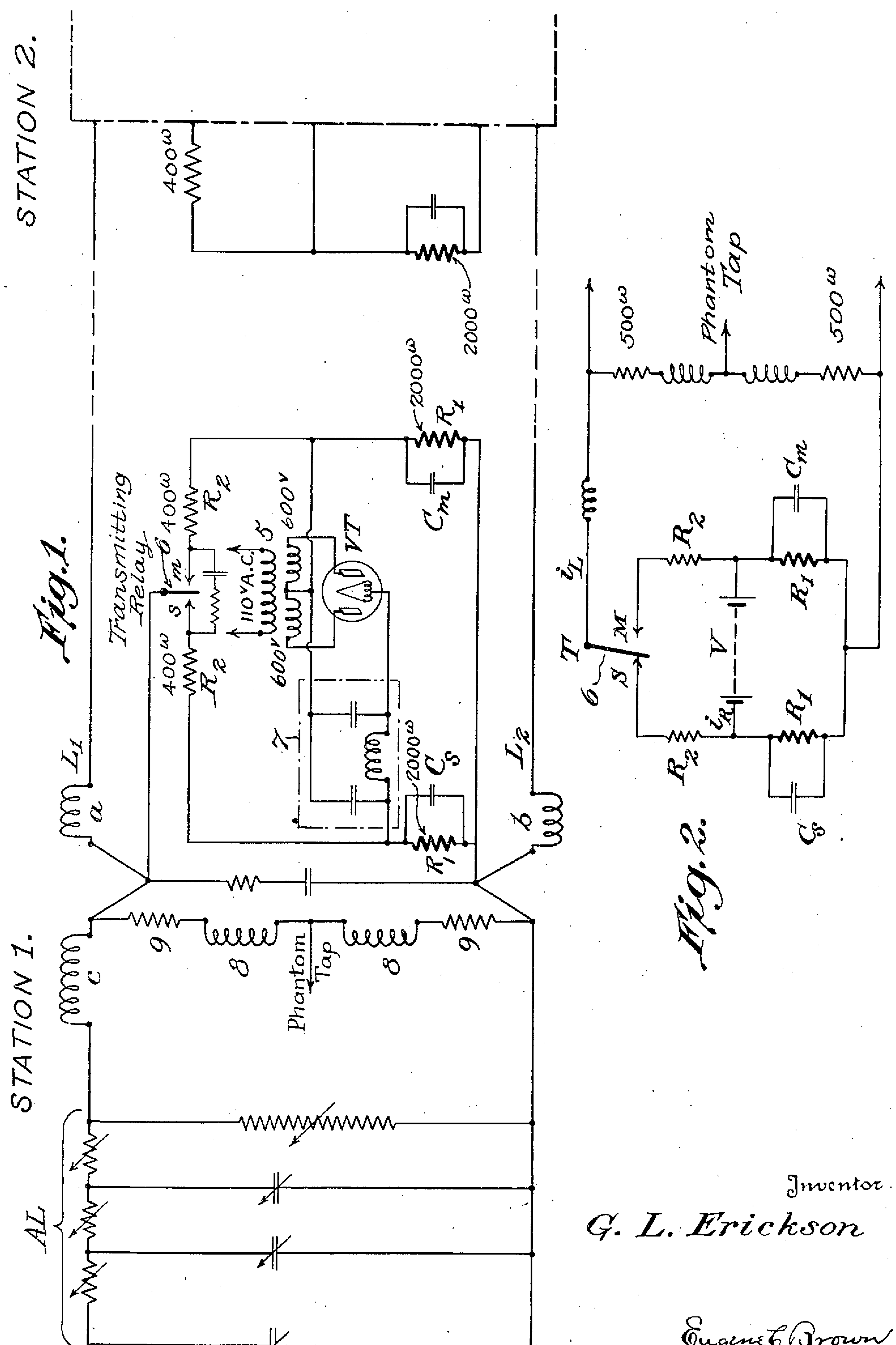
Sept. 5, 1939. G. L. ERICKSON 2,172,277

RECTIFIER POWER UNIT AND SIGNAL SHAPING ARRANGEMENT
FOR METALLIC TELEGRAPH CIRCUITS

Filed July 31, 1936



Inventor

G. L. Erickson

Eugene C. Brown
Attorney

Patented Sept. 5, 1939

2,172,277

UNITED STATES PATENT OFFICE

2,172,277

RECTIFIER POWER UNIT AND SIGNAL SHAPING ARRANGEMENT FOR METALLIC TELEGRAPH CIRCUITS

George L. Erickson, Hasbrouck Heights, N. J., assignor to The Western Union Telegraph Company, New York, N. Y., a corporation of New York

Application July 31, 1936, Serial No. 93,694

3 Claims. (Cl. 178—60)

This invention relates to metallic telegraph circuits and particularly to a rectifier arrangement for supplying the operating current and for shaping the wave form of the transmitted signals to compensate for line attenuation.

The transmitted telegraph signals are composed of a fundamental current wave and an infinite number of harmonics. As is well known the higher frequency components of the signal wave become attenuated in traversing a long metallic circuit, thereby causing serious distortion of the signals. One object of this invention is to provide an arrangement which enhances the higher frequency components and shapes the transmitted signal wave form in a manner to compensate for line attenuation.

Another object of this invention is to provide a rectifier power unit for supplying current to the contacts of the transmitting relay which permits much higher transmitting speeds than is possible with motor-generator power units and reduces the potential required at the transmitter pole changer contacts over that required when two separate sources of potential are used. The equivalent of polar battery is obtained by floating a D. C. potential across a bridge arrangement of a pair of resistances.

A more comprehensive understanding of the invention will be obtained from the following detailed description in connection with the accompanying drawing, in which—

Figure 1 is a schematic diagram of a metallic telegraph circuit illustrating one embodiment of the invention;

Figure 2 is a diagram to illustrate the principles of the invention.

The metallic telegraph circuit illustrated in Fig. 1, extends between two stations having identical transmitting and receiving apparatus. The artificial line AL balances the apparatus and characteristics of the real line L_1, L_2. The receiving relay is provided with line coils *a*, *b* and a coil *c* in the artificial line having turns equal to the sum of the turns of the other two coils.

The thermionic vacuum tube VT rectifies the currents of opposite polarity received alternately from the secondary coils of the transformer **5** to supply current of opposite polarity to the contacts of the transmitting relay **6**. The wave form is given the desired shape by the shaping network **7**.

To overcome and prevent the distortion of the received signal waves caused by the line attenuation, which occurs mainly in the higher frequency components, the initial portion of each signal impulse or wave is augmented by energy stored in a condenser during the previous impulse. The signal wave therefore initially rises to a peak and then declines to the steady state value. This initial peak portion of the signal wave is mainly composed of the higher frequency components which are more subject to line attenuation. By proper proportioning the peak values the received signals may be substantially distortionless.

To accomplish this purpose, a pair of condensers C_s, C_m are shunted across resistances R_1 and R_1 which are bridged between the lines with a polar current source from the rectifier floated therebetween.

A pair of inductance coils **8**, **8** with series resistances **9**, **9**, are connected in shunt to the transmitting apparatus. In a composite system having a pair of side circuits, such as shown in Fig. 1, a phantom circuit may be tapped into the side circuits at the center of said inductive shunts, as indicated.

The operation will be evident from a consideration of the simplified diagram shown in Fig. 2:

Let R_1=bridge resistances=2000ω

R_2=tap resistances=365ω

R_L=nominal load resistance=750ω

V=voltage across rectifier

i_L=steady state current delivered by relay polechanger to a load resistance R_L.

Then—

$$i_L=\frac{V-R_1\left[\dfrac{V}{\dfrac{1}{\dfrac{1}{R_2+R_L}+\dfrac{1}{R_1}}+R_1}\right]}{R_2+R_L}$$

$$\text{Voltage across } C_m=R_1\left[\frac{V}{\dfrac{1}{\dfrac{1}{R_2+R_L}+\dfrac{1}{R_1}}+R_1}\right]$$

$$\text{Voltage across } C_s=i_L(R_2+R_L)$$

The load resistance is approximately one-third that of R_1, so that the voltage across condenser C_s is approximately one-third that across condenser C_m. Thus C_m is charged to approximately ⅔ V. When the tongue of the polechanger or transmitting relay **6** engages its marking contact *m*, this voltage across condenser C_m is applied to the load or line. As condenser C_m discharges, the voltage across it drops to the steady state value of about one-third V. The values of the resistances R_1 and condensers C_s and C_m are so chosen that the charging transients are over in the time required for the transmission of the shortest signal impulse.

Hence as the tongue of the transmitting relay **6** alternately engages its contacts in response to the signals, the discharges of the condensers cause an initial peak voltage in the signal current wave which is so designed or predetermined as to compensate for the distortion due to line attenuation. The ratio between the bridge resistances and the load resistance determines the difference between the initial and final charge of the shaping condensers, and therefore the discrimination between the steady state and the initial voltage applied to the line circuit.

It will be apparent that the inductive shunt **8**, **8**, has a greater effect in blocking the high frequency components of the signal waves. Therefore the high frequency components of the initial peak voltage of the signal waves are not shunted across said inductive path and hence do not interfere with the building up of the peak voltage of the transmitted signal.

I claim:

1. In a communication system having a metallic circuit and provided with means for transmitting thereover impulses of opposite polarities corresponding to the desired intelligence signals, the method of compensating for the distortion of the transmitted signals due to line attenuation of the high frequency components of the signal waves, which consists in superposing upon each transmitted signal impulse for a brief interval during the initial portion of each signal impulse, a high potential transient preshaped to supply harmonics of the fundamental dot frequency essential to compensate for the predetermined loss of high frequency components due to line attenuation.

2. In a communication system having a metallic circuit, means for supplying current impulses of opposite polarities and predetermined voltage in accordance with intelligence signals to be transmitted over said circuit, means for impressing upon the initial portion of each current impulse an electrostatic discharge of high voltage preshaped to supply harmonics of the fundamental dot frequency essential to compensate for the predetermined loss of high frequency components due to line attenuation.

3. In a telegraph system having a metallic circuit, a transmitter having a pair of contacts connected to one side of said circuit and a transmitting element connected to the other side of said circuit and adapted to alternately engage said contacts in accordance with the intelligence signals to be transmitted to said circuit, a source of alternating current, a thermionic rectifier interposed between said source and said transmitter and each of said contacts, a shaping network in series with said rectifier and the respective contacts, a pair of resistance elements connected in series between said rectifier and the respective contacts and a condenser in shunt to each of said resistances.

GEORGE L. ERICKSON.