July 10, 1923. 1,461,645

G. R. BENJAMIN

AUTOMATIC TELEGRAPH SYSTEM

Filed Nov. 4, 1916 2 Sheets-Sheet 1

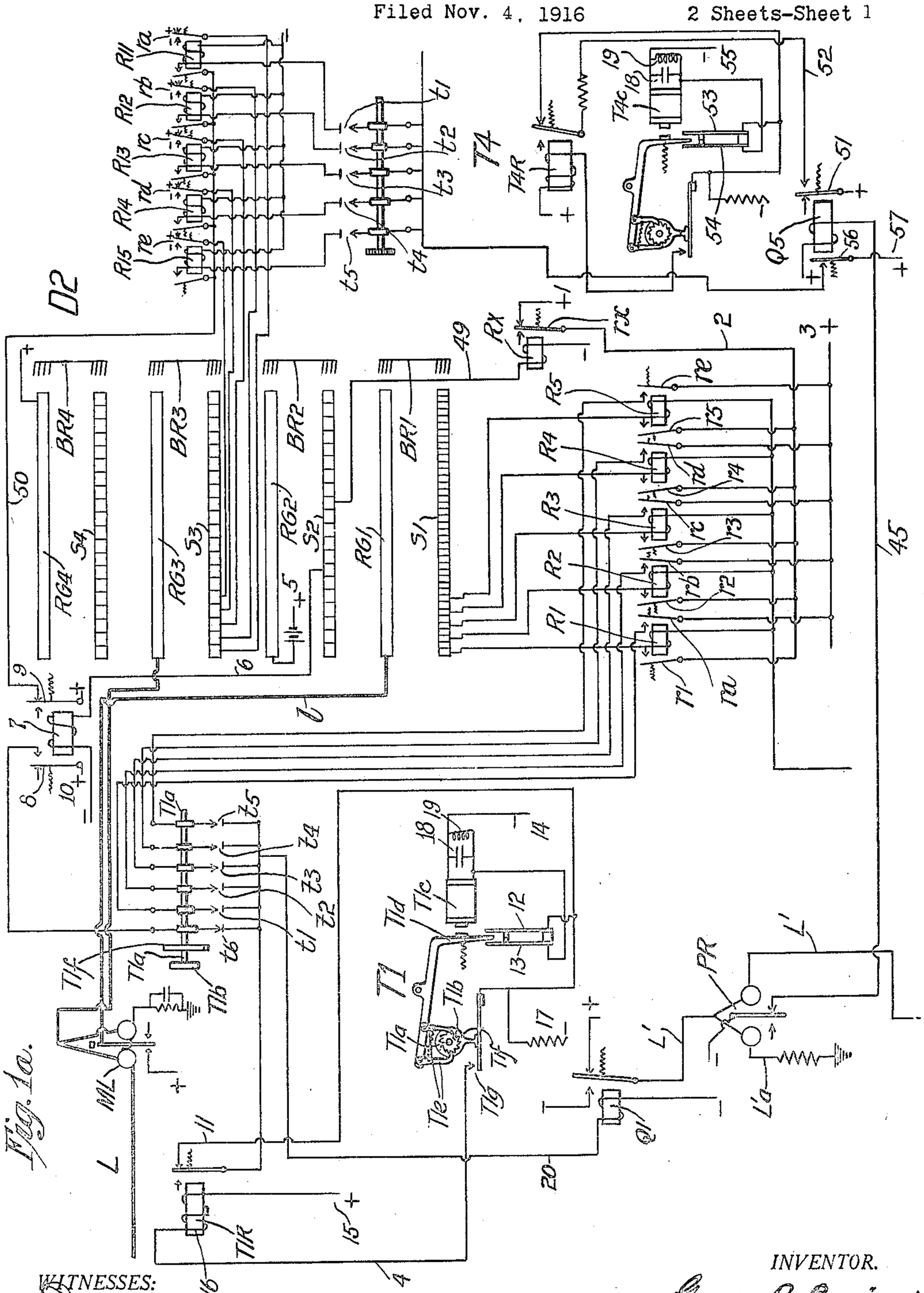

Fig. 1a.

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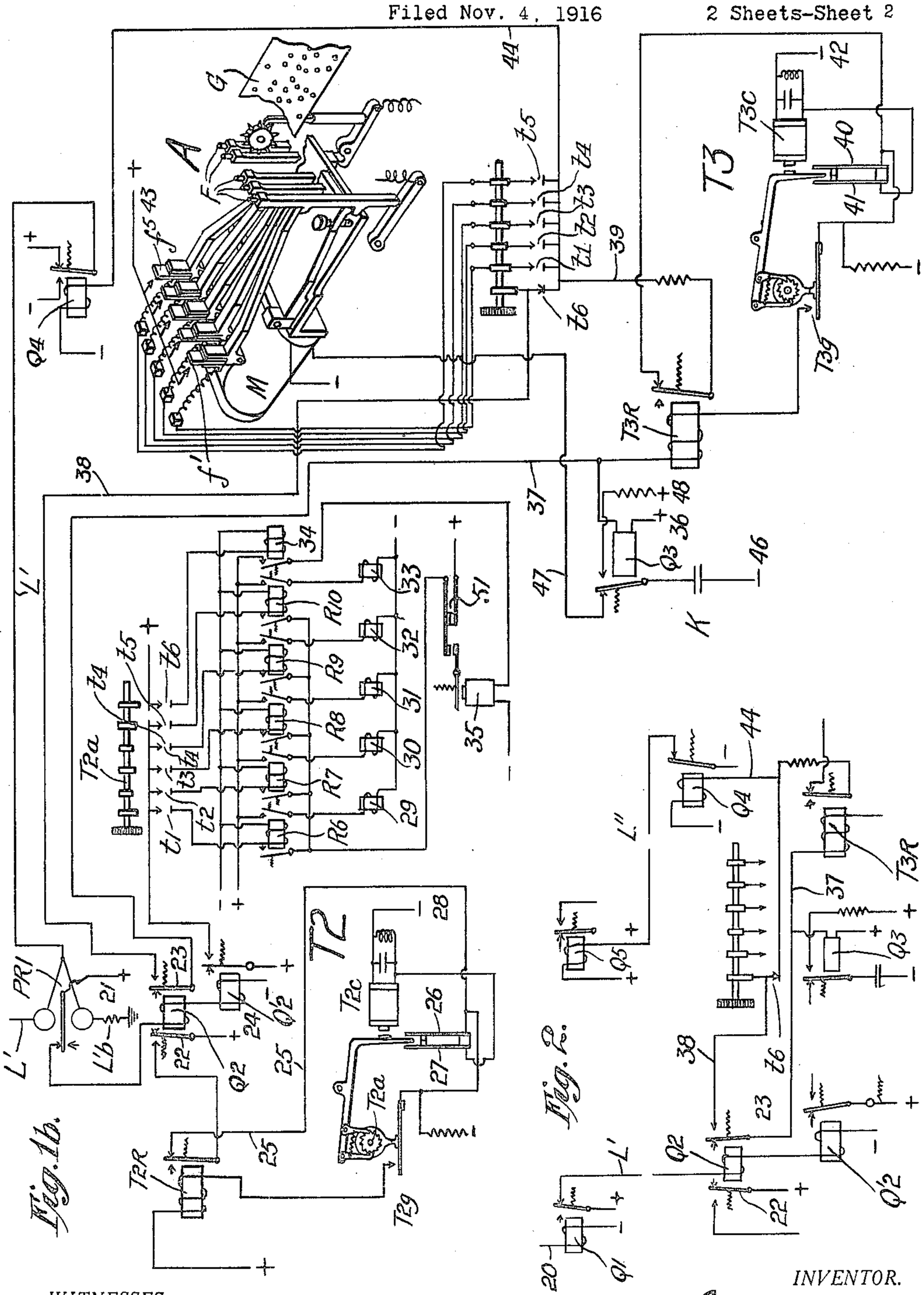

Fig. 1b.

Fig. 2.

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Patented July 10, 1923. 1,461,645

UNITED STATES PATENT OFFICE.

GEORGE R. BENJAMIN, OF JERSEY CITY, NEW JERSEY, ASSIGNOR TO THE WESTERN UNION TELEGRAPH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

AUTOMATIC TELEGRAPH SYSTEM.

Application filed November 4, 1916. Serial No. 129,421.

To all whom it may concern:

Be it known that I, GEORGE R. BENJAMIN, a citizen of the United States of America, and a resident of Jersey City, county of Hudson, and State of New Jersey, have invented certain new and useful Improvements in Automatic Telegraph Systems, of which the following is a specification.

My invention relates to improvements in automatic telegraph systems, and comprises means whereby receiving apparatus may be operated in an extension loop from one terminal of an automatic telegraph system, and whereby transmitting apparatus may operate through an extension loop into one terminal of an automatic telegraph apparatus. My invention also comprises various other features as hereinafter pointed out.

Synchronous telegraph systems, wherein transmitting and receiving distributers or commutators at two ends of a line, operate in synchronism, are well known; certain of which systems, for example, the well known Baudot system, and its modifications and adaptations, provide a plurality of simultaneous channels of communication in each direction. It is sometimes desirable to operate one or more extensions from such synchronously operating apparatus. For example, supposing there be a line between New York and Chicago with synchronously operated telegraph transmitting and receiving apparatus in both such cities, it may be desirable to operate automatically one or more loops extending from the main office in one or both such cities, to a branch office or subscriber's station; and it is often desirable at such branch office or subscriber's station, both to receive messages transmitted through the synchronous apparatus at the main station, and to transmit from such branch station or subscriber's station into the synchronous apparatus at the main station. Oftentimes it is desirable to transmit and receive, directly and automatically, between a branch station in the one such city and a branch station in the other such city, through the synchronously operated transmitting and receiving apparatus at the two cities mentioned, and through the line wire connecting such cities. Such operation is termed "extended loop operation." For use at such branch or subscribers' stations of the extension loop, synchronous apparatus of the type employed at the main stations is not convenient for various reasons, one of which is that the loop apparatus may be in operation intermittently only, and to put it into operation it must be brought into synchronism with the main office apparatus from which it is to receive, or into which it is to transmit; and this synchronizing takes some little time. Another reason is, that while little difficulty has been experienced in keeping two apparatus on the line in synchronism, much more difficulty would be experienced in keeping all of three or four apparatus in synchronism.

There is a type of automatic telegraph apparatus wherein both the transmitter and the receiver start operation at the beginning of transmission of a character, and come to rest at the end of the transmission of a character, restarting for the transmission of the next character, and so on; the interval of time required for the transmission of any one character being so short that, without the use of special synchronizing devices, the transmitting and receiving apparatus, if properly regulated, will not get "out of step" during the transmission of any one character; and since the transmitting and receiving apparatus start afresh for the transmission of each character, in practice they remain in step continuously. One system using such apparatus is what is known as the Cardwell system, involving "step-by-step" transmitting and receiving "translators", which translators start operation afresh at the beginning of transmission of each character, and stop at the end of the transmission of such character, starting afresh for the transmission of a new character. These Cardwell transmitting and receiving translators are in public use, and are, therefore, known apparatus; also, other transmitting and receiving apparatus of the restarting type are known.

I have found that automatic telegraph apparatus of the type which starts afresh for the transmission of each character, and stops at the end of the transmission of each character, is particularly adaptable for extended loop operation of the type referred to above. For distinction, I will term the main synchronously operating telegraph apparatus "continuously operating synchronous apparatus", and will term the exten-

sion loop apparatus, which starts afresh for the transmission of each character, and ceases operation at the end of the transmission of such character, "restarting apparatus", the said Cardwell apparatus being one example of such "restarting" apparatus. Such "restarting" apparatus commonly requires a special starting pulse to start it in operation for the transmission of each character, and in the system herein described the "continuously operating synchronous apparatus" not only repeats into the "restarting" apparatus, (or, alternatively, or simultaneously, the "restarting" apparatus repeats into the "continuously operating synchronous" apparatus), but such "continuously operating synchronous apparatus" provides the starting pulses required for the operation of such "restarting" apparatus.

The object of my invention is to facilitate, and make entirely automatic, the operation of transmitting and receiving apparatus operating through circuit means extending from or to "continuously operating synchronous" apparatus, particularly multichannel apparatus of the general Baudot type; and to accomplish this object by relatively simple and reliable means.

I will now proceed to describe my invention with reference to the accompanying drawings, and will then point out the novel features in claims.

In said drawings:

Figures 1^a and 1^b, together constituting one figure, show diagrammatically, a main receiving and transmitting distributer of the general Baudot type, located at one end of a line conductor, that is to say, located at a main station, together with an extension circuit conductor and transmitting and receiving apparatus adapted to receive automatically from and to transmit automatically into, the said main distributer, a single conductor only being employed for transmission from or into such main distributer. Figure 1^a shows the apparatus at the main station, and Figure 1^b the apparatus at the branch or subscriber's station.

Figure 2 is a fragmentary diagram illustrating the use of two conductors for transmission from and into such main distributer, in lieu of the "duplex" arrangement, illustrated in Figures 1^a and 1^b and requiring only one such conductor.

In the drawings D^2 designates a combined transmitting and receiving distributer of the general Baudot type, and, particularly, of the type illustrated and described in the patent to G. M. Yorke and myself No. 1,298,622, dated March 25, 1919, and comprising alternate plain and segmented commutator rings arranged in pairs, each such pair being provided with connecting brushes, BR^1, BR^2, etc., which brushes, in the apparatus as actually constructed, rotate along the faces of said commutator rings. These rings are shown "developed" in the drawing. Certain of the rings have functions into which it is not necessary to go in the present description. For the present it suffices to say that rings RG^1 and S^1 are receiving rings; that a main receiving polar relay ML repeats, from a line L through a conductor *l* into ring RG^1, signals received from a main line L, and that such signals are transmitted, through brushes BR^1, into the segments of ring S^1. The segments of this ring S^1 are divided into four groups of five segments each, and each segment of one such group is connected electrically to the magnet coil of a corresponding relay of a group of relays R^1–R^5 inclusive, and thence to a source of current supply, indicated by a — sign. (I have not illustrated circuits for the other groups of segments of ring S^1, as these other segments pertain to other "channels of communication"). These relays are "self-locking", that is to say, the magnet of each relay, when energized, attracts the two armatures with which it is provided, one of which armatures, designated by character r^1 or r^2, etc., closes a local circuit from a source 1 through the back contact and armature *rx* of the relay R*x* and conductor 2 and the armature r^1, r^2 etc., as the case may be, and the magnet coil of the corresponding relay R^1, R^2, etc., as the case may be, to return. The magnets of relays R^1, R^2, etc., so energized from the source 1, remain energized until the rear contact of relay R*x* is broken by means hereinafter described. When the magnet of such relay R^1, R^2, etc., is energized as above described, circuit is completed from a source 3 through the second armature, *ra*, *rb*, etc., as the case may be, of such relay to a corresponding one of a series of contacts t^1, t^2, etc., of a translator T^1. This translator T^1 may be understood to be a Cardwell transmitting translator, which as previously stated, is a known instrument. I illustrate this translator diagrammatically only, and without attempt at even diagrammatic illustration of the actual details of construction; the illustration being, however, of such nature that the general plan and method of operation of the instrument will be apparent, in connection with the following description, to those skilled in automatic telegraphy, even without acquaintance with the said Cardwell transmitting translator.

The said transmitting translator T^1 comprises a cam shaft T^1a, having a series of cams thereon, as hereinafter described; a ratchet wheel T^1b on said shaft T^1a, a ratchet magnet T^1c, an armature therefor T^1d, and double-pawl ratchet mechanism T^1e driven thereby, and arranged to advance ratchet wheel T^1b one step on each

instroke, and another step on each outstroke, of the armature T^1d. The cam shaft T^1a and its ratchet wheel T^1b are shown twice in the upper left hand corner of Figure 1, being shown once in connection with contacts t^1, t^2, etc., and being shown again in connection with this magnet T^1c; this is for convenience in illustration.

The translator T^1 comprises, besides the contacts t^1–t^5, a further contact t^6, which latter contact, when the instrument is at rest, is closed; the contacts t^1–t^5 inclusive, being open, when the instrument is at rest. The cam shaft T^1a comprises six cams, one corresponding to each of the said six contacts, these cams being spaced angularly about the shaft, so that as that shaft rotates, contact t^6 is first broken, and then contacts t^1–t^5 are completed and then broken, successively, contact t^6 being finally closed just before the cam shaft T^1a comes to rest at the end of the cycle of operations. The said shaft T^1a carries, besides the six cams corresponding to contacts t^1–t^6, a further cam T^1f for actuating a contact T^1g in a local magnet circuit 4 of a relay T^1R. This circuit 4 is closed the instant cam shaft T^1a starts to rotate from its rest position. The function of the circuit 4 and contact T^1g will be explained hereafter.

It will be understood by those skilled in the art, that the brushes of the distributor D^2 rotate in synchronism with the brushes of a similar distributor (not shown) at the distant end of line L; that at the time when brushes BR^1 are passing over the segments of ring S^1 corresponding to relays R^1–R^5 inclusive, a corresponding series of segments of a transmitting ring of a distant distributor are being connected successively, to the contacts of a transmitter. The signals of the Baudot system consist each of five impulses, some of which impulses are positive and others negative; the various permutations required to make up the various signals of the alphabet being obtained by varying the polarity of the pulses. It may be understood that the relays R^1–R^5 inclusive are to respond to pulses of one polarity only, (for example, positive pulses,) transmitted through line L. That is to say, if the first, third and fifth impulses of a character so transmitted are positive and the second and fourth negative, only relays R^1 R^3, and R^5 will be operated, and therefore only contacts *ra*, *rc* and *re* of series *ra*–*re* will be closed; and, by the closing of such contacts circuit paths will have been completed from source 3 to contacts t^1, t^3 and t^5 of translator T^1.

In other words, at each revolution of brushes BR^1 a series of contacts is "set up" in relays R^1–R^5, which contacts are in series circuit with corresponding contacts of series t^1–t^5 of the transmitting translator T^1.

An instant after such contacts are so set up in the relays R^1–R^5, brush BR^2 connects ring RG^2 with a segment of ring S^2, thereby completing a circuit form a source 5 through rings RG^2 and S^2 and a conductor 6 to the magnet coil of a relay 7, and thence to return. Thereby both armatures 8 and 9, of that relay, are attracted. For the present we are interested only in the attraction of armature 8. This armature, when so attracted, makes contact with the corresponding front stop of the relay, closing a circuit path from a source 10 to the contact t^6 of translator T^1 and thence through armature and back contact of relay T^1R and conductor 11 to contact springs 12 and 13 (which are then in contact) and thence through the ratchet magnet T^1c of translator T^1 to return at 14. Thereby the magnet T^1c is energized, advancing the ratchet wheel T^1a through the space of one tooth and in so doing moving cam T^1f so as to permit contact T^1g to close.

The current impulse thus transmitted by relays 7 through contact t^6 and the magnet T^1c is the "starting" pulse. The instant contact T^1g is closed, a circuit path is closed from source 15 through coil 16 of relay T^1R, and conductor 4 to return at 17, whereby the armature of relay T^1R breaks the circuit of conductor 11 through which magnet T^1c was energized by the starting pulse, as just explained; but so long as contact T^1g remains closed, there is a circuit path from source 15 through coil 16, conductor 4 and contact T^1g to spring 12, and thence through spring 13 (when in contact with spring 12) to magnet T^1c and thence to return at 14. Contact springs 12 and 13 are separated by the action of armature T^1d when that armature nears the pole of its magnet T^1c, and are brought in contact again when such armature retracts. We have here, therefore, the action of the familiar vibrator, whereby magnet T^1c is alternately energized and deenergized; and a condenser 18 and inductive resistance 19 time or "tune" the circuit of magnet T^1c so as to regulate as desired the rate of vibration of armature T^1d.

By the alternate magnetization and demagnetization of magnet T^1c and consequent attraction and retraction of its armature, the ratchet wheel T^1b is rotated step-by-step, and thereby the contacts t^1, t^2, etc., of the translator are closed in succession, and then each are broken, before the next contact is closed, until, after contact t^5 has been closed and then broken, contact t^6 is closed; whereupon cam T^1f opens contact T^1g, breaking the circuit of magnet T^1c and so stopping the

operation of the translator. As each of the contacts t^1–t^5 is closed, if the corresponding relay contact *ra–re* is at the same time closed, a circuit will be completed from the source 3 through such relay contact and such translator contact, and conductor 20 to a transmitter relay Q^1.

Each time the magnet of relay Q^1 is energized a signal will be transmitted through a line L′, containing two polar relays PR and PR^1; (for PR^1 see Figure 1^b); the line L′ having also artificial lines L′*a* and L′*b*, also passing through magnets of said polar relays PR and PR^1; in other words, the line L′ is "duplexed" between relays PR and PR^1; the reason for which will be explained hereafter. Line L′ extends to return through the armature and back contacts of a relay Q^4 to be referred to hereinafter. When, as a result of the energization of the magnet relay Q^1, a signal is transmitted through line L′, relay PR^1 is operated, but relay PR is not operated, as will be understood by those familiar with the principles of the polar duplex; and thereby a circuit (normally complete from a source 21 through the armature of relay PR^1 and through the magnet coils of relays Q^2 and Q'^2 to return) is broken, whereby the two armatures, 22 and 23, of relay Q^2 are retracted, as is the armature of relay Q'^2. At present we are interested only in armature 22. This armature, when retracted, closes a circuit from a source 24 through the back contact corresponding to such armature and the armature and the back contact of a relay T^2r, and the conductor 25, to contact springs 26 and 27 (then in contact with each other) and the coil of magnet T^2c to return at 28. This magnet T^2c is the rotor magnet of a second translator T^2; and the contact springs 26 and 27, correspond to the contact springs 12 and 13 of the translator T^1. It is unnecessary, therefore, to describe the operation of this translator T^2 for obviously it operates in the same manner as the translator T^1, and in its operation, rotates a cam shaft T^2a closing contacts t^1–t^6, in succession.

Assuming, as may properly be done, that the two translators T^1 and T^2 operate in unison, any telegraph character transmitted, as above described, through translator T^1 and relay Q^1, will be transmitted to translator T^2 (which translator T^2, it will be understood, is located at the branch office or subscriber's station). The contacts t^1–t^5 of translator T^2 control printer-selecting relays R^6–R^{10} respectively, which relays in turn control selecting magnets 29–33 respectively; while the sixth contact t^6, of translator T^2, controls a relay 34 controlling the printing magnet 35 of the automatic printer of which magnets 29–33 control selecting mechanism. It will be apparent that upon the transmission of each marking pulse transmitted through the line L′, the magnet of relay Q'^2 will be deenergized and a current pulse transmitted through that contact of series t^1–t^5 of translator T^2 which is closed at the instant, to the magnet of the corresponding selecting relay of series R^6–R^{10} and thence to return. I have not thought it necessary to show the mechanism of the printer, as various automatic printers arranged to be controlled by a series of five selecting magnets, and to be operated through the energization of a printer magnet, are well known. It will be apparent to those skilled in the art that, by the means so far described, a telegraphic character transmitted from translator T^1 to translator T^2 will cause the printing of such character by the printer represented in the accompanying drawings by the magnets 29–33 inclusive, and the printer magnet 35.

As will be noted, the printer relays R^6–R^{10} are self-locking, in the same sense as are the relays R^1–R^5 associated with distributor D^2.

Relay Q^2 also controls, by its armature 23, a transmitting translator T^3 at the said branch office or subscriber station, at which translator T^2 is located. When the magnet of relay Q^2 is deenergized, as above stated, as a result of transmission of a signal pulse through line L′, the armature 23 of this relay Q^2, being retracted, makes contact with its back contact stop, thereby completing a circuit from a source 36 through the magnet of a relay Q^3 and thence through a conductor 37, the said armature 23 and its corresponding back contact and a conductor 38, to the contact t^6 (then closed) of translator T^3 and a conductor 39, the armature and back contact of a relay T^3R, and contact springs 40 and 41 (then in contact with each other) and the rotor magnet T^3c of the translator T^3, to return at 42. The mechanism of this translator is precisely similar to that of the translator T^1, and therefore it will be apparent that the "starting pulse" thus transmitted from armature 23 of relay Q^2, will start translator T^3 in operation, and will cause the immediate opening of contact t^6 of that translator, followed by the successive closing and opening of contacts t^1–t^5 of that translator T^3 and finally by the closing of contact t^6 of that translator, the opening of contact T^3g, and the consequent stopping of the operation of that translator.

A designates a perforated-tape-controlled automatic transmitter located at the branch or subscriber's station. The illustration of such transmitter contained in Figure 1^b is intended to be diagrammatic only and not to illustrate actual details of construction, and as many such perforated-tape-controlled transmitters which are adaptable for use in the present system, are known, it

suffices to say at present that this transmitter comprises an operating magnet M and a series of feelers F adapted to engage corresponding holes in the perforated-tape-strip G, together with contacts f^1–f^5, one or more of which will be closed, selectively, for the sending of each telegraph character, upon the deenergization of magnet M; the particular contact or contacts f^1–f^5 which are so closed being determined by the perforated tape. Contacts f^1–f^5 so closed complete circuit paths from a source 43 to contacts t^1–t^5 respectively of translator T^3. At the time the translator T^3 is started in operation by a starting pulse sent, as previously described, from relay Q^2, it may be assumed that a character-combination of the series of contacts f^1–f^5, has already been set up in the transmitter A. Therefore, as the translator T^3 operates, it is apparent that this transmitter will operate, through circuit conductor 44, relay Q^4, which relay therefore will transmit the same character through line L′ to relay PR at the main station, which relay will repeat such character through conductor 45 and relay Q^5, into translator T^4, located at the main office. When, upon the completion of the transmission of the character, translator T^3 at the branch office stops its operation, and its contact T^3g is broken, the magnet of relay Q^3 is deenergized and its armature is retracted, whereby a circuit is completed from 46 through condenser K and the back contact of relay Q^3 and through conductor 47 and the magnet M of the transmitter A, to return; whereby that magnet, being energized by discharge of the condenser, operates means causing feeding forward the tape G another space, so permitting the selection of another combination of the contacts of the series f^1–f^5 preparatory to a further operation of the translator T^3. The condenser K charges, during the period of energization of the magnet of relay Q^3, from a source 48. This condenser is employed, both to insure a strong action of the magnet M, and also to insure that only a brief current shall pass through the magnet M; in effect, the circuit of conductor 47 is opened at the condenser, at the conclusion of the discharge of such condenser, and remains open until the next discharge of the condenser.

For further explanation of the construction and operation of the particular transmitter A indicated in the drawings, I refer to the above mentioned Yorke-Benjamin Patent No. 1,298,622, or to my Patent No. 1,298,440 dated March 25, 1919. It will be seen that this transmitter A performs with respect to the translator T^3, the same function as is performed with respect to translator T^1 by relays R^1–R^5.

When relay Q^2 operates to start translator T^3 in operation, not only is the starting pulse transmitted through contact t^6 of translator T^3 to the ratchet magnet T^3c of that translator, but also a current pulse is transmitted through contact t^6 and conductor 44 to the magnet of relay Q^4, which relay then transmits a starting pulse through line L′ to relay PR, which relay, being thereby operated, breaks the circuit through conductor 45, deenergizing relay Q^5, and closing a circuit from a source of current supply through the armature 51 and back contact of relay Q^5, conductor 52, and the armature and back contact of relay T^4R to contact springs 53 and 54, then in contact, and thence through the ratchet magnet T^4c of translator T^4 to return at 55; whereby translator T^4 is started in operation, just as the other translators of the system are started in operation as previously described. Translator T^4 being thus started in operation simultaneously with the starting of translator T^3, and being regulated to run at the same speed as translator T^3, will naturally operate in synchronism therewith. When so started in operation, it will first close its contact t^1, and will then close the other contacts of its series t^1–t^5, in succession, and concurrently with the closing of contacts t^2–t^5, respectively, of translator T^3.

As previously explained, each row of perforations of tape G, when over the row of feelers F of transmitter A, sets up a particular combination of the contacts f^1–f^5 of that transmitter upon the deenergization of the magnet M of that transmitter; that is to say, one or more of the contacts f^1–f^5, are closed. When one of the contacts t^1–t^5 of translator T^3, which corresponds to and is in series circuit with a closed contact of series f^1–f^5 of the transmitter A, is closed, circuit is completed from source 43 through that closed contact of series f^1–f^5 of transmitter A, and the corresponding closed contact of series t^1–t^5 of translator T^3, through conductor 44 and the magnet of relay Q^4; whereby that relay is again operated and caused to transmit a current pulse through line L′ to relay PR; and this latter relay being then operated, again breaks the circuit through conductor 45 again deenergizing relay Q^5, and causes the second armature 56 to drop back, thus closing circuit from a source 57 through that armature and its back contact to the contact of series t^1–t^5 of translator T^4 corresponding to the contact of series t^1–t^5 of translator T^3 closed at that instant (such contact of translator T^4 being also closed at the instant); thereby energizing a corresponding relay magnet of the series of relays R^{11}–R^{15} respectively. (Armature 56 of relay Q^5, of course, falls back when the magnet of that relay is deenergized upon the sending of a starting signal by relay PR as previously described;

but at the time of the sending of the starting signal, the falling back of the armature 56 is not effective upon the contacts t^1–t^5 of translator T^4, because none of the contacts of that series are then closed.) Relays R^{11}–R^{15} are self locking relays in the same sense as relays R^1–R^5 inclusive, and their contacts R*a*–R*e*, respectively, are connected to corresponding segments of ring S^3 of distributer D^2.

It will be apparent that by each cycle of operations of transmitter A and translators T^3 and T^4, a combination of contacts, of relays R^{11}–R^{15}, is set up, corresponding to the perforations in the particular row of the transmitter tape which has set up a combination of contacts in transmitter A. When, as the brush BR^3 passes over the segments of rings S^3 which are connected to the contacts of series R*a*–R*e* of relays R^{11}–R^{15}, that brush passes over segments which are connected to closed contacts of such series R*a*–R*e*, a current pulse will be transmitted in the line L and thence to the distant station.

Shortly after the conclusion of the reception of a telegraph character from line L through relay ML and segments of ring S^1, brush BR^2 contacts with a segment of ring S^2 and completes a circuit through conductor 49 and relay R*x* thereby breaking the circuit through armature *rx* and conductor 2, and permitting restoration of the armature r^1–r^5 of relays R^1–R^5, to normal; i. e., "clearing" said relays. Upon the energization of the magnet of relay 7, immediately following the passage of the brush BR^1 over the groups of segments of ring S^1 corresponding to relays R^1–R^5, a circuit from the armature of relay 7 through conductor 50 is broken, whereby the armatures of relays R^{11}–R^{15} are permitted to retract or return to normal, thus "clearing" that bank of relays. When printing magnet 35 is energized, it opens a contact 51 in the locking circuit of relays R^6–R^{10} inclusive, thereby "clearing" that bank of relays.

For the purposes of the following claims it may be considered that relays R^1–R^5 inclusive, R*x* and 7 are a part of distributer D^2; that relays T^1R and Q^1 are a part of the translator T^1; that relays T^2R, Q^2 and Q'^2 and R^6–R^{10} inclusive, and 34, are part of the translator T^2; that relays T^3R, Q^3 and Q^4 are part of the translator T^3; and the relays Q^5, T^4R and R^{11}–R^{15} are part of the translator T^4.

For convenience, in certain of the following claims, translators T^2 and T^3 are referred to as "distant" translators, or translators located at a distant point, and translators T^1 and T^4 as "home" translators.

Obviously, instead of "duplexing" the extension conductor L', separate outgoing and return extension conductors may be employed. This is illustrated in Figure 2, wherein, for simplicity only the instruments directly connected with the incoming and outgoing extension lines L' and L'' are illustrated; similar reference characters to those employed in Figures 1^a and 1^b being employed in Figure 2, so that the connection between Figure 2 and Figures 1^a and 1^b is apparent.

The translators shown in this application are of the step-by-step or "vibrating" type, this type of translator having special advantages. However, other types of translators may be employed, and in my prior Patent No. 1,370,402, I have shown translators of the sunflower type, in lieu of the vibrating translators shown herein.

In referring hereinabove to the Baudot system, and to the Baudot five-unit code, I do not intend to limit my invention to use with a Baudot system, or Baudot apparatus, or to use with a Baudot code. My invention is suitable for use in connection with any system or apparatus employing a code having the same number of current impulses for each character; for example, with systems the characters of which, or some of them, are made up of positive, negative and no-current units.

What I claim is:—

1. In an automatic telegraph system, the combination with a continuously operating synchronous distributer adapted to receive main line signals, of extension circuit means, transmitting means therefor controlled by such distributer and adapted to transmit telegraphic signals received therethrough, but non-synchronous with respect to said distributor, receiving means connected to such extension circuit means and operated by signals transmitted therethrough, and other transmitting means and actuating mechanism therefor likewise controlled by said distributer for a start impulse and thereafter free from all control of said receiving means and adapted for transmitting, through such extension circuit means, into said distributer and thence into a main line.

2. In an automatic telegraph system, the combination with a continuously operating, synchronous main line distributer, of extension circuit means extending to a distant point, means operated by such distributer for repeating into such extension circuit means, receiving means at the distant point arranged to receive signals so repeated, transmitting means at the distant point arranged to transmit through such extension circuit means, a receiving translator in connection with such distributer but non-synchronous with respect thereto and arranged to receive signals so transmitted from the distant point, said transmitting means and said receiving translator being each provided with actuating mechanism, controlled

by said distributer for a start impulse and thereafter each free from all control of the other and of said extension circuit receiving means, and a bank of relays having contacts connected to segments of a transmitting ring of such distributer, the magnets of said relays controlled by said receiving translator.

3. In an automatic telegraph system, the combination with a continuously operating, synchronous main line distributer, of extension circuit means extending to a distant point, means operated by such distributer for repeating into such extension circuit means, receiving means at the distant point arranged to receive signals so repeated, transmitting means at the distant point comprising a restarting translator, such transmitting means and translator arranged to transmit through such extension circuit means, and repeating means arranged to receive signals so transmitted from the distant point and to repeat them into said main line distributer, and comprising a receiving translator and actuating means therefor controlled by said distributer for a start impulse and thereafter free from all control of said distributer-operating means, and means controlled by said receiving translator for setting up contact combinations corresponding to the signals received, said distributer comprising means controlling the time of transmission into it from the contact combinations so set up.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

GEORGE R. BENJAMIN.

Witnesses:
H. M. MARBLE,
PAUL H. FRANKE.