

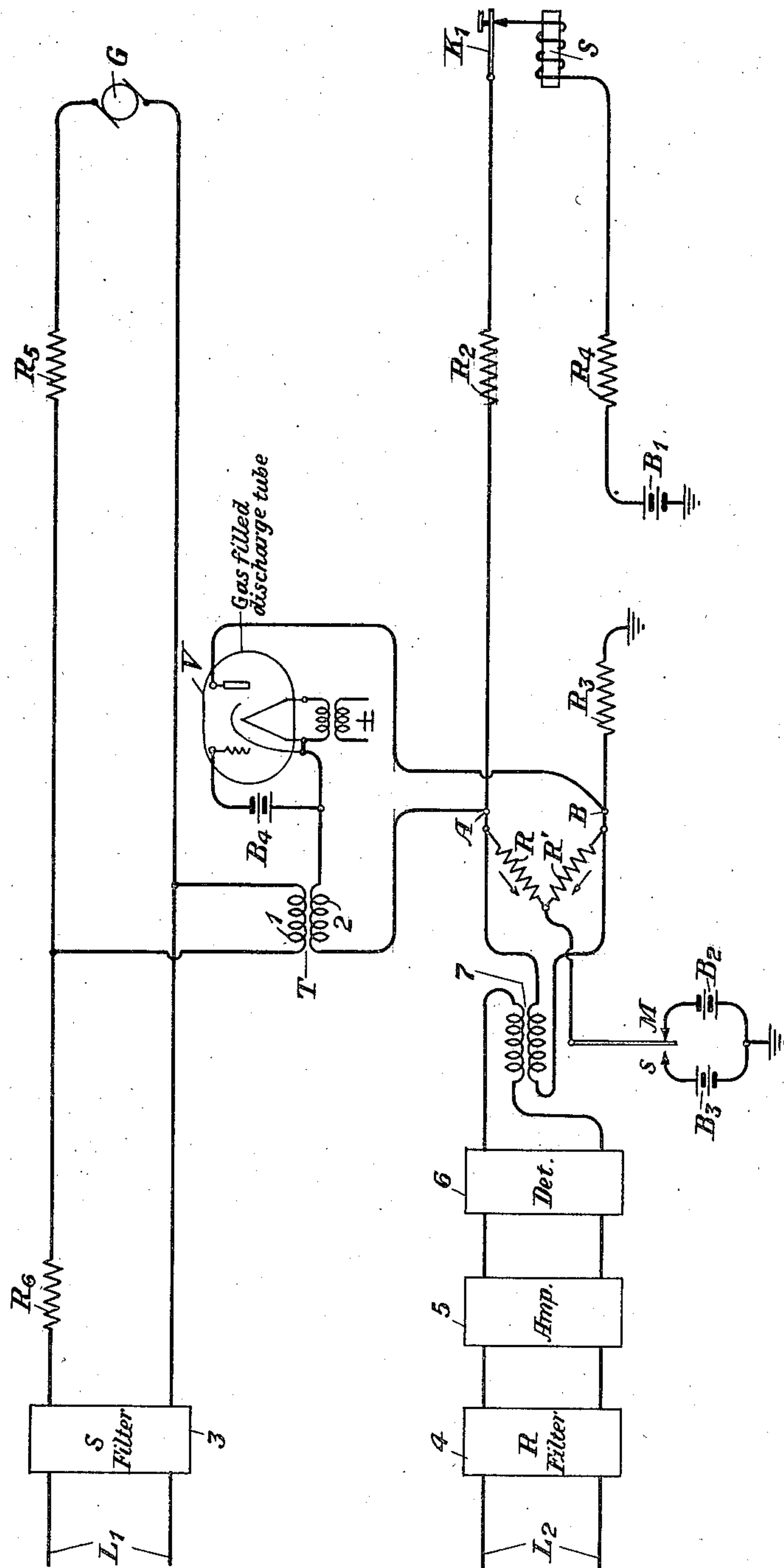
Feb. 23, 1937.

V. P. THORP

2,071,476

TELEGRAPH SYSTEM

Filed March 15, 1935



INVENTOR
V. P. Thorp
BY *g2402*
ATTORNEY

UNITED STATES PATENT OFFICE

2,071,476

TELEGRAPH SYSTEM

Vaughn Penfold Thorp, River Edge, N. J., assignor
to American Telephone and Telegraph Com-
pany, a corporation of New York

Application March 15, 1935, Serial No. 11,349

4 Claims. (Cl. 178—66)

This invention relates to telegraph systems and, more particularly, to a method and means for controlling the transmission of signals over such systems.

5 The arrangements of the invention are particularly adapted for use in telegraph systems in which currents of carrier frequencies are utilized for the transmission of signals. In carrier telegraph systems used heretofore, it has been
10 customary to control the outgoing carrier current by means of an electromagnetic relay having stationary contacts and a movable armature. Troubles have often been experienced with relays of this type, necessitating expensive
15 maintenance of the relay adjustment, cleaning of contacts, etc. In the arrangements of this invention, the electromagnetic sending relay ordinarily used in carrier current telegraphy is done away with and a gas-filled discharge tube
20 and circuit arrangements therefor are utilized to control the sending of signals over the system. Such an arrangement will require very little attention, will operate at higher speeds and will not get out of adjustment. While the
25 arrangements of the invention are particularly adapted for use in carrier current telegraph systems, they might be also used for the control of any alternating current outgoing to a line by means of direct current without the use
30 of an electromagnetic relay. Other objects and features of the invention will appear more fully in the detailed description thereof hereinafter given.

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

40 In the drawing is shown one terminal of a carrier current telegraph system. Signals would come in from a distant station over the line L_2 . This line might include a receiving filter 4, an amplifier 5, a detector 6 and a receiving relay 7. The receiving relay 7 would be connected to
45 the subscriber's loop circuit 12 which would be of the balanced loop type. The subscriber's loop circuit would include the sounder S, transmitting key K_1 , the equal resistance arms R and R' and the resistances R_2 , R_3 , R_4 and the battery B_1 . Connected to the junction point of the
50 resistance arms R and R' would be the armature of the receiving relay with which would be associated contacts leading to the marking and spacing batteries B_2 and B_3 , respectively. For
55 transmission of signals to the distant station,

the line L_1 is provided. This line would include the sending filter 3 and a generator G for generating suitable carrier frequency currents. The carrier current produced by the generator G would flow freely through the resistances R_5 and
5 R_6 into the sending filter 3 to the line L_1 provided winding 1 of transformer T, which is bridged across the line, presents a small shunt loss to the circuit. If, however, winding 1 of
10 transformer T presents a low impedance path to the flow of carrier current, there will be a large flow of current in that winding and a corresponding large drop of carrier voltage applied
15 to the sending filter due to the drop across resistance R_5 . Under this condition, the outgoing carrier current is reduced to a small value and a spacing signal may be transmitted to the line.

Means whereby the winding 1 of the transformer T is made to present either a large or
20 small loss to the outgoing carrier current so that the transmission of signals may be controlled is the gas-filled discharge tube V and the circuits therefor. The secondary winding of the transformer is connected in series with the
25 filament and plate of the tube V. The filament and plate of the tube V are connected across the points A and B of the subscriber's loop circuit.

30 The method whereby the operation of the gas-filled discharge tube V controls the impedance of the winding 1 of transformer T will now be described. The subscriber's loop circuit 12, as heretofore pointed out, consists of the well known
35 balanced loop type arrangement with certain modifications for the purpose of actuating the gas-filled tube V. The armature of the receiving relay is connected to the midpoint of resistances R and R' . The resistance from this midpoint over the upper branch or arm of the sub-
40 scriber's loop, which includes resistance R_2 , sounder S, resistance R_4 , battery B_1 to ground, is practically equal to the resistance of the other branch or arm of the loop including resistance R_3 to ground. This may be arranged by proper ad-
45 justment of the resistances. When the receiving relay is on its marking contact and key K_1 is closed, about sixty milliamperes of current will flow from battery B_1 through resistance R_4 ,
50 sounder S, resistance R_2 , resistance R, battery B_2 to ground. This is due to the fact that the batteries B_1 and B_2 are so connected as to be an aid to each other. At the same time, current of
55 about thirty milliamperes will flow from ground through resistance R_3 , resistance R' , battery B_2

to ground. In other words, twice as much current will flow through the upper branch or arm of the loop circuit as will flow through the lower branch or arm of the loop circuit. Under these conditions there will be a difference of potential between the points A and B and point A will be positive with respect to point B. This is the condition for transmitting a marking signal. When the key K_1 is opened, there will be no current in the upper branch or arm of the loop circuit but the current in the lower branch or arm of the loop circuit will continue in the same direction and with the same magnitude as before. Under this condition, the potential difference across points A and B will be equal in value but reversed in polarity as compared to the case when key K_1 is closed. In other words, when key K_1 is opened or closed, reversals of polarity occur across points A and B.

Point A is connected through winding 2 of transformer T to the cathode of the gas-filled discharge tube V. Point B is connected to the anode of the tube V. A battery B_1 is provided between the grid and cathode of tube V for adjustment of the point at which a discharge will take place between the cathode and anode of tube V, if desired. When point B is negative with respect to point A, the plate of the tube will be negative with respect to the cathode, and no discharge can take place between the anode and cathode. Hence, the circuit including winding 2 of transformer T is open-circuited. Under this condition, winding 1 of transformer T will present a high impedance to the flow of carrier current through it (due to its high inductance) and the current from the generator will flow unimpeded to the sending filter 3 and line L_1 and thence to the distant station. When key K_1 is opened, point B becomes positive with respect to point A, as previously described. This will cause the plate of the tube V to become positive with respect to the cathode and a discharge will take place between the anode and cathode of tube V. When a discharge occurs in the tube V, the impedance between the anode and cathode becomes very low. Under this condition, transformer T is substantially short-circuited by the relatively low impedances R, R' and V in series. When this condition exists, the carrier current to the line L_1 is substantially cut off and a spacing signal is transmitted to the line L_1 and thence to the distant station. Accordingly, it will be seen that the outgoing carrier current from the generator G may be interrupted and controlled in accordance with the operation of the subscriber's key K_1 .

When signals are being received from the line L_2 , the key K_1 is kept closed. Accordingly, when the receiving relay armature is on either of its contacts, point B and hence the plate of tube V will always be negative with respect to the point A and the cathode of tube V. Therefore, incoming signals from line L_2 will have no effect on the steady outgoing carrier current to line L_1 .

While the invention has been disclosed as embodied in certain specific forms which are deemed desirable, it is understood that it is capable of embodiment in many and widely varied forms without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. A telegraph system comprising a transmitting circuit and a receiving circuit terminating at a station and a subscriber's loop circuit, said loop circuit being of the balanced loop type and comprising two equal resistance arms, a receiving relay having a winding connected to opposite ends

of said equal resistance arms and its armature connected to the junction point of said resistance arms, marking and spacing batteries of different polarities connected to the contacts of said receiving relay, a transmitting key and a battery in circuit with one of said resistance arms, whereby when said key is closed one of the ends of said resistance arms will be positive in polarity with respect to the opposite ends of the other and when said key is opened this condition will be reversed, a gas filled discharge tube having its filament and plate electrodes connected to opposite ends of said resistance arms whereby the operation and release of said tube may be controlled by the polarity relationship between opposite ends of resistance arms, and means controlled by said tube for controlling said sending circuit.

2. A telegraph system comprising a transmitting circuit and a receiving circuit terminating at a station and a subscriber's loop circuit, said loop circuit being of the balanced loop type and comprising two equal resistance arms, a receiving relay having a winding connected to opposite ends of said equal resistance arms and its armature connected to the junction point of said resistance arms, marking and spacing batteries of different polarities connected to the contacts of said receiving relay, a transmitting key and a battery in circuit with one of said resistance arms, whereby when said key is closed one of the ends of said resistance arms will be positive in polarity with respect to the opposite end of the other and when said key is opened this condition will be reversed, and whereby when said key is closed the connection of either said marking or said spacing batteries to said resistance arms will not change the existing polarity relationship between opposite ends thereof, a gas-filled discharge tube having its filament and plate electrodes connected to opposite ends of said resistance arms whereby the operation and release of said tube may be controlled by the polarity relationship between opposite ends of said resistance arms, and means controlled by said tube for controlling said sending circuit.

3. A telegraph system comprising a transmitting circuit and a receiving circuit terminating at a station and a subscriber's loop circuit, said loop circuit being of the balanced loop type and comprising two equal resistance arms, a receiving relay having a winding connected to opposite ends of said equal resistance arms and its armature connected to the junction point of said resistance arms, marking and spacing batteries of different polarities connected to the contacts of said receiving relay, a transmitting key and a battery in circuit with one of said resistance arms, whereby when said key is closed one of the ends of said resistance arms will be positive in polarity with respect to the opposite end of the other and when said key is opened this condition will be reversed, and whereby when said key is closed the connection of either said marking or said spacing batteries to said resistance arms will not change the existing polarity relationship between them, a gas filled discharge tube having its filament and plate electrodes connected to opposite ends of said resistance arms whereby the operation and release of said tube may be controlled by the polarity relationship between opposite ends of said resistance arms, and a transformer having its primary winding bridged across said sending circuit and its secondary winding connected in circuit with the filament and plate of said tube whereby when said tube is operated the

impedance of said transformer in shunt of said sending circuit may be varied to control the flow of signal current thereover.

5 4. A telegraph system comprising a transmitting circuit and a receiving circuit terminating at a station and a subscriber's loop circuit, said loop circuit being of the balanced loop type and comprising two equal resistance arms, transmitting apparatus in circuit with one of said arms,
10 means controlled by the operation of said transmitting apparatus for reversing the polarity rela-

tionship between opposite ends of said resistance arms, a gas filled discharge tube so connected to opposite ends of said resistance arms that its operation and release may be controlled by the polarity relationship between opposite ends of said resistance arms, a generator of carrier frequency signals connected to said sending circuit, an impedance shunted across said sending circuit, and means controlled by said tube for varying said impedance.

10 VAUGHN PENFOLD THORP.