

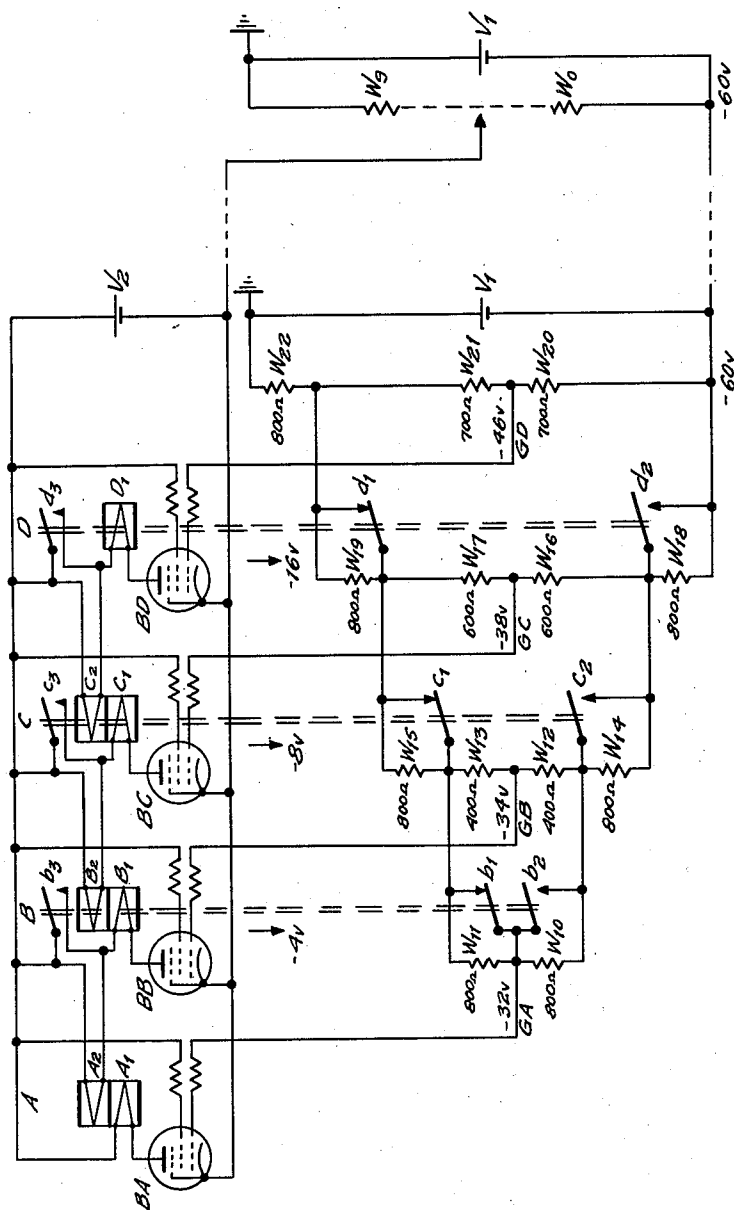
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2,556,975

BRIDGE MARKING RECEIVER

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BRIDGE MARKING RECEIVER

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The present invention relates to a selecting system responsive to signals in the form of different voltages.

The selecting device according to the invention comprises a series of selector relays which are caused to assume a distinct and different combination of operative and non-operative positions in response to every different signal voltage, as described in the copending patent application Serial No. 767,536 filed August 6, 1947, now Patent 2,543,050, patented on Feb. 27, 1941.

The object of this invention is an improvement in which the final combination of operative and non-operative selector relays for any signal is attained in a short time without the occurrence of intermediate operation of any relay which in the final combination has to be non-operative.

Another object of this invention is an improvement in which the operating delays of the selector relays are independent of one another, the mutual relationship of the relays being positively interlocking.

According to the invention the selecting system has a series of vacuum tubes, the number of which is equal to the number of the selector relays which have two opposing windings each, except the last having only one winding.

The first winding of every relay is connected in the plate circuit of a corresponding tube. The second winding of each double-wound relay is connected in the plate circuit of the next tube in the series, but is disconnected when the next relay in the series operates.

The bias of said vacuum tube is derived from a potentiometer which has as many taps as the number of tubes. The potentials of said potentiometer taps, with the exception of the tap connected to the last tube, are controlled by the selector relays, except the first relay.

The invention will now be described in detail with reference to the drawing which shows a wiring diagram of the selecting device.

In the drawing four selector relays A, B, C, D are shown. The first three relays have two windings each: A₁, A₂; B₁, B₂; C₁, C₂; but the last relay D has only one winding D₁. Windings A₁, B₁, C₁ and D₁ are connected in the anode circuits of vacuum tubes BA, BB, BC and BD, respectively.

Windings A₂, B₂ and C₂ are connected in the anode circuits of tubes BB, BC and BD, respectively. It follows that the tubes BB, BC and BD serve two windings each, viz. A₂ and B₁, B₂ and C₁ and C₂ and D₁ respectively; BA serves only one winding A₁. Relay contacts b₃, c₃, and d₃

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uncouple the windings A₂, B₂ and C₂, respectively, when the said contacts are operated by their respective relays B, C, and D.

The uncoupling is performed by shunting in the drawing, but a different method of uncoupling would also be feasible.

Other relay contacts b₁, b₂; c₁, c₂; d₁, d₂ are connected to a potentiometer which comprises resistors W₁₀ to W₂₂. Operation of any relay makes all potentials on the control grids of lower order in the series to shift by the same amount, this amount being differently predetermined for each relay. In the drawing all relays are shown in their non-operative or "normal" position and in that position the control grid potentials are assumed to be -32, -34, -38 and -46 volts, respectively.

The contacts b₁/b₂ cause a 4 volt shift of control grid BA, the contacts c₁/c₂ cause an 8 volt shift of grids BA and BB, and the contacts d₁/d₂ cause a 16 volt shift of grids BA, BB and BC.

If the signal line has a potential of -30 volts, this being the "normal" or zero signal, all tubes and relays remain inoperative as shown in the drawing.

Any other signal causes a distinct combination of tubes and corresponding relays to become operative, according to the following table:

Table I

Signal		Tubes or relays				stages
number	voltage	(B) A	(B) B	(B) C	(B) D	
0	-30	-	-	-	-	1
1	-32	+	-	-	-	1
2	-34	-	+	-	-	2
3	-36	+	+	-	-	2
4	-38	-	-	+	-	2
5	-40	+	-	+	-	2
6	-42	-	+	+	-	3
7	-44	+	+	+	-	3
8	-46	-	-	-	+	2
9	-48	+	-	-	+	3
10	-50	-	+	-	+	3
11	-52	+	+	-	+	3
12	-54	-	-	+	+	3
13	-56	+	-	+	+	4
14	-58	-	+	+	+	4
15	-60	+	+	+	+	4

The final condition of the tubes is the same as the final condition of the corresponding relays, but there may be a few intermediate stages in which more tubes than relays are operative. Along these intermediate stages the condition of tubes and relays will be paralleled gradually, either by dropping tubes or by adding relays. Taking signal "6," (signal voltage -42 volt) as an

example, the three stages of operation are given in Table II.

relay and the other winding being connected to the tube corresponding to the next succeeding

Table II

Signal		Test voltage				Tubes				Relay windings								Relay armatures				stage
No.	Volt	BA	BB	BC	BD	BA	BB	BC	BD	(BA) A ₁	(BB)		(BC)		(BD)		A	B	C	D		
											A ₂	B ₁	B ₂	C ₁	C ₂	D						
6	-42	-32	-34	-38	-46	+	+	+	-	+	+	+	0	+	-	-	-	-	-	+	-	
		-40	-42	-38	-46	+	+	+	-	+	+	+	0	+	-	-	-	-	+	+	-	
		-44	-42	-38	-46	-	+	+	-	-	-	0	+	0	+	-	-	-	+	+	-	

In the first stage the signal voltage of -42 volts on the four cathodes connected with one another renders tubes BA, BB and BC conductive, the control grids of these tubes being positive with respect to the cathodes. Tube BD with a -46 volt grid remains non-conductive. Thus, relay windings A₁, A₂, B₁, B₂ and C₁ are energized, but only relay C is operated, because windings A₁ and A₂, and likewise windings B₁ and B₂ mutually neutralize each other. The operation of relay C modifies the bias of the lower ordered control grids (BA and BB) with an 8 volt shift, thus starting the second stage.

The test voltages are now -40, -42, -38 and -46 volts respectively, and the cathode voltage still being -42 v., no change in the operating combination of the tubes is effected. The second winding B₂ of relay B is short-circuited, and this renders relay B to operate, as its first winding B₁ is no longer counteracted by winding B₂. The operation of relay B modifies the bias of the lower ordered tube BA with a 4 volt shift, and the third stage is started with the test voltages -44, -42, -38 and -46 volts. The grid of tube BA is now 2 volts negative with respect to the cathode. This tube becomes non-conductive, and winding A₁ is de-energized. Simultaneously, however, winding A₂ is short-circuited by relay contact b₃; relay A remains inoperative. The shunting of relay windings B₂ and A₂ is indicated by "0" in the above Table II.

It will be observed that in the first and second stage tube BA is operative though its final condition is inoperative. It is a consequence of the second winding of relay A₁ that this relay is not operative in the first and second stage, and this involves the advantage that the position of each relay can be registered or used for transmission to other apparatus as soon as this relay operates. As it is not necessary to wait for the completion of the combination, useful time can be saved, as well as the apparatus which would be required for the waiting and subsequent taking over.

By using pentodes as shown in the drawing the anode currents can be made practically independent of the shunting of relay windings A₂, B₂, C₂; but triodes can also be used.

While we have illustrated and described what we regard to be the preferred embodiment of our invention, nevertheless it will be understood that such is merely exemplary and that numerous modifications and rearrangements may be made therein without departing from the essence of the invention, we claim:

1. A selecting system responsive to different voltages comprising a series of vacuum tubes having means for biasing them to be operative on different voltage values, a series of relays having two windings acting in opposition, one of the windings of each relay being connected in the output circuit of a tube corresponding to the

15 relay in the series, means operated by each relay to modify the bias of the tube corresponding to the preceding relay and other means simultaneously operated to shunt the one differential winding of the preceding relay which is connected in the output circuit of the tube corresponding to the next relay.

2. A selecting system responsive to different voltages comprising a series of vacuum tubes having means for biasing them to be operative on different voltage values, a series of relays having a main winding and an auxiliary winding acting in opposition, said main winding being connected in the output circuit of a tube corresponding to the relay and said auxiliary winding being connected to the tube corresponding to the next succeeding relay in the series, means operated by each relay to modify the bias of the tube corresponding to the preceding relay and other means simultaneously operated to shunt the auxiliary winding of the preceding relay.

3. A selecting system responsive to different voltages comprising a series of vacuum tubes having means for biasing the same to be operative on different voltage values, a series of relays having main windings connected in the respective output circuits of said vacuum tubes, each relay except the last having a counteracting auxiliary winding connected to the next vacuum tube in the series when the next relay in series is not operated, said auxiliary winding being disconnected when the next relay in the series operates, and means operated by said relays for modifying the bias of the preceding ones of said tubes to be operative on different signal voltages.

4. A selecting system responsive to different voltages comprising a series of vacuum tubes having means for biasing the same to be operative on different voltage values, an equal number of relays having main windings connected in the respective output circuits of said vacuum tubes, each relay except the last having an opposing auxiliary winding connected to the next tube in the series, means operated by each relay except the first to shunt the auxiliary winding of the preceding relay in the series, and other means simultaneously operated for modifying the bias of the preceding ones of said vacuum tubes by the same amount so as to be operative on different signal voltages.

5. A selecting system responsive to different voltages, comprising a series of vacuum tubes each having a cathode and a control grid, a common connection of said cathodes to receive the signal voltage, potentiometer taps connected to said control grids, respectively, an equal number of relays having means to control the potentiometer tap potentials, each relay having a main winding and except the last of said relays an auxiliary winding, the output circuits of said

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vacuum tubes feeding said main windings of the respective corresponding relays and said opposing auxiliary windings of the respective preceding relays in the series, means for shunting said auxiliary windings when the next relay in the series operates, and means simultaneously operated with said shunting means for modifying the bias of said vacuum tubes by the same amount so as to be operative on different signal voltages, said amount being specifically predetermined for each relay.

6. A selecting system responsive to different signal voltages comprising a series of vacuum tubes having a common cathode connection and control grids, different potentiometer taps connected to said control grids, respectively, an equal number of relays having main windings in the respective anode circuits and having opposing auxiliary windings connected to the next tubes, respectively, each relay except the first in the

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series having means for shunting the auxiliary winding of the one preceding relay, and means for shifting the control grid potentials of all preceding vacuum tubes by the same amount, said amount being specifically predetermined for each relay.

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