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REMOTE CONTROL SYTEM

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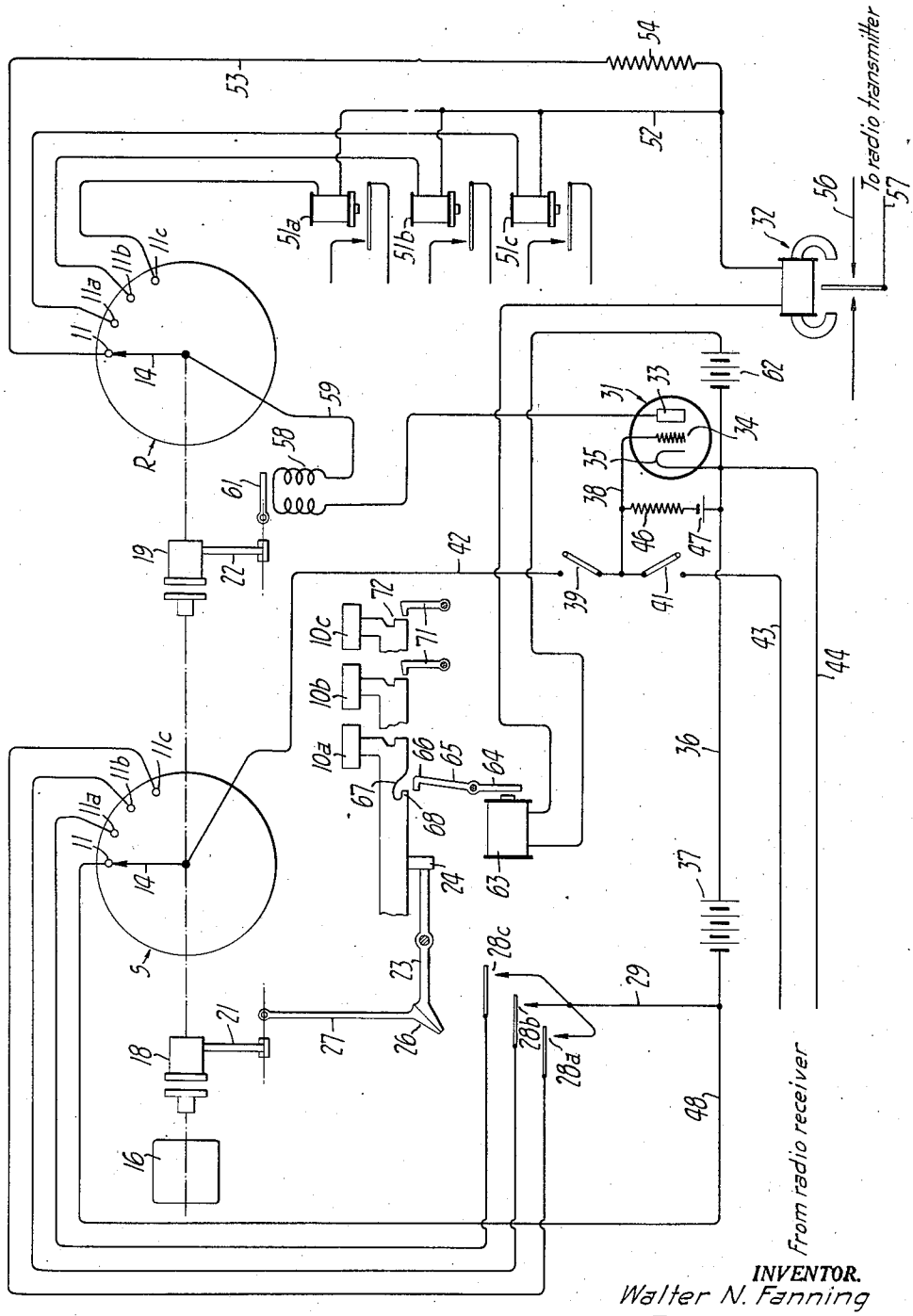

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REMOTE CONTROL SYSTEM

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1 Claim. (Cl. 178—23)

This invention relates generally to remote control systems of the type in which electrical impulses transmitted from one station are employed to carry out predetermined operations or functions at a remote receiving station. Such systems can be used for various purposes, including the operation of printers for transmission of messages, or the remote automatic control of devices such as aircraft.

It is a primary object of the invention to provide a system of the above character which can selectively effect a relatively large number of operations at a remote point, with a high degree of reliability and at relatively high speed.

A further object of the invention is to generally improve upon remote control systems of the type making use of rotary distributors. In this connection the present invention makes use of a time delay action in conjunction with the functioning circuits at the receiving end, thus making possible reliable operation of each functioning circuits, while at the same time the rotary distributing means are operated at high speed.

Further objects of the invention will appear from the following description in which the preferred embodiment of the invention has been set forth in detail in conjunction with the accompanying drawing.

As previously specified the present invention makes use of rotary distributing means, located at transmitting and receiving stations. The rotary distributing means can consist of a single multiple contact rotary distributor at the transmitting station, and a device of like construction at the receiving station. In order that the transmitting operator may monitor transmitted impulses, I prefer to use two rotary distributors at the transmitting station, whereby selected impulses are clearly indicated to the operator as they are transmitted. Where the system is to make possible two-way transmission and reception of signals, each station is provided with two rotary distributors, one being designated as a sending distributor, and the other as a receiving distributor. The equipment and circuit connections illustrated in the single figure of the drawing represent equipment located at one station, with the presumption that this equipment is to be used in conjunction with the remote station having like equipment. In the drawing the sending distributor has been marked S, and the receiving distributor R. The devices used in conjunction with distributors S preferably include a number of keys or like operating elements whereby the operator may select the function desired at the receiving end. Assuming that the system is to be used for the transmission of letters of the alphabet in the operation of a printer, a number of keys 10*a*, 10*b* and 10*c* are provided, similar to a typewriter keyboard. As will be presently explained, the receiving distributor R connects with a number of relays, having delayed action, and which in turn control function circuits such as can be employed for the operation of a printer.

The construction of the distributors S and R need not be described in detail. Each distributor is provided with a number of spaced contacts, including a starting contact 11, and additional contacts 11*a*, 11*b* and 11*c*. The number of contacts employed may vary in accordance with the number of functions desired at the receiving end. For operating printers, about thirty contacts will suffice, in addition to the starting contact 11. The contacts of each distributor are engaged by the rotary contact arms 14, and these arms are driven by a common electric motor 16.

The distributors S and R should be driven at a rate in synchronism with driving of the corresponding distributors at the remote station. This can be accomplished by having the motors adapted for absolute synchronous operation at constant speed. Various synchronizing means for this purpose are known to those skilled in the art. The arrangement illustrated in the drawing makes use of start and stop operations, that is the distributors rotate one revolution from a starting position after which they are disconnected from the motor. With such an arrangement the motors themselves need not be precisely synchronized, but may be merely of approximately the same speed.

In the drawing a one-revolution clutch 18 has been shown in the drive connection between motor 16 and the distributor S. Between distributors S and R there is another one-revolution clutch 19. Clutch 18 is released by a pivoted trip lever 21, and clutch 19 by a similar lever 22. The operation of these one-revolution clutches and their associated trip levers, is identical in both instances. Referring for example to clutch 18, when lever 21 is swung to dis-engaged position the clutch engages so that motor 16 drives the arm 14 of distributor S. When the arm has made one revolution cam means in conjunction with the clutch 18 again engages lever 21, whereby the clutch is automatically dis-engaged. In the operation to be presently described both clutches 18 and 19 are engaged and dis-engaged

automatically and substantially simultaneously.

The trip lever 21 is actuated by operation of any one of the keys 10a, 10b or 10c. Thus for this purpose the representative mechanism illustrated includes a fulcrumed lever 23, one end of which carries a bar 24 which in turn is adapted to be engaged and depressed by operation of any one of the keys. The other end of lever 23 has a cam arrangement 26, for establishing operative connections with lever arm 27. Lever arm 27 is operatively connected to the trip lever 21, so that when lever 23 is rocked in a clockwise direction as viewed in the drawing, lever 27 is likewise rocked in a clockwise direction, to move trip lever 21 to tripped position.

Each of the keys are also adapted to individually actuate electrical contacts 28a, 28b and 28c. In other words there is a pair of contacts for each key, and as a key is depressed its corresponding contact is automatically closed. One side of each of the contacts 28a, 28b and 28c, is connected by an individual conductor to a corresponding contact on the distributor S. The other side of each of the contacts is connected to a common conductor 29, leading to one side of a circuit such as will be presently explained.

The sending circuit connected with distributor S preferably includes at least one electron relay 31, whereby signal impulses are amplified for operating the transmitting relay 32. The same electron relay is also utilized for repeating and amplifying received impulses, that is, impulses received from a remote station.

With the arrangement illustrated the electron relay 31 includes the usual plate 33, grid or control element 34, and cathode 35. The cathode 35 is connected to a conductor 36, which in turn connects to conductor 29 and the biasing battery 37. The grid 34 connects to a conductor 38, which in turn connects with the sending and receiving switches 39 and 41. Switch 39 when closed connects conductor 38 with a conductor 42, which in turn leads to the contact arm 14 of sending distributor S. Receiving switch 41 when closed connects conductor 38 with the conductor 43, which is one of the lines 43, 44, by means of which received signals are impressed upon the apparatus. The other receiving line 44 connects to the cathode 35. Connected across the grid and cathode there is also a grid resistor 46, and a negative C-battery bias 47. In addition to the conductor 29 which leads from battery 37 to switches 28a, 28b and 28c, there is another conductor 48 leading from battery 37 directly to the starting contact 11 of distributor S.

It will be apparent from the foregoing that when switch 41 is closed and switch 39 open, received electrical impulses applied by conductors 43 and 44, are impressed directly upon the grid 34, whereby the plate circuit or output of relay 31, to be presently described, receives an amplified impulse.

When switch 41 is open and switch 39 closed, positive potentials are impressed upon the grid 34 from the battery 37, depending upon the manner in which the transmitting equipment is operated. In this connection it may be noted that negative C-battery 47 is preferably adjusted so that the plate current of relay 31 is normally negligible. Battery 37 is connected in such a manner that when applied to grid 34, the grid is made more positive to provide an amplified current flow in the relay output.

Referring now to the circuit connections to the receiving distributor R, I have shown a plurality of magnetic relays 51a, 51b and 51c, and these relays are of the type which will afford quick closing when energized, with delayed opening. One side of each of these relays is connected by an individual conductor to corresponding contacts 11a, 11b and 11c. The other sides of the relays are connected to a common conductor 52, which leads to one terminal of the transmitter relay 32. The starting contact 11 is connected by conductor 53 to the same side of relay 32, through the resistance 54. The contacts of relay 32 are shown controlling the transmission lines 56 and 57.

The plate 33 of electron relay 31 connects to one side of the magnetic device 58, the other side of which connects by conductor 59 with the contact arm 14 of distributor R. The armature 61 of device 58, is mechanically connected to operate the trip lever 22. Thus when the windings of device 58 are energized trip lever 22 is moved to dis-engaged position.

The source of B-battery potential for the electron relay 31 is represented by battery 62. One side of this battery connects to cathode 35, and the other side connects to the transmitting relay 32, in series with the electromagnet 63. The magnet 63 operates an armature 64, which is connected to a lever 65 and latch bar 66. Each of the keys of the transmitting apparatus is provided with a recess 67 and a shoulder or projection 68, which automatically engage beneath the latch bar 66, when a particular key is pressed. Such latching engagement retains a key in depressed position, after it is operated, until magnet 63 is energized. In connection with each of the keys it is desirable to have means whereby a key may be manually locked in depressed position. Such means can consist of one or more latches 71, adapted to be manually engaged with the key projections 72.

The system as described can be used for either line transmission of signals, or radio transmission and reception. If radio transmission and reception is used, the lines 43 and 44 connect to the output of a suitable radio receiver. Lines 56 and 57 connect to a radio transmitter, whereby the operation of the transmitting relay 32 properly modulates or keys the radio transmitter, to produce impulses of the duration and type desired. The radio transmitter and receiver at a given station, may operate upon different frequencies.

Operation of the system described above can now be explained as follows: The motor 16 is placed in operation, and if it is desired to transmit impulses, the sending switch 39 is closed, while switch 41 remains open. At that time the contact arm for distributor S is on a dead or blank contact immediately preceding contact 11 while the contact arm for distributor R is on contact 11. When one of the sending keys is depressed, clutch 18 is closed and contact arm 14 of distributor S moves to contact 11. This causes the potential of battery 37 to be applied to the grid 34 of the electron relay 31, through a circuit including conductor 48, starting contact 11, distributor arm 14, conductor 42, switch 39 and conductor 38. As a result there is an amplified flow of current in the plate circuit of relay 31, and this plate current flow occurs through the magnetic windings 58, conductor 59, distributor arm 14 of distributor R, starting contact 11, conductor 53, resistor 54, the windings of

transmitter relay 32, and magnet 63, back to the other side of battery 62. One revolution clutch 19 is thus released and this release immediately results in driving of the arm 14 for distributor S, together with driving of the distributor R, since at that time the clutch 19 is also engaged. When the contact arm 14 of distributor S reaches the contact corresponding to the key depressed, as for example contact 11b, another impulse is applied to the grid of electron relay 31, because at that time switch 28b is closed, thus causing a circuit to be established through this switch, contact 11b, and the contact arm. The impulse as amplified by the electron relay 31 is applied to transmitting relay 32 and is also applied to relay 51b, because the contact arm of distributor R is also engaging its contact 11b. After the distributors have rotated one revolution they are stopped automatically by disengagement of clutches 18, 19. At the receiving station the impulses are received on lines 43 and 44, and switch 41 is closed while switch 39 is open. Received impulses are impressed directly upon the grid of electron relay 31 whereby amplified impulses are applied to the parts connected with the distributor R. At the receiving station receipt of a starting impulse starts the distributors in operation to receive a selective impulse.

The delayed opening of relays 51a, 51b and 51c can be over a time period that is slightly less than that required for one revolution of the distributors. Where it is desired to continue a function for an indefinite period of time, each of the relays 51a, 51b and 51c can have its opening delayed over a period of time slightly greater than that required for one revolution of the distributors. With properly synchronized motors a sending key can be locked down, thus causing the distributors to run continuously and causing continuous repetition of a signal. Should the corresponding receiving relay be such as to have a time period of delay greater than the time required for one revolution of the distributors, the corresponding relay circuit will be continuously closed. Such operation is desirable for the remote control of devices such as aircraft.

Irrespective of the precise time period afforded for the relays 51a, 51b and 51c, the use of a time delay makes for positive operation of the function circuits controlled by these relays, thus making it possible to operate the distributors at high speed without sacrificing reliability.

I claim:

In a remote control system of the type in which any one of a number of predetermined operations can be selectively effected by impulses transmitted from one station to the other through a single transmission circuit, normally quiescent rotatable distributing means located at each station, means for effecting synchronous driving rotations of said distributing means when each said operation is to be performed, each said distributing means being provided with angularly spaced contacts whereby different circuits connected to said contacts are closed at intervals spaced as to time within the rotation period of the distributing means, sending keys at the transmitting station for selectively applying impulses to the contacts of the associated rotating distributing means to provide impulses spaced as to time in accordance with the driving of said rotating distributing means, means automatically operative to positively lock the actuated sending key in sending position until the second impulse is transmitted, and means operative to utilize the second impulse to release the key-locking means.

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