 4).

In Fig. 1, A is a radio sender, the wave of which is modulated from the generators B1, B2, B3, B4, B5, B6 and B7, which can individually be put in circuit by a switch C which constitutes the remote control component.

In Fig. 2, I is a frequency change receiver comprising a high frequency amplifier D, a frequency converter stage E, a medium frequency amplifier F, a detector stage G and a low frequency amplifier H with symmetrical output anode circuit.

Following the radio receiver properly so-called I (at the outlet of which signals with the frequencies produced by the generators B are collected) is a symmetrical amplitude limiter II, the purpose of which is to limit the amplitude of the signals to a predetermined value independent of the input amplitude.

The symmetrical amplitude limiter II energizes a frequency detector III of a standard type but the input transformer secondary winding of which can be successively connected in parallel with seven condensers J, through a switch K, so as to permit of tune the detector to each of the control frequencies, and so that, once it has been tuned to the frequency which is then being emitted, no voltage is produced at its output terminals.

The frequency detector output terminals are connected to a direct current amplifier IV comprising two parallel chains of transmission IVa and IVb which controls a contactor unit V intended to control the switching-on and switching-off of the motor VI, the direction of rotation of this motor, and the motor brake.

Through a speed reducer VII, the motor VI simultaneously actuates the brush *k* of the switch K and the moving component to be telecontrolled, the said component being here represented in the form of the brush *l* of a switch L.

The circuit of the brush *l* can be controlled by the contactor V so that this circuit is closed only when the motor VI is disconnected.

The various parts briefly described above and shown in Fig. 2 can be made in many different ways. The particular embodiment shown in Figs. 3 to 6 is given merely by way of illustration and has been designed for the control of a teleguided missile vehicle, etc. provided with a source of 24 volt low voltage direct current and with at least one source of high voltage direct current supplying the various anode voltages required by the thermionic tubes (for instance 133 v., 190 v., 270 v.).

The tuned circuit 1 connected to the receiving aerial 1a is coupled to a high frequency amplifier tube 2 which here is a pentode (type UF 41, for instance). This pentode is coupled, through a high frequency adjustable

transformer 3, to an oscillating-mixing tube 4 which produces a frequency change. This tube 4 here is a triode-hexode (type UCH 41, for instance) which attacks, by means of a medium frequency adjustable transformer 5, a medium frequency amplifier tube 6, here a pentode (type EF 41, for instance). Through the medium frequency adjustable transformer 7, the pentode 6 attacks a low frequency pre-amplifying detector stage comprising a double diode-triode 8 in the anode circuit of which is collected a current detected at the modulated frequency of the sender.

The anode circuit of the tube 8 comprises a coil 9 with medium tapping, the two ends of which (where opposite voltages are produced) control a symmetrical amplitude limiter comprising a double triode tube 10 (type ECC 40 for instance), the anodes of which are connected to the two end-terminals of the medium-tapping primary winding of the transformer 11 of the frequency detector III, the medium tapping of the secondary winding of this transformer being connected, through a condenser 12, to one of the two above-mentioned primary winding ends.

The two secondary winding ends of the transformer 11 are connected to the anodes of a double diode 13 (type EBC 41, for instance). The two above-mentioned secondary winding ends are also coupled with a series of condensers J1, J2, J3, J4, J5, J6, J7 which can successively be put in circuit (in parallel, on the said secondary winding) by means of the hunting quadrant *k* of the switch K. The capacities of the various above-mentioned condensers are such that, according to which ones of them are put in circuit, the frequency detector is tuned on one or the other control frequency produced by the modulators B1 to B7 of the transmitter (Fig. 1). It is well known that such a frequency detector supplies no voltage to the output terminals X and Y of the tube 13 when it resonates to the frequency which is applied to it. On the contrary, as soon as the applied frequency is different from that on which it is tuned, a negative voltage (in relation to earth) will be produced, either at X or at Y, according to whether the applied frequency is greater or lesser than its own frequency.

Each of the output terminals X and Y of the frequency detector III is connected to a direct current amplifier chain IV. Each chain comprises a pre-amplifying pentode 14 or 14a (type EF 41 for instance) and a power pentode 15 or 15a (type EL 42, for instance).

In the foregoing, the circuits (and the components such as condensers, resistances, coils, rheostats, potentiometers, etc. associated with these circuits) of the receiver have not been described in detail, as these circuits are more within the scope of radio technique and are well-known of technicians who will find the details thereof in Figures 3 to 5.

The anode circuit of each of the power tubes 15 and 15a comprises an energizing winding 16 (and 16a) of the contactor relay V comprising two series of moving contacts 17, 18, and 17a, 18a. The moving contacts 17 and 17a, connected to the power source of the motor VI, operate respectively in conjunction with the fixed working contacts 19 and 19a connected to the armature windings 20 and 20a of the said motor and to the windings 21 and 21a controlling the brake release of the said motor, the rotor of which (see Fig. 2) is connected, through a speed reducer VII, to the brush *k* of the switch K (associated with the frequency detector) and to the brush *l* of the telecontrolled switch L. The moving contacts 18 and 18a are series-connected with the resting contacts 22 and 22a in the circuit of the brush *l*.

The above-described device operates in the following manner, it being understood that when it is stopped the motor is locked by an electromagnetic brake Br which is released only when one of the brake-release windings 21 or 21a is energized.

At the emission, when the brush of the telecontrol

switch C is brought onto one of the contact studs, the wave initiated by the sender A is modulated to the frequency of either of the generators B1 to B7 which is connected to the circuit by the above-mentioned switch.

At the receiver, a signal is found, after detection, which has the same frequency as that initiated by the generator put in circuit at the emission.

If, in the frequency detector, the brush *k* is in a position such that the value of the condensers J put in circuit causes the said detector to resonate to the frequency in question, no voltage will be produced at the detector output and the direct current amplifiers following it will not operate, so that the motor VI will be disconnected from the circuit.

The telecontrolled switch L, positively connected to the switch K, will be in a well-defined position which is precisely that which was to be given it by the control switch C of the sender.

If the brush *k* is not in the above-mentioned position, the detector is not tuned to the said frequency: a negative voltage will occur at either of its output terminals (according to whether it resonates to a greater or lesser frequency than the frequency of the signal received). At this point, one of the amplifier chains will come into action to control the group of contactors associated with it, and the motor VI will rotate in the proper direction to actuate the switch K until the frequency detector is tuned to the frequency of the signal; during this operation, the switch L is also actuated. As soon as the frequency detector is tuned, it supplies no more output voltage and the motor, which is no longer energized, stops under the action of the brake Br which comes into action as soon as the brake release windings 21, 21a are de-energized.

It will be noted that during the hunting motions of the switch K, the circuit of the switch L is cut off, which eliminates any control disturbance resulting from the said switch during the exploration of its contact studs.

For the automatic sensitivity control of the receiver, the latter can, as in receivers of known types, comprise an automatic gain-control device at which the points Z end (Figs. 3 and 4).

It goes without saying that the specimen embodiment of the telecontrol device described above and shown in the accompanying drawing is given merely by way of illustration and is in no way restrictive and that any detail changes can be made therein. For instance, the radio control could be a cable control.

What I claim is:

1. Telecontrol device comprising a transmitter which can emit control signals with different frequencies and a receiver having at least one controlled moving component which can be put in as many selected positions as the transmitter is capable of emitting different frequencies, each position of the said moving component corresponding to one of the said frequencies, the said receiver comprising: means for receiving control signals; a frequency detector with tuning circuit connected to the said receiving means and comprising several tuning components and a switch to switch any of the said tuning components in the said tuning circuit; a contactor relay connected to the frequency detector to be controlled by the said detector; a source of electric current; an electric motor of the dual rotation type connectable to the said source of current and controlled by the said contactor relay; transmission means to connect, operatively, the motor to the frequency detector switch and to the receiver moving component.

2. Telecontrol device according to claim 1, in which the said frequency detector comprises an input transformer and in which the tuning components are fixed condensers of different capacities which can be coupled to the secondary winding of the said transformer, by means of the switch.

3. Telecontrol device according to claim 1, in which

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the motor comprises two armature windings while the contactor relay comprises two contactors, each connected to one of the said armature windings.

4. Telecontrol device according to claim 1, in which at least one direct current amplifier is switched in between the frequency detector and the contactor relay.

5. Telecontrol device according to claim 1, further comprising an electromagnetic brake for the motor, this brake being arranged so that it exerts its braking action only when it is not energized and which is connected in parallel to the circuit of the motor.

6. Telecontrol device according to claim 1, in which the controlled moving component is the brush of a tele-controlled switch, further comprising a switching means placed in the circuit of the said switch and controlled by the contactor relay, so that the circuit of the said switch is open when the motor is energized and when the brush is moving.

7. Telecontrol device according to claim 1, in which the transmitter comprises a radio wave sender, frequency generators and contacting means to connect each fre-

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quency generator to the sender, in order to modulate the waves it emits, while the receiving means of the receiver consist in a radio receiver tuned to the waves emitted by the sender.

8. Telecontrol device according to claim 7, in which the radio receiver comprises a high frequency amplifier, a frequency changer connected to the said high frequency amplifier, a medium frequency amplifier connected to the frequency changer, a detector connected to the medium frequency amplifier, and a low frequency amplifier which is connected to the detector and which comprises at least one push-pull output stage.

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