

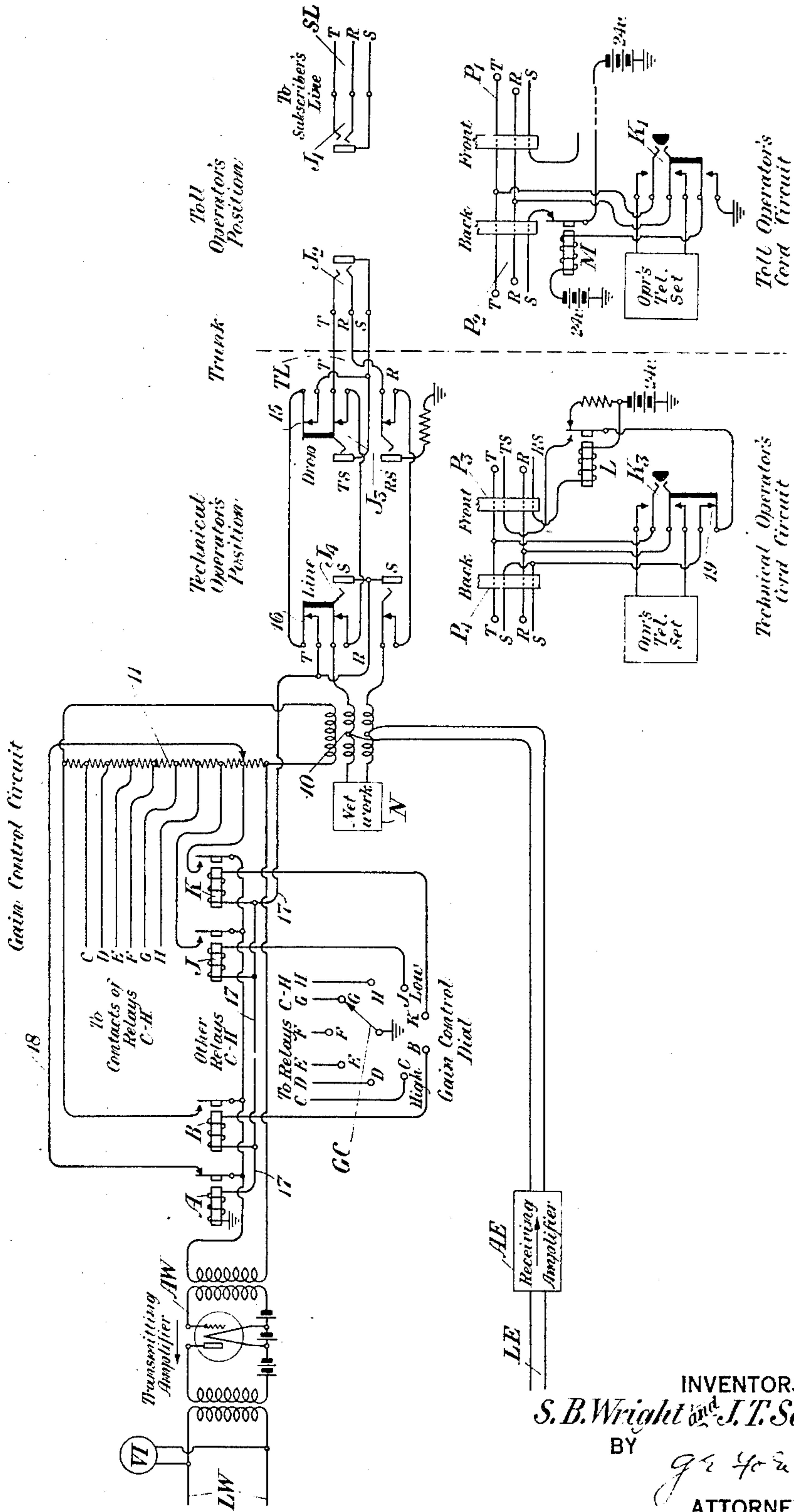
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GAIN CONTROLLING CIRCUITS

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GAIN-CONTROLLING CIRCUITS.

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To all whom it may concern:

Be it known that we, SUMNER B. WRIGHT and JOHN T. SCHOTT, citizens of the United States, residing at East Orange and Brooklyn, in the counties of Essex and Kings and States of New Jersey and New York, respectively, have invented certain Improvements in Gain-Controlling Circuits, of which the following is a specification.

10 This invention relates to telephone transmission circuits and more particularly to arrangements for controlling the gain of telephone repeaters.

15 In certain cases it is desirable to transmit a relatively high and substantially constant volume over a transmission circuit from all subscribers. For example, in the case of a radio telephone transmitter it is necessary to radiate a practically constant volume in
20 order to keep the voice currents strong as compared to noise. Since certain subscribers may be connected to such a radio telephone transmitter over long circuits having large losses, while other subscribers may
25 be connected over relatively short circuits, and since regardless of the length of the circuit some subscribers talk much louder than others, it is necessary to adjust the gain of an amplifier associated with the
30 radio transmitter for the different conditions met with if the volume radiated is to be maintained constant. In circuits arranged to meet such a requirement some method must be provided to insure that
35 when the circuit is adjusted for a large repeater gain to amplify the weak currents, strong currents such as those put out by operators near the input of the circuit will
40 not exceed the value for which the circuit is adjusted, otherwise serious distortion or other harmful effects may occur.

It is one of the objects of this invention to provide a circuit arrangement whereby
45 when an operator comes in on a circuit of the type above described near the point at which the variable gain repeater is provided, the gain will be reduced to a value such that the volume of energy resulting from the operators speaking on the circuit
50 will not exceed the limiting value for the circuit.

Other and further objects of the invention will be clear from the following detailed description when read in connection

with the accompanying drawing, the figure 55 of which illustrates a circuit diagram embodying the principles of the invention.

Referring to the drawing, SL represents a subscriber's line which may be connected to a four-wire repeater link comprising
60 paths LE and LW through the usual hybrid coil 10 and balancing network N. The path LW includes a transmitting amplifier AW and the path LE includes a receiving amplifier AE. The path LW may be connected
65 to a suitable radio telephone transmitter and the path LE to a corresponding radio telephone receiving circuit. The subscriber's line SL is connected to the hybrid
70 coil through a trunk TL and in order that different lines may be connected with the trunk, the line SL and the trunk TL terminate in jacks J₁ and J₂ respectively, adapted to cooperate with the plugs P₁ and P₂ of a
75 toll operator's cord circuit.

In order to adjust the gain of the amplifier AW so that the volume of energy transmitted over the circuit LW may be maintained at a substantially constant value, a potentiometer 11 is associated with the input
80 side of the amplifier. This potentiometer 11 may be adjusted by steps determined by the gain control dial GC whose contacts B to K inclusive are connected to close circuits through individual relays B to K, inclusive. These relays in turn establish connections from various points on the potentiometer 11 to the amplifier AW. For
85 simplicity, the relays C to H inclusive and their connections are not illustrated. The gain control dial may be manipulated by a
90 technical operator at a technical operator's position. A volume indicator VI is provided on the output circuit of the amplifier AW to indicate to the technical operator the
95 amount of volume being transmitted from the amplifier.

The technical operator is provided with a cord circuit terminating in twin plugs P₃ and P₄ adapted to co-operate with twin
100 jacks J₃ and J₄ connected in the trunk TL. The technical operator's cord circuit is provided with a telephone operator's set which may be connected to the cord by means of
105 key K₃. The back plug P₄ of the cord may be inserted in the jack J₄ when the technical operator desires to speak over the line LW at such times as no line such as SL is con-

nected to the trunk through the toll opera-
 tor's cord circuit. If, however, such a con-
 nection is established with the toll operator's
 cord circuit, the technical operator's cord
 5 circuit may have its front and back plugs
 P₃ and P₄ inserted in the jacks J₃ and J₄
 respectively so that the connection will ex-
 tend through the technical operator's cord
 circuit. A special relay A is provided in the
 10 gain control circuit and the circuit of this
 relay is under the joint control of the key
 K₃ of the technical operator's cord circuit
 and the key K₁ of the toll operator's cord
 circuit. If either operator goes in on the
 15 circuit with a telephone set by operating the
 key K₁ or key K₃ as the case may be, the
 relay A, which is normally energized when
 either cord circuit is in use, will be released
 during the time that the operator's tele-
 20 phone set is connected to the cord circuit
 and will close a circuit for a special adjust-
 ment of the potentiometer 11, which will
 bring the gain of the amplifier AW down to
 a point such that when the operator talks,
 25 the volume of energy transmitted over the
 circuit LW will not exceed the maximum
 limit. At the same time, the relays B to K
 inclusive are all placed in an inoperative
 condition so that the setting of the potenti-
 30 ometer 11 will not under these conditions be
 determined by the setting of the gain control
 dial GC.

Further details of the invention will now
 be clear from a description of the operation
 35 which is as follows: The toll operator will
 establish a connection from a line such as
 SL to the radio transmitter associated with
 the circuit LW by inserting the front and
 back plugs P₁ and P₂ of her toll cord cir-
 40 cuit in the jacks J₁ and J₂ respectively. A
 circuit is now established from battery, over
 the back contact of the relay M, sleeve con-
 ductor of the back plug P₂, sleeve conductor
 of the jack J₂, over contacts 15 and 16 of
 45 jacks J₃ and J₄ to conductor 17. Relay A,
 which has one terminal of its winding con-
 nected to the conductor 17 and the other
 terminal connected to ground, will be ener-
 gized and will open the circuit 18. At the
 50 same time, one of the relays B to K inclu-
 sive, as determined by the setting of the gain
 control GC, is energized and connects a
 point of the potentiometer 11 to the input
 transformer of the amplifier AW. As soon
 55 as the subscriber begins to talk over the cir-
 cuit, the volume transmitted from the
 amplifier AW will be indicated by the
 volume indicator VI so that the technical
 operator may adjust the gain control dial
 60 GC to bring the volume to the desired level.
 For example, if the subscriber talks in a
 weak voice over a long telephone line the
 volume indicated by the volume indicator
 VI will be quite low and the gain control
 65 dial will be set upon its high contact B,

thereby closing a circuit from ground
 through the winding of the relay B to the
 conductor 17. The relay B is energized and
 connects the upper terminal of the input
 winding of the transformer over the front
 70 contact of the relay B to the upper terminal
 of the potentiometer 11. If, however, the
 volume of current incoming from the line
 SL should be greater, the gain control dial
 might be set to a lower contact, such as J, 75
 in which case the relay J would be ener-
 gized and close the circuit from the input
 transformer to a lower setting of the poten-
 tiometer. It will be noted that the circuits
 of all of the relays A to K inclusive extend 80
 over the sleeve conductor of the jack J₂ to
 a battery in the sleeve circuit of the back
 cord of the toll operator's cord circuit.

Suppose now, with the gain control set
 upon contact B so that the relay B is oper- 85
 ated for the corresponding setting of the
 potentiometer 11, the toll operator should
 desire to speak over the circuit. The key
 K₁ will then be actuated to connect the toll
 operator's telephone set to the toll cord. 90
 The operation of the key K₁ closes a circuit
 of the relay M associated with the toll cord,
 which relay in turn opens the sleeve con-
 nection to the 24-volt battery. This removes
 battery from the sleeve conductor of the 95
 trunk and consequently from the conductor
 17. The relay B or any other relay of the
 set of relays B to K inclusive will be de-
 energized so that these relays no longer con-
 trol the setting of the potentiometer. The 100
 relay A will also be deenergized at the same
 time and will close a circuit over its back
 contact from the upper terminal of the in-
 put transformer, through the conductor 18,
 to a point on the potentiometer 11 such that 105
 the volume of energy due to the operator's
 speech as indicated on the volume indicator
 VI will not exceed the limits for the circuit.

If at a time when the connection through
 the operator's toll cord is not established, 110
 the technical operator should desire to speak
 over the circuit, the technical operator will
 insert the back plug P₄ into the jack J₄,
 thereby opening the connection to the sleeve
 conductor of the jack J₂ at the contact 16 115
 and connecting the tip and ring conductors
 leading from the hybrid coil to the tip and
 ring conductors of the technical operator's
 cord circuit. The conductor 17 is also con-
 nected over the sleeve conductor of the twin 120
 jack and the sleeve conductor of the twin
 plug and thence over a contact of the key
 K₃ and a contact of the relay L to a 24-volt
 battery. A circuit is thus established from 125
 the 24-volt battery for one of the relays B
 to K inclusive, depending upon the setting
 of the gain control dial at that time. When
 the operator throws the talking key K₃ to
 connect the telephone set to the technical
 operator's cord circuit, the battery con- 130

nection to the sleeve conductors of the twin plug P_4 is opened at contact 19, thereby releasing the relay of the group B to K inclusive which is at the moment actuated to open the potentiometer connection then established. At the same time the relay A is deenergized and establishes the normal potentiometer connection through the conductor 18, bringing the volume level back to the level desirable for the conversation of an operator.

If, when a connection is established through the toll operator's cord circuit, the technical operator desires to come in on the circuit, plugs P_3 and P_4 of the technical operator's cord circuit will be inserted in the jacks J_3 and J_4 respectively. The normal tip and ring connections through the twin jacks J_3 and J_4 are now broken and the tip and ring connections are established through the technical operator's cord circuit. The connection from the sleeve of the jack J_2 to the conductor 17 is also broken and conductor 17 is connected over the S contacts of the twin jack J_4 and the corresponding S contacts of the twin plug P_4 and over the contact 19 of the key K_3 to the armature of the relay L. A circuit is also completed from the 24-volt battery through the winding of the relay L, contact RS of the twin plug P_3 and corresponding contact of the jack J_3 to ground. The relay L being energized, the circuit previously traced from the conductor 17 to the armature of the relay L is extended over the TS contacts of the twin plug P_3 and twin jack J_3 , over the sleeve contact of the jack J_2 and plug P_2 , and thence over the back contact of the relay M to the 24-volt battery connection at the toll operator's position.

It will thus be seen that the controlling circuit for the relays A to K inclusive extends through both cord circuits. Therefore, if the toll operator throws her key K_1 , the relay M will be operated to release all of the relays A to K inclusive, thereby breaking the setting of the potentiometer as determined by the gain control dial and establishing a setting of the potentiometer over the conductor 18. Similarly, if the technical operator throws the key K_3 , the relay controlling circuit will be opened at contact 19 with the same result. The operation of the key K_2 or key K_1 , as the case may be does not open the through connection as established by the cord circuits.

It will, of course, be obvious that any number of sets of twin jacks similar to J_3 and J_4 may be provided in the circuit at different positions and by using cord circuits at these points similar to the technical operator's cord circuit any desired number of operators may independently come in on the circuit in the manner above described. This is for the reason that each cord circuit

of the type shown at the technical operator's position completes a sleeve connection over the talking keys of successive cords in series so that the operation of any key will set the gain control circuit to normal without interrupting transmission.

It will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. In a signaling system, an amplifier, means to control the gain of said amplifier, a cord circuit for establishing connections to said amplifier, an operator's telephone set associated with said cord circuit, and means whereby when said operator's telephone set is connected in circuit the existing gain adjustment of said amplifier will be disabled and the amplifier will be adjusted to the requirements of said operator's telephone set.

2. In a signaling system, an amplifier, a potentiometer having variable settings for controlling the gain of said amplifier, a cord circuit for establishing connections to said amplifier, an operator's telephone set associated with said cord circuit, and means whereby when said operator's telephone set is connected in circuit the existing potentiometer connection is disestablished and a normal potentiometer setting dependent upon the requirements of said operator's telephone set will be established.

3. In a signaling system, an amplifier, means for variably adjusting the gain of said amplifier, a plurality of cord circuits connected in tandem to establish connections to said amplifier, operator's telephone sets for each cord circuit, and means whereby when the operator's telephone set of any cord circuit is connected in the circuit the existing gain adjustment of said amplifier will be automatically disestablished and a gain adjustment conforming to the requirements of the operator's telephone set will be automatically established.

4. In a signaling system, an adjustable potentiometer for varying the gain of said amplifier, a plurality of cord circuits adapted to be connected in tandem to establish connections to said amplifier, operators' telephone sets for each cord circuit, and means whereby when an operator's telephone set is connected in circuit, the existing setting of the potentiometer will be automatically disestablished and a setting corresponding to the requirements of the operator's telephone set will be automatically established.

5. In a signaling system, an amplifier, a potentiometer, an adjustable switch for variably setting said potentiometer to ad-

just the gain of said amplifier, a cord circuit for establishing connections to said amplifier, an operator's telephone set associated with such cord circuit, means whereby
5 when the operator's telephone set is connected in circuit the setting of the potentiometer determined by said switch will be automatically disestablished and the potentiometer will be automatically set to produce a gain
10 in accordance with the requirements of said operator's telephone set.

6. In a signaling system, an amplifier, an adjustable potentiometer for controlling the gain of said amplifier, a gain control switch
15 adapted to be variably set, a plurality of relays selectively energized in accordance with the setting of said switch, each relay controlling an individual setting of said po-

tentiometer, an additional relay controlling the normal setting of said potentiometer, a
20 cord circuit for establishing connections to said amplifier, an operator's telephone set associated with said cord circuit, and a circuit for said relays extending to said cord circuit and controlled thereby whereby when
25 the operator's telephone set is connected in circuit the circuit of said relays will be changed to disestablish the potentiometer setting determined by the selective relays and to establish the normal setting con-
30 trolled by said additional relay.

In testimony whereof, we have signed our names to this specification this 29th day of April, 1925.

SUMNER B. WRIGHT.
JOHN T. SCHOTT.