

June 7, 1949.

O. C. KEIL, JR., ET AL

2,472,536

TUNING INDICATOR SYSTEM

Filed Nov. 25, 1947

FIG. 1.

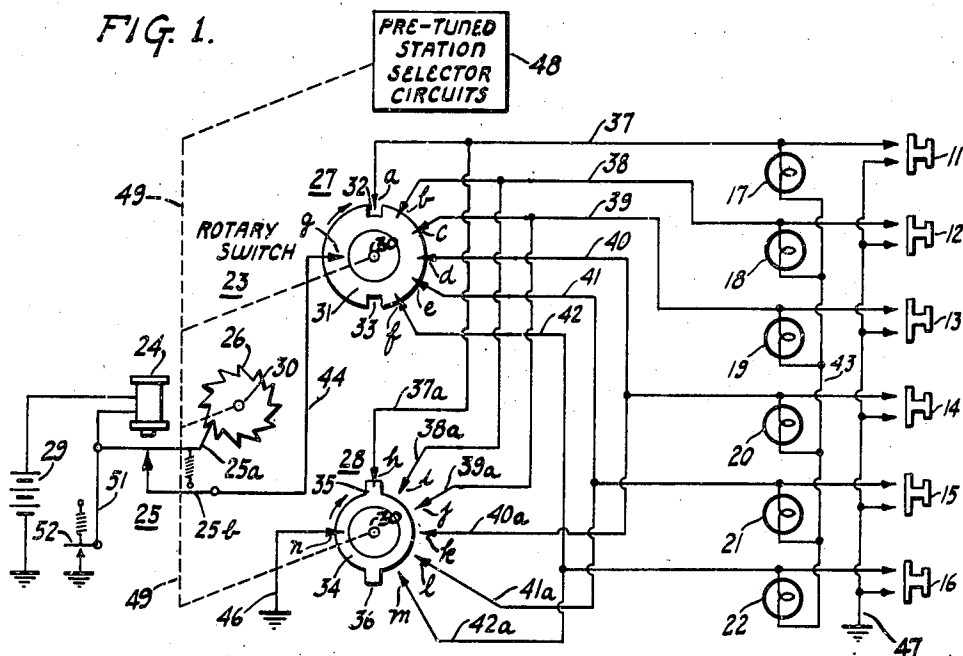


FIG. 2.

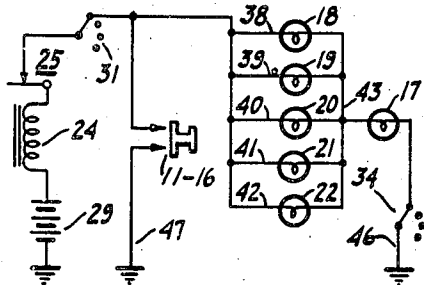


FIG. 3.

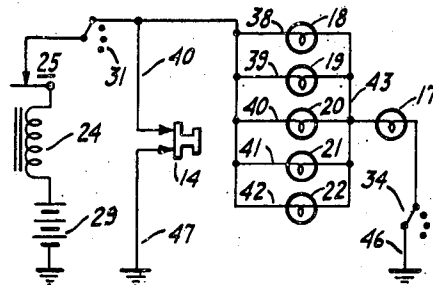
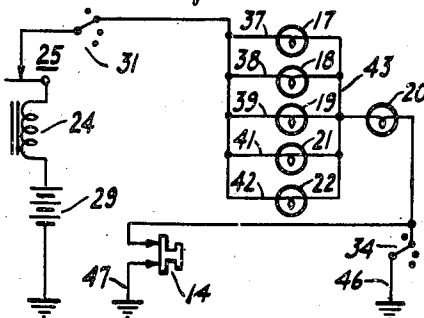


FIG. 4.



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TUNING INDICATOR SYSTEM

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4 Claims. (Cl. 177—353)

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The invention herein described and claimed relates to an improved annunciator system adapted for use in selective multi-circuit communication and signaling apparatus. More particularly, the invention relates to an improved visual-indicator system employing individual indicating means, preferably lamps, for identifying the circuit or station selected.

The present invention may be employed to excellent advantage in pushbutton-operated radio receivers, particularly radio receivers which use a non-latching type of pushbutton mechanism, either for station or wave-band selection. Non-latching pushbutton mechanisms have been found to be particularly useful in automobile radio receivers where it is desired to provide tuning means controlled both by hand-operated pushbutton station-selector mechanism and by a foot-operated station-selector switch.

It will be understood that in a non-latching type of selector mechanism, a pushbutton, when depressed, returns to released position as soon as the pressure of the operator's finger is removed; and thereafter, all pushbuttons occupy similar released positions. It is hence impossible to ascertain, from merely looking at the pushbuttons, the station to which the receiver is tuned, and it is necessary to provide some means of identifying the station. That is the function of the announcement or visual-indicator system whose improved circuit arrangement is the subject matter of the present invention.

The invention may be used to excellent advantage in radio receivers employing the non-latching type of pushbutton mechanism described and claimed in the copending application of Gilbert J. Kennedy, Serial No. 754,013, filed June 11, 1947, and assigned to the assignee of the present invention.

It is an object then of this invention to provide an improved annunciator or visual-indicator system for selective multi-circuit communication and signaling apparatus.

It is another object of this invention to provide an improved indicating lamp system for use in pushbutton-operated radio receivers.

It is a more specific object of this invention to provide, in a radio receiver having a non-latching type of pushbutton selector mechanism, improved means for identifying, by the lighting of an individual indicator lamp, the station and/or wave band to which the receiver is tuned.

In a preferred embodiment of the present invention employed in a radio receiver having non-latching pushbutton station selectors, when a

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selected pushbutton is depressed by the operator, all indicator lamps are immediately extinguished and all remain in extinguished condition until a rotary switch, through whose agency the station selection is accomplished, has completed its step-by-step rotation, at which time the individual indicator lamp, associated with the selected station, is automatically illuminated. The undesirable flashing of lamps, which would otherwise occur as the rotary switch passed through various station positions during the course of its rotation, is eliminated by the means of the present invention.

These and other objects, features and advantages of the present invention, and the manner in which the objects are attained, will become clear from a consideration of the following description and of the accompanying drawing, wherein:

Figure 1 is a schematic representation of visual indicator means embodying a preferred form of the present invention; and

Figures 2, 3, and 4 are schematic representations which will be helpful in describing and understanding the operation of the circuit of Figure 1.

Referring now to Figure 1, there is shown a portion of a radio receiver including six station-selector pushbuttons 11—16, individual indicator lamps 17—22 associated with the six pushbuttons, a rotary switch 23, a source of direct-current voltage 29, and conductors 37—42 and 37a—42a for effecting various circuit connections to be described.

In Figure 1, rotary switch 23 is comprised of a solenoid 24, a combination switch and pawl 25, a ratchet 26, a wafer-section 27, and a wafer-section 28. The switch contacts of switch-pawl 25 are normally closed, as shown in the drawing, but when solenoid 24 is actuated, as will be described, the movable switch-arm 25a is pulled upwardly, i. e., toward the solenoid, and the switch contacts are opened. When so moved, switch-arm 25a functions as a pawl to rotate ratchet 26 a preselected amount in a clockwise direction.

Rotary switches capable of accomplishing the required functions are known in the art, and it is to be understood that the particular rotary-switch structure, shown schematically in Figure 1 and described above, is merely an example of readily understandable means for effecting the desired results. In practice, the rotary switch may, for example, have a cam-operated interrupter switch instead of the switch mechanism illustrated.

Wafer-section 27 of rotary switch 23 includes a plurality of wiper contacts *a—g* and a disc-like rotor 31 having recessed portions or notches 32 and 33, spaced 180° apart. Wafer-section 28 includes a plurality of wiper-contacts *h—n* and a disc-like rotor 34 having extending portions or contacts 35 and 36 which are in radial alignment with notches 32 and 33 of rotor 31.

Ratchet 26, rotor 31, and rotor 34 are splined or keyed to a common shaft 30, as is indicated in Figure 1 by the dotted-line representation 49, and when ratchet 26 is rotatably moved, rotors 31 and 34 rotate in corresponding manner.

In Figure 1, wiper-contacts *a—f* terminate conductors 37—42 from lamps 17—22 at rotor 31; and wiper-contact *g* terminates conductor 44 from switch 25. Wiper-contacts *h—m* terminate conductors 37*a*—42*a* from lamps 17—22 at rotor 34; and wiper-contact *n* terminates ground connection 46.

In the particular arrangement illustrated in Figure 1, there are three equally-spaced wiper-contacts per switch quadrant. Therefore, the switch mechanism, comprising solenoid 24, pawl-arm 25*a* and ratchet 26, is so constructed as to move rotors 31 and 34 through 30° sectors for each actuation of the rotary switch.

A plurality of pre-tuned station-selector circuits, indicated generally in Figure 1 by block 48, are operatively associated with rotary switch 23, being mechanically connected to shaft 30 by known means, indicated by the dotted-line representation 49. Upon each actuation of the solenoid, the station selector device 48 is switched from one position, in which a predetermined station is received, to another position, in which a different station is received. Such pre-tuned station-selecting circuits are well known in the art and it is unnecessary to describe device 48 in greater detail.

The operation of the circuit of Figure 1 will now be described. It is believed that an understanding of the invention will be facilitated by describing, in sequence, a series of assumed operating conditions.

Assume first that, as the description starts, the receiver is in operation and that, as a result of pushbutton 11 having been previously depressed by the operator, the receiver is tuned to the station associated therewith. All pushbuttons are now in released position, since, as described above, the pushbutton mechanism is of the non-latching type and a button remains depressed only so long as the finger of the operator is in engagement therewith.

Indicator lamp 17, associated with pushbutton 11, is illuminated, but all other indicator lamps are extinguished. The circuit components and connections which effect this condition may be reduced to the circuit shown schematically in Figure 2. By referring to Figures 1 and 2 it will be observed that a circuit is completed from the grounded terminal of voltage source 29 through lamp 17 to ground by way of the following circuit components: voltage source 29, solenoid 24, the normally closed switch-contacts of switch 25, conductor 44, wiper-contact *g*, rotor 31, wiper-contacts *b—f*, conductors 38—42 in parallel, lamps 18—22 in parallel, conductor 43, lamp 17, conductor 37, conductor 37*a*, wiper-contact *h*, contact 35, rotor 34, wiper-contact *n*, and ground connection 46. Observe that the current, which passes, by way of the above-described circuit, through lamp 17 to effect illumination thereof,

divides substantially equally among the other indicator lamps 18—22, these five lamps being in parallel with each other, as just described. Each of these five lamps therefore receives but one-fifth of the total current.

In accordance with the present invention, the circuit constants are so chosen that, while the total current in the above or similar circuit, when passed through a series-connected indicator lamp, is adequate to effect illumination, i. e., incandescence, thereof, one-fifth of the total current is not sufficient to effect illumination. In addition, the circuit constants are so chosen that the total current through the above-described or similar circuit, while sufficient to illuminate an indicator lamp, is insufficient to actuate solenoid 24. Hence, in the example being described, with all pushbuttons in released positions, indicator lamp 17 remains illuminated as a result of a prior actuation of pushbutton 11, all other lamps remain extinguished, and the receiver remains tuned to the station associated with pushbutton 11 and identified by lamp 17.

Assume now that the operator presses, say pushbutton 14, with the intention of tuning in the station associated therewith. As soon as pushbutton 14 is depressed, lamp 17 is extinguished, for the current, which previously passed through the series-connected lamp 17 and through the bank of parallel-connected lamps 18—22, is now passed directly to ground 47, by way of the closed contacts of depressed pushbutton 14. The circuit which exists at the instant pushbutton 14 is depressed is shown in reduced form in Figure 3 and comprises the following: voltage source 29, solenoid 24, the closed contacts of switch 25, conductor 44, wiper-contact *g*, rotor 31, and, forming a low resistance bypass across the entire indicating-lamp circuit, wiper-contact *d*, conductor 40, the closed contacts of pushbutton 14, and the ground connection 47. When the indicator lamps are thus bypassed, the resistance of the battery-through-solenoid-to-ground circuit is decreased, the magnitude of the current through solenoid 24 is increased, and the increased current is adequate to actuate the solenoid.

When solenoid 24 is thus actuated, the movable pawl-arm 25*a* is drawn upwardly, i. e., toward the solenoid, and ratchet 26 is moved rotatably in a clockwise direction. When pawl-arm 25*a* moves upwardly, the contacts of switch 25 open, but it will be understood that the established magnetic field of solenoid 24 is effective to complete the upward stroke of the pawl-arm, thus moving ratchet 26 through 30° of rotation.

When solenoid 24 is actuated and ratchet 26 is rotated, by pawl-arm 25*a*, as just described, rotors 31 and 34, being splined to common shaft 30, move rotatably clockwise, as is indicated by the arrows in Figure 1. Connection is made substantially immediately between rotor 31 and wiper-contact *a*, and, concurrently connection is broken at contact 35 between rotor 34 and wiper-contact *h*. Pawl-arm 25*a* completes its stroke, as above described, and rotors 31 and 34 move through 30° of rotation, thus bringing notch 32 and contact 35 to the positions occupied by wiper-contacts *b* and *i*, respectively. At or about this time, pawl-arm 25*a* is released by solenoid 24 and returns to the de-energized position, thereby again closing the switch contacts of switch 25. Lamp 18 is now connected in a manner similar to that of lamp 17 in Figure 3, i. e., lamp 18 now occupies the position between the bank of

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parallel-connected lamps and ground 46 shown in Figure 2 to be occupied by lamp 17. The circuit now obtaining may be traced in Figure 1 as follows: voltage source 29, solenoid 24, the again-closed contacts of switch 25, conductor 44, wiper-contact *g*, rotor 31, wiper-contacts *a*, *c*—*f*, conductors 37, 39—42 in parallel, lamps 17, 19—22 in parallel, conductor 43, lamp 18, conductors 38, 38*a*, wiper-contact *i*, contact 35, rotor 34 and ground connection 46. When so connected, lamp 18 does not become illuminated, for, as previously described with respect to lamp 17, the lamp circuit bypassed by the low-resistance path which extends from rotor 31 to ground 47 by way of the closed contacts of the depressed pushbutton, i. e., pushbutton 14. The current through solenoid 24 therefore remains substantially the same as that which obtained when pushbutton 14 was first depressed. Solenoid 24 therefore remains energized, pawl-arm 25*a* is again drawn upwardly, ratchet 26 is again moved through 30° of rotation, and rotors 31 and 34 are moved in like manner.

The action described above continues, in well known step-by-step fashion, until the low-resistance path, through solenoid 24 to ground 47, by way of the still-closed contacts of pushbutton 14, is broken at rotor 31 by the arrival of notch 32 at the position occupied by wiper-contact *d* associated with conductor 40 and depressed pushbutton 14.

After the connection between rotor 31 and conductor 40 is broken at wiper-contact *d*, as above described, a path obtains from voltage source 29 through solenoid 24 to ground which may be traced as follows: battery 29, solenoid 24, the again-closed contacts of switch 25, conductor 44, wiper-contact *g*, rotor 31, wiper-contacts *a*—*c*, *e*, *f*, conductors 37—39, 41, 42 in parallel, lamps 17—19, 21, 22 in parallel, conductor 43, lamp 20, and then, assuming pushbutton 14 to be still depressed, to ground by way of parallel paths, one comprising the closed contacts of pushbutton 14 and ground connection 47, and the other path comprising conductor 40*a*, wiper-contact *k*, contact 35, rotor 34 and ground connection 46. The reduced circuit is shown schematically in Figure 4.

It will be observed that in the circuit of Figure 4, just described, lamp 20 is in series with a parallel network comprised of the remaining five lamps and associated conductors. It is apparent that the resistance of the circuit of Figure 4 is increased over that of the circuit of Figure 3, for in Figure 4 the bank of parallel-connected lamps and the single series-connected lamp 20 are in series with solenoid 24 whereas in Figure 3 the lamps are shunted by a path of negligible resistance. The current through solenoid 24 is hence decreased with respect to that which obtained in the circuit of Figure 3; and this decreased current is insufficient to actuate solenoid 24.

It will be seen from the above that the step-by-step action of rotary switch 23 ceases when the low-resistance shunt path through the closed contacts of the depressed push-button is broken by the arrival of notch 32 at the wiper-contact associated with the depressed pushbutton. The current in the circuit then obtaining, i. e. the current in the circuit shown in Figure 4, while insufficient to actuate solenoid 24, is, as previously described, adequate to illuminate the series-connected lamp 20 associated with the depressed pushbutton 14. However, each of the other lamps, being in shunt with each other, draws but one-

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fifth of the total current, which is insufficient to effect incandescence.

The receiver has now been tuned, through the agency of the pre-tuned station-selector circuits, to the station identified with pushbutton 14; and the operator is informed that this has been accomplished by the lighting of lamp 20. In practice, the action is fast, and the selected station is obtained without appreciable delay. The operator thereupon releases the depressed pushbutton, i. e., pushbutton 20 in the present example, and the circuit of Figure 4 becomes similar to that shown in Figure 2, with the exception of course that lamp 20 occupies the position occupied in Figure 2 by lamp 17.

In prior art circuits of which we have knowledge, indicator lamps associated with non-depressed pushbuttons are illuminated as the various wipe-contacts are passed during the homing action of the rotary switch. And, since the pushbuttons and indicator lamps are ordinarily in sequential arrangement, the illumination will appear to run along the dial. This is an undesirable condition which is completely eliminated by the improved circuit of the present invention. For, as described above, all indicator lamps are extinguished as soon as a pushbutton is depressed, that is, as soon as a pushbutton is depressed to tune in a station other than the station to which the receiver is already tuned. Thereafter, no indicator lamps become illuminated until the homing action of the rotary switch is completed, at which time the individual indicator lamp identified with the selected station is lighted.

Attention is invited to the fact that the visual-indicator system of the present invention will correctly identify the station received, even though the station received is not identified with the particular pushbutton depressed. For, in a radio receiver equipped with station-selector mechanism actuated by a rotary switch, it is quite possible, ordinarily, for the operator to tune in a station other than the station identified with the particular depressed pushbutton. For example, assume again that in Figure 1 the receiver is tuned to the station associated with pushbutton 11 and that the operator presses pushbutton 14. Assume further, however, that the operator releases pushbutton 14 after the rotary switch has moved through but two steps, i. e., through 60° instead of 90°. In such case, the station associated with pushbutton 13 will be received instead of the station associated with pushbutton 14. Observe, however, that the visual indicating system of the present invention will correctly identify the station received. For, under the circumstances just assumed, lamp 19 will become illuminated rather than lamp 20. This will be readily apparent from Figure 1 and from the circuit descriptions previously given.

The indicating system of the present invention is readily adapted to use in automobile radio receivers which employ a foot-operated switch as an auxiliary to the hand-operated pushbutton mechanism. In Figure 1, the connection 51 and the normally-open switch 52 is intended to indicate such an auxiliary foot-control circuit. When switch 52 is closed, as by the foot of the operator, solenoid 24 is actuated and ratchet 26 is advanced 30°, thus to tune in the station associated with the particular position to which the rotary switch is now advanced. Upon release of foot pressure, switch 52 opens, and the indicating lamp associated with the station then tuned-in,

is illuminated, as will be readily understood from the description previously given hereinabove. Repeated operation of foot-switch 52 will bring in sequentially the stations associated with the various positions of the rotary switch, and will illuminate sequentially the individual lamps associated with the said stations.

We have described a preferred embodiment of our invention. Various modifications will occur to those skilled in the art.

Having described our invention, we claim:

1. In a radio apparatus, an annunciator system comprising: a source of supply voltage; a sequence switch actuated by a solenoid in response to a current of at least predetermined magnitude; a plurality of selector circuits operatively associated with said rotary switch; a plurality of manually-operated switches operatively associated with said selector circuits through the agency of said sequence switch; a plurality of individual indicator means operatively associated with said sequence switch, each of said indicator means being identified with a different circuit of said selector circuits; means, operative upon closing of a manually-operated switch, for completing a low resistance path, which includes said source of supply voltage and said solenoid but excludes said indicator means, to effect current flow therethrough of at least said predetermined magnitude and to effect actuation of said sequence switch; means, including said sequence switch, for opening said low resistance path, when said sequence switch has effected selection of the selector circuit associated with said closed switch, to effect cessation of actuation of said sequence switch; and means, including said sequence switch, for closing, substantially concurrently with said opening of said low resistance path, a high resistance path which includes, in series, said source of supply voltage, said solenoid, the individual indicator means identified with said selected selector circuit, and the other of said indicating means, said other indicating means being connected in shunt with each other, the resistance of said high resistance path being such that the current through said solenoid is smaller than said predetermined magnitude, the current through the series-connected indicating means identified with said selected circuit is sufficient to effect activation thereof, and the current through said other shunt-connected indicating means is insufficient to effect activation thereof.

2. In a radio receiver, an annunciator system comprising: a source of supply voltage; a rotary switch actuated by a solenoid in response to a current of at least predetermined magnitude; a plurality of pre-tuned station-selector circuits operatively associated with said rotary switch; a plurality of pushbutton switches operatively associated with said pre-tuned circuits through the agency of said rotary switch; a plurality of individual indicator lamps operatively associated with said rotary switch, each of said lamps being identified with a different circuit of said pre-tuned station-selector circuits; means, operative upon closing of a pushbutton switch, for completing a low resistance path, which includes said source of supply voltage and said solenoid but excludes said indicator lamps, to effect current flow of at least said predetermined magnitude and to effect actuation of said rotary switch; means, including said rotary switch, for opening said low resistance path, when said rotary switch has effected selection of the pretuned circuit as-

sociated with said closed pushbutton switch, to effect cessation of actuation of said rotary switch; and means, including said rotary switch, for closing, substantially concurrently with said opening of said low resistance path, a high resistance path which includes, in series, said source of supply voltage, said solenoid, the individual lamp identified with said selected pre-tuned circuit, and the other of said lamps, said other lamps being connected in shunt with each other, the resistance of said high resistance path being such that the current through said solenoid is smaller than said predetermined magnitude, the current through the series-connected lamp identified with said selected pre-tuned circuit is sufficient to effect incandescence thereof, and the current through said other shunt-connected lamps is insufficient to effect incandescence thereof.

3. In a radio apparatus; a plurality of keys, each of said keys being identified with a different circuit; a plurality of individual indicator means associated with said keys; selector mechanism, operative in response to the actuation of a key, for effecting automatically selection of a circuit; means, operative upon said actuation of said key, for connecting a low resistance path in shunt with said plurality of indicator means to maintain said indicator means in inactive condition during operation of said selector mechanism; and means, automatically operative when the selection of the circuit has been effected, for opening said shunt path and for connecting the individual indicator means identified with the circuit selected in series with the other of said indicator means, said other indicator means being connected in shunt with each other, thus to activate the indicator means identified with the station selected while maintaining said other indicator means in inactive condition.

4. In a radio receiver; a plurality of pushbuttons, each of said pushbuttons being identified with a different station; individual indicator lamps associated with said pushbuttons; station selector mechanism operative in response to the actuation of a pushbutton for tuning automatically said receiver to a selected station; means operative upon said actuation of said pushbutton for connecting a low resistance path in shunt with said indicator lamps to maintain said indicator lamps extinguished during operation of said selector mechanism; and means automatically operative when the selection of the station has been effected, for opening said shunt path and for connecting the individual indicator lamp identified with the station selected in series with the other of said lamps, said other lamps being connected in shunt with each other, thus to illuminate the indicator lamp identified with the station selected while maintaining said other lamps in extinguished condition.

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REFERENCES CITED

The following references are of record in the file of this patent:

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Number	Name	Date
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Certificate of Correction

Patent No. 2,472,536.

June 7, 1949.

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It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows:

Column 1, line 30, for "annunciation" read *annunciator*; column 2, line 31, for "conductors 37-42" read *conductors 37-44*; column 5, line 13, before the word "bypassed" insert *is*; line 41, after "one" insert *path*; column 6, line 19, for "wipe-contacts" read *wiper contacts*; column 7, line 6, for "sequently" read *sequentially*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 8th day of November, A. D. 1949.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.