

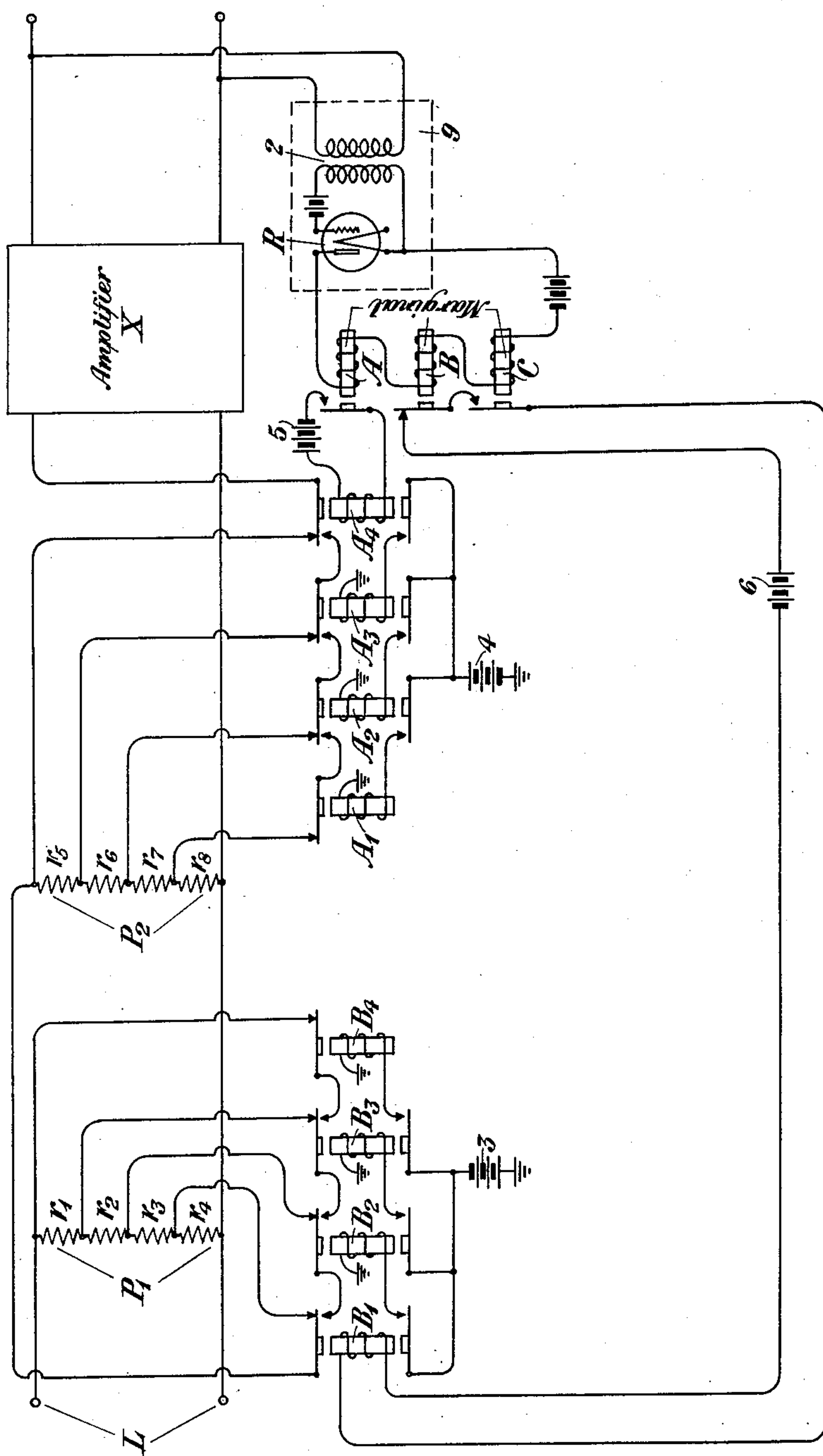
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ARRANGEMENT FOR AUTOMATICALLY CONTROLLING VOLUME OUTPUT

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ARRANGEMENT FOR AUTOMATICALLY CONTROLLING VOLUME OUTPUT.

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To all whom it may concern:

Be it known that I, CHARLES H. FETTER, a citizen of the United States, residing at Millburn, in the county of Essex and State of New Jersey, have invented certain Improvements in Arrangements for Automatically Regulating Volume Output, of which the following is a specification.

This invention relates to arrangements for automatically regulating the volume output of transmission circuits.

The regulation of volume becomes an important problem in systems of public address and in broadcasting work, and in the past has been accomplished manually by a carefully trained operator. An illustration of the need for volume control would be found in the case wherein it is desired to pick up the program of a concert for broadcasting or transmission purposes. In many cases it is inherently impossible to pick up and send through an electrical circuit a faithful reproduction of the program. This is not due to the frequency transmission characteristic of the apparatus involved but because the electrical apparatus, including the telephone lines, limits the variation in level to a small part of the variation which actually occurs at the source. The volume level at the source may vary between such wide limits as to be barely audible to the other extreme where a large concert hall may be completely filled. Under this condition, when a program is being picked up, there is a certain definite lower level which is limited by noise either in the apparatus used or in the telephone line. There is also a definite upper level limit which is limited by overloading of amplifiers and cross-talk in telephone circuits. To illustrate more concretely, it is pointed out that the safe operating upper level and the length of circuit confine these limits to about -13 to +2 mile units from zero transmission, giving a range of about 15 mile units; whereas in an actual program, the variation in level may be as high as 50 mile units. It is therefore necessary under such conditions to artificially flatten out the volume characteristic, cutting down the volume when it is too high and increasing it when it is too low. In the past this has been accomplished by the manual operation of a potentiometer associated with a control amplifier, the volume being

indicated at all times by a volume indicator. This is a calibrated device so operated that when the deflection on a meter passes certain points on the scale, the volume is manually increased or decreased as necessary. For volume control in this manner, it requires an expert attendant who must at all times use very great care and judgment in the controlling of volume. Accordingly, it is the primary object of the arrangements of this invention to provide a means for automatically regulating the volume on a circuit so that in instances as above illustrated, the human element may be obviated. While the arrangements for automatic volume control are especially adapted for instances as the one above referred to, it is pointed out that the arrangements of the invention for controlling volume level may be utilized in many other ways besides broadcasting, such as on long distance toll service or on public address systems. Other features and objects of the arrangements of the invention will appear more fully from the detailed description hereinafter given.

The invention may be more fully understood from the following description, together with the accompanying drawing, in the figure of which is illustrated a circuit diagram of a preferred form of the invention.

In the drawing is shown a transmission line L which includes an amplifying device X. Bridged across the line on the input side of the amplifier are the potentiometers P_1 and P_2 . Bridged across the output of the amplifier is a rectifier device 9 comprising a transformer 2 and a vacuum tube R. The rectifier device controls the relays A, B and C. Relay A will operate when the voltage at the output of the amplifier becomes greater than a certain prescribed amount. Relays B and C will release when the voltage at the output of the amplifier reaches prescribed limits. Relay A controls a chain of relays A_1 , A_2 , A_3 and A_4 , whereby the amplifier gain may be increased through the manipulation of potentiometer P_2 . Relay B controls a chain of relays B_1 , B_2 , B_3 and B_4 , whereby the amplifier gain may be reduced through the manipulation of potentiometer P_1 . Relay C controls the operation of relay B.

The operation of the arrangements is as

follows: Suppose that there is no transmission through the amplifier X and that its output is zero. Under these conditions all of the relays A, B and C would be released.

5 Suppose that a program is now transmitted over line L and through the amplifier X at a predetermined volume level which is not sufficient to cause relay A to operate but which is sufficient to operate relays B and C.

10 Under such conditions with relays B and C operated and relay A not operated, there will be no operation of the relays B₁, etc., and A₁, etc., and hence no change in the settings of potentiometers P₁ and P₂. If the

15 volume level now increases to a certain point, relay A will operate. The operation of relay A will cause the chain of relays A₄, A₃, A₂ and A₁ to operate in sequence. As each of these relays operates, it will cut into

20 the circuit one of the resistance elements, such as r₅, r₆, r₇ or r₈, of the potentiometer P₂ and decrease the gain. This will cut down the volume until a point is reached where relay A will release again. The chain

25 of relays will then release and allow the volume to increase again until relay A will operate. This operation will be repeated during the time when the volume is too great. Suppose now that the volume drops

30 to a level which is lower than that previously described as sufficient to operate relay A. Under these conditions relay B will release. The release of relay B will operate relay B₁, which in turn will cause the other

35 relays B₂, B₃ and B₄ of the chain to operate in sequence. The operation of these relays will automatically cut out of the circuit, one at a time, the resistance elements, such as

40 r₁, r₂, r₃ and r₄ of the potentiometer P₁ and hence increase the gain and volume. When the gain has been sufficiently increased, relay B will operate again and the chain of relays will release and reduce the gain. This operation will continue around the point of minimum

45 transmission level. However, should the volume drop below the permissible level above noise, or some such limiting value, then relay C will release and thus prevent relay B from further increasing the gain.

50 It is desirable for relay C to have considerable time lag in its release. It is also desirable that relays A and B have sufficient time lag so that they will control the general volume level but will not cut off individual peaks.

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While the potentiometers have been shown as under the control of a chain of relays, the invention might also be arranged so that the desired operations would be obtained by

60 other mechanisms. Accordingly, while the arrangements of the invention have been illustrated in certain specific arrangements which are deemed desirable, it is understood that they are capable of embodiment in

65 many and widely varied forms without de-

parting from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. A transmission line including an amplifier, a plurality of potentiometers associated with the input of said amplifier, a voltmeter rectifier device bridged across the output of said amplifier, a plurality of relays connected in series with the output of said rectifier device, one of said relays being adjusted to operate on current of a predetermined voltage, another of said relays being adjusted to operate on current of a lesser voltage, and means controlled by said relays for controlling said potentiometers.

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2. A transmission line including an amplifier, a voltmeter rectifier device bridged across the output of said amplifier, a plurality of relays associated with said rectifier device, said relays being adjusted to operate on currents of predetermined voltages, and means controlled by each of said relays for varying the gain of said amplifier.

85 90

3. A transmission line including an amplifier, a plurality of potentiometers associated with the input of said amplifier, a voltmeter rectifier device bridged across the output of said amplifier, a plurality of relays connected in series with the output of said rectifier device, one of said relays being adjusted to operate on current of a predetermined voltage, another of said relays being adjusted to operate on current of a lesser voltage, a chain of relays operating in sequence controlled by said first relay, means controlled by said chain of relays for adjusting the setting of one of said potentiometers, a second chain of relays operating in sequence, said second chain of relays being controlled by said second mentioned relay, and means controlled by said second chain of relays for adjusting the setting of the other of said potentiometers.

95 100 105 110

4. A transmission line including an amplifier, a plurality of potentiometers associated with the input of said amplifier, a voltmeter rectifier device bridged across the output of said amplifier, a plurality of relays connected in series with the output of said rectifier device, one of said relays being adjusted to operate on current of a predetermined voltage, the second of said relays being adjusted to operate on current of a lesser voltage, the third of said relays being adjusted to operate on current of still lesser voltage, a chain of relays operating in sequence controlled by said first relays, means controlled by said chain of relays for adjusting the setting of one of said potentiometers, a second chain of relays operating in sequence and controlled by said second relay, means controlled by said chain of relays for adjusting the setting of said other potentiometer, and means controlled by said

115 120 125 130 135 140 145 150 155 160 165

third relay for controlling the operation of said second mentioned chain of relays.

5. Arrangements for controlling transmission level, comprising a line, adapted to transmit energy at levels between prescribed limits, a potentiometer associated with said line, and means associated with said line and controlled by the energy supplied to the line when the energy exceeds the prescribed limits for controlling said potentiometer.

6. A transmission line, adapted to transmit energy at levels between prescribed limits, a potentiometer associated with said line, a regulating device associated with said line, said device being responsive to the volume of energy supplied to the line when it exceeds the prescribed limits, and means controlled by said device for controlling the potentiometer.

7. A transmission line, adapted to transmit energy at levels between prescribed limits, means associated with said line for varying the transmission characteristics of said line, regulating means associated with said line and directly controlled by the volume of energy supplied to said line when it exceeds the prescribed limits, and means controlled by said last mentioned means for controlling said first mentioned means.

8. In a signaling system in which signaling energy is translated into electrical energy having variations of volume, a transmission circuit upon which said electrical energy may be impressed, and means automatically responsive to a change in the volume of the electrical energy impressed upon said circuit to change the volume of the energy transmitted thereover.

9. In a signaling system, in which signaling energy is translated into electrical energy having variations of volume extending over a wide range, a transmission circuit over which a lesser range of volume is to be transmitted, means to impress said electrical energy upon such transmission circuit, and means automatically responsive to changes in the volume of the electrical energy so impressed to reduce the volume of the energy transmitted over the circuit so that the range of volume transmitted will be less than the range of volume impressed on the circuit.

10. In a signaling system in which signaling energy is translated into electrical energy having variations of volume, a transmission circuit upon which said electrical energy may be impressed, a variable loss element included in said transmission circuit, and means to automatically vary the

loss introduced by said element as the volume of the applied electrical energy varies.

11. In a signaling system in which signaling energy is translated into electrical energy having variations of volume, a transmission circuit upon which said electrical energy may be impressed, a variable shunt bridged across the transmission circuit, and means to vary the electrical values of said shunt automatically in response to variations of the electrical energy so impressed.

12. In a signaling system, a transmission medium capable of transmitting a relatively narrow range of energy volume, means to apply thereto signaling energy having variations of energy volume extending over a range greater than that which the medium is capable of transmitting, means for automatically changing the volume of the energy when it exceeds the limits of the transmitting medium so as to bring it within the energy volume range which the medium will transmit, and means to transmit the energy over the medium with variations in volume extending over a narrower range than that of the energy originally applied.

13. In a signaling system, a transmission medium capable of transmitting a relatively narrow range of energy volume, means to apply thereto signaling energy having variations of energy volume extending over a range greater than that which the medium is capable of transmitting, means for automatically decreasing the volume of the energy when it exceeds the highest energy volume which the transmitting medium will carry, and means for transmitting the energy over the medium with variations in volume extending over a narrower range than that of the energy originally applied.

14. In a signaling system, a transmission medium capable of transmitting a relatively narrow range of energy volume, means to apply thereto signaling energy having variations of energy volume extending over a range greater than that which the medium is capable of transmitting, means for automatically increasing the volume of the energy when it falls below the lowest energy volume which the transmitting medium will carry, and means for transmitting the energy over the medium with variations in volume extending over a narrower range than that of the energy originally applied.

In testimony whereof, I have signed my name to this specification this 8th day of July, 1924.

CHARLES H. FETTER.