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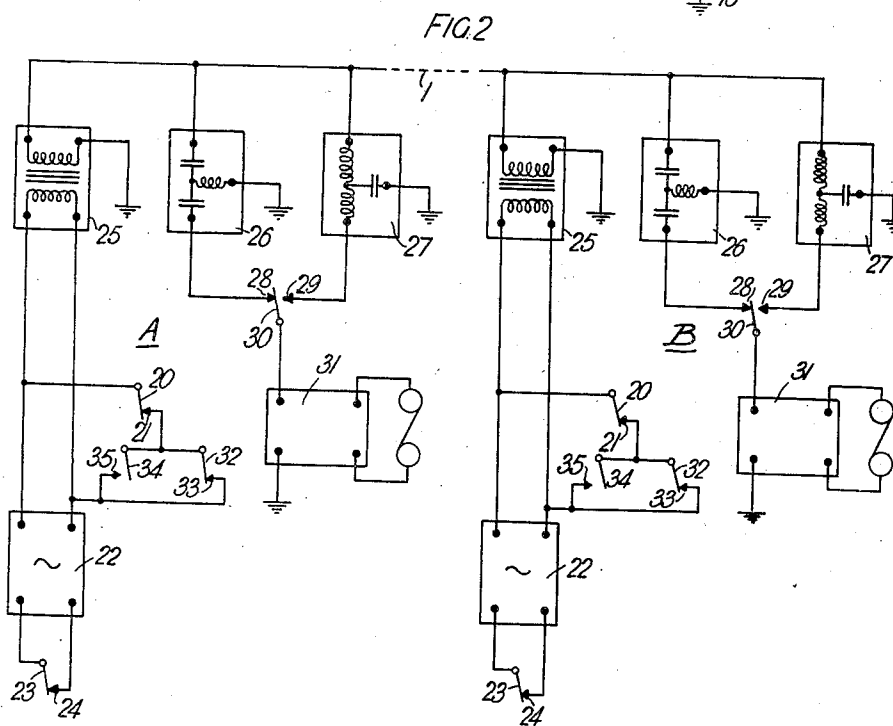
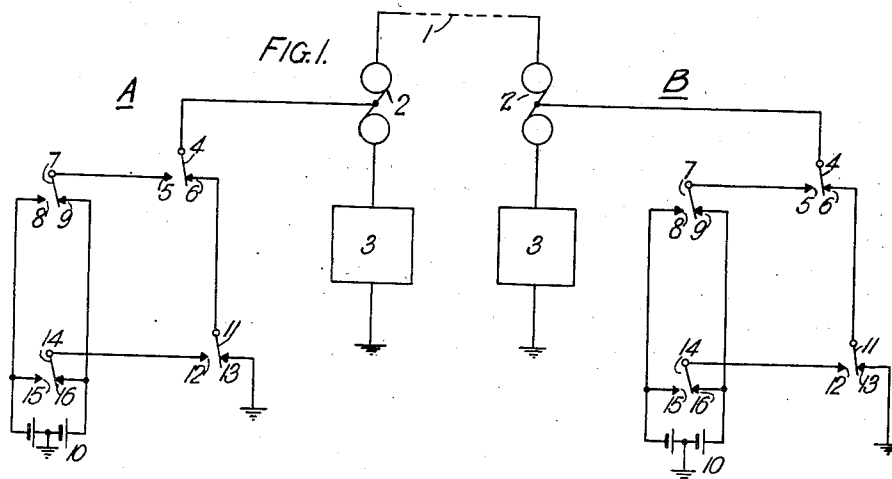
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1,923,724

TELEGRAPH SYSTEM

Filed Feb. 29, 1932

3 Sheets-Sheet 1



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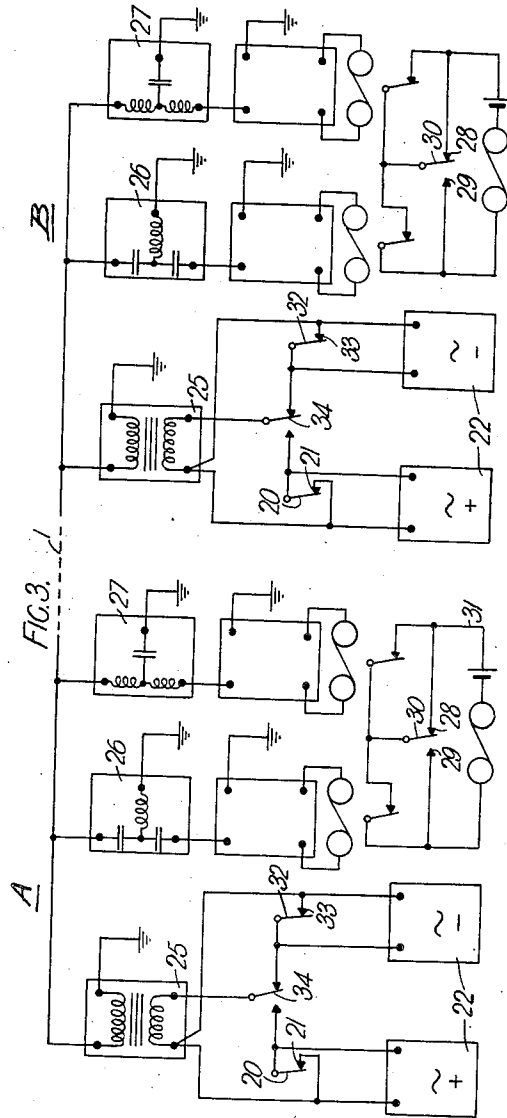
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3 Sheets-Sheet 2



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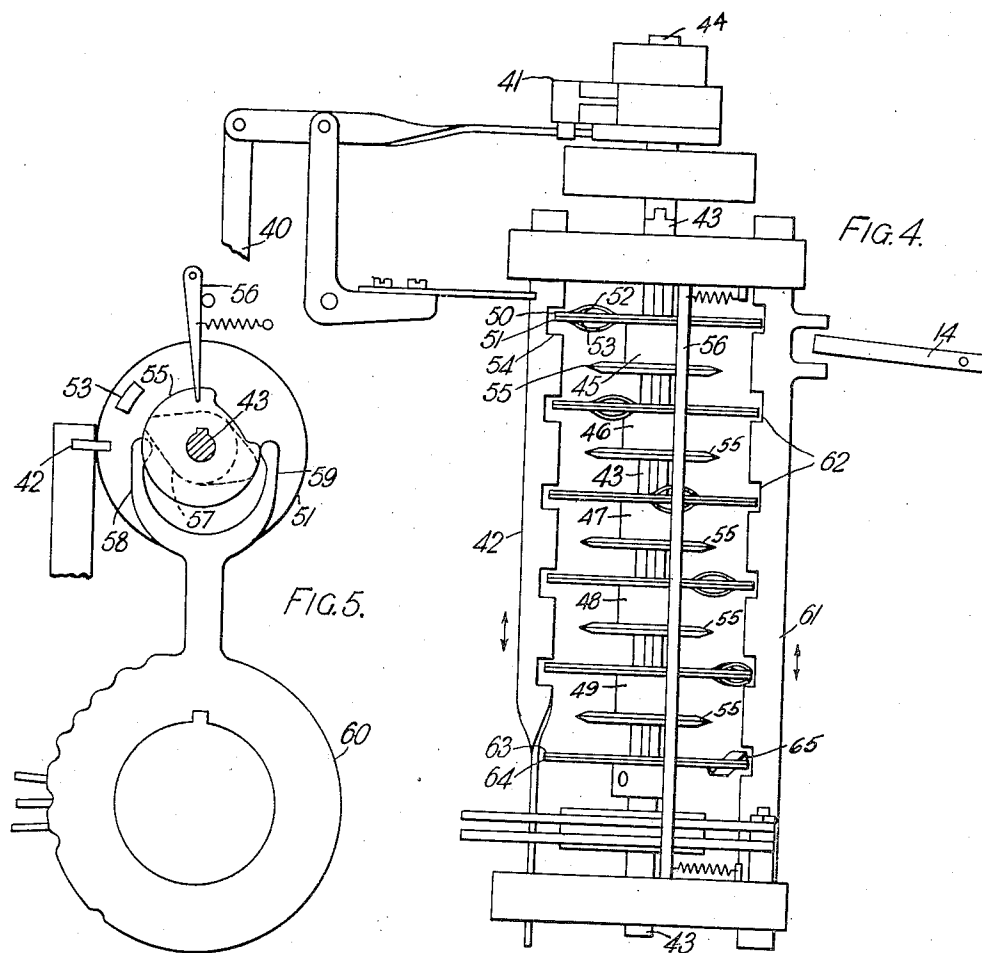
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TELEGRAPH SYSTEM

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3 Sheets-Sheet 3



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## UNITED STATES PATENT OFFICE

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## TELEGRAPH SYSTEM

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11 Claims. (Cl. 178—23)

This invention relates to telegraph systems wherein means is provided for obtaining at a signal transmitting station a record of the signals as received at a distant signalling station.

5 In certain signalling systems it is a great advantage for an operator at a transmitting station to be able to receive an indication that the signals which are being transmitted from that station are being correctly received at a distant station with which it is in communication. In remote control and signalling systems generally, various means have been devised for the purpose of returning this indication to a transmitting or control station. In a telegraph system, means 10 have been proposed for inter-connecting and inter-locking transmitting apparatus at one station with receiving apparatus at a distant station so that each one of a series of controlled operations in selecting a printing character at a distant station is required to be correctly effected before the next controlling operation at the transmitting station for the selection of the character can be effected.

This latter system is relatively complicated, and where, as is often the case in telegraph systems, either of two stations at the ends of a line circuit may be the transmitting station in turn at which the return signals are required the complications would be increased in the application of the methods of this latter system.

According to the present invention a telegraph system comprises a plurality of signalling stations each having signal responsive means, signal transmitting means, and other means operatively associated with said signal responsive means for re-transmitting to a transmitting station the signals as received therefrom. The signal transmitting and signal receiving means employed is preferably printing telegraph apparatus of the type in which each printing character is selected by means of a signal combination consisting of a permutation of a group of signal impulses. In apparatus of this class it is usual for the signal responsive means to actuate a series of permutation members preparatory to the selection of a printing character.

It is preferable for these permutation members, therefore to control the signal re-transmitting means of the present invention, in addition to effecting the selection of a printing character in the receiving apparatus. The signals as re-transmitted thus serve as a check on the signal combination as set up in the distant receiving apparatus. It will be appreciated however, that considerable modifications both with regard to

the types of apparatus and to the manner in which the signal re-transmitting means is controlled by the signal receiving means are possible, but as these modifications will readily occur to those skilled in the art it is not considered necessary to describe the details. 60

An important feature of the invention resides in the provision of means in a system of this kind for rendering inoperative the signal re-transmitting means at a station during the transmission of signals therefrom, and thereby preventing re-transmission from an originating station. 65

It will be seen from the following that the application of the invention is not limited to the single wire circuits of the examples hereinafter shown for it can be applied to a system employing any connecting medium such as a metallic loop or a radio link, in which signalling can be effected simultaneously in opposite directions. 70

In Fig. 1 of the accompanying drawings the invention is shown as applied to a single wire line circuit and in which signal impulses of direct current are transmitted in the line circuit. In Fig. 2 the invention is shown as applied to a system in which alternating current signal impulses of two different frequencies for the transmitted and re-transmitted signals respectively are employed. Fig. 3 shows the application of the same principles in a system suitable for multi-channel voice frequency apparatus and Figs. 4 and 5 75 show an example of means which can be employed for controlling signal re-transmitting contacts in response to received signals. 80

Referring to Fig. 1, a single line wire 1 connects two separate signalling stations A and B. The arrangements at each station are identical, similar reference numerals being employed for like apparatus at each station. A receiving relay 2 at each end of the line is connected to earth through line balancing means 3 in the usual manner for providing a duplexed line circuit. The midpoint of receiving relay 2 is connected to a switch contact lever 4 which is operable between contacts 5 and 6. Contact 5 is connected to the signal transmitting contact lever 7 of a transmitting apparatus (not shown) which may be of any convenient type as previously mentioned. The lever 7 is actuated in accordance with signals to be transmitted from one or the other of two contact stops 8 and 9 connected to opposite poles of an earthed signalling battery 10 in the known manner. The contact lever 4 when no signals are being transmitted is arranged to make contact with contact stop 6 but immediately on lever 7 being actuated by the signal transmitting apparatus 110

is arranged to be actuated, preferably by this transmitting apparatus, to the opposite stop 5 and to remain in that position during the transmission of signals and to return to stop 6 on the cessation of the transmission of signals.

Contact lever 4 as thus described is very similar in operation to that of the well known send-receive switch means generally utilized in printing telegraph apparatus wherein signal transmitting apparatus is connected to a line during operation of the transmitting apparatus but on cessation of transmission connects the line to earth through signal receiving apparatus instead in order to put the station in a condition to receive signals in pauses between signalling. Contact lever 4 in the present case, however, although actuated in a similar manner performs functions entirely different from those of a send-receive switch as it will be appreciated that in the arrangement of Fig. 1 receiving relay 2 is at all times in a condition to receive signals from the distant station. For reasons which will hereinafter be evident, it is preferable also to arrange that lever 4 is maintained on contact 5 for a short interval following the cessation of transmission of signals instead of returning immediately upon this cessation. The modifications for this purpose will readily suggest themselves.

Connected to the normal or rest position contact stop 6 is a contact lever 11 operable between stops 12 and 13 connected to a signal re-transmitting contact lever 14 and earth respectively. Contact lever 11 is arranged to be actuated from contact 13 to contact 12 on reception of signals through relay 2 and to be maintained in this position during continued reception of signals. This is preferably effected by the receiving apparatus in a similar manner to that in which lever 4 is actuated by the transmitting apparatus during transmission of signals. Signal re-transmitting contact lever 14 is arranged to be actuated in accordance with received signals between contacts 15 and 16 connected to the opposite poles of the signal battery 10. As already mentioned this actuation is preferably effected under control of permutation members in the signal receiving apparatus which are set in accordance with the signal impulses as received on relay 2. As the means for this purpose only involves the adaptation of known signal receiving and signal transmitting mechanisms it is not thought necessary to describe these details.

The operation of the system as above described is as follows: Supposing that an operator at station A is transmitting signals to station B. The transmitting apparatus actuates transmitting contact lever 7 between contacts 8 and 9 in accordance with the signals and maintains lever 4 in contact with stop 5 to convey these signals to the line circuit. These signals do not directly affect the receiving apparatus at station A as the receiving relay 2 thereat is connected in the differential duplexed manner. The signals are received at station B on the receiving relay 2 and actuate the receiving apparatus which thereupon moves the associated contact lever 11 to contact 12 to connect the signal re-transmitting means in circuit with the line. As the transmitting apparatus at station B is at rest during reception of signals from station A contact lever 4 at station B is making contact with stop 6. The receiving apparatus at station B is actuated in response to received signals and controls the movements of the signal re-transmitting means, the signals are thereupon returned in a circuit

from the signal re-transmitting contact lever 14, over contact 12 lever 11 contact 6 lever 4 and the line circuit to station A where they are received on relay 2 and translated and printed in the printing apparatus as a record of the signals returned from station B. Owing to the duplex connections, signals are returned or retransmitted from station B to station A without affecting the transmission and reception of the signals originating from station A and original signals are only printed by the printing apparatus at station A through the actuation of the printing apparatus at station B.

It will be noted that in this system owing to the actuation of the contact lever 4 from contact 6 to contact 5 by the transmitting apparatus at either station when signals are being originally transmitted the signals after being received are printed on the receiving apparatus following retransmission from the distant station but cannot be re-transmitted a second time as the contact means 4 is in the position in which the signal re-transmitting means 14 is disconnected from the line circuit. This feature is of importance in systems where signals are required to be returned from either station according to the direction of signalling and particularly where the same line circuit is used for transmission and for retransmission of signals from a particular station.

It will now be appreciated that the reason previously stated for the contact lever 4 being actuated for a predetermined short interval after the cessation of signals is to allow time for the signals to traverse the line circuit to the distant station, actuate the distant receiving and re-transmitting apparatus, retrace the line circuit to the original station and there actuate the receiving apparatus. It is necessary that the lever be maintained actuated for a sufficient period to cover the various line and instrumental lag periods. This is easily arranged for by known methods.

In the system above described the contact means 11 actuated by the receiving apparatus could be dispensed with if desired and the signal re-transmitting contact lever 14 connected direct to contact stop 6. These switch means however serve a useful purpose in disconnecting the signal battery from the line circuit during idle periods.

In the system shown in Fig. 2 the transmitted signals and the re-transmitted signals are constituted by impulses of alternating current of two different frequencies. A line circuit 1 connects the two stations A and B as before. The transmitting apparatus at each station in this case actuates signal transmitting contact lever 20 which makes or breaks a circuit with contact stop 21 in accordance with signals to be transmitted. The source of signal current is represented by an oscillator 22 the frequency of its output being at one or the other of two definitely timed frequencies according to whether a switch contact lever 23 is making contact with contact stop 24 or not respectively. Transmission to line is effected through a transformer 25. For the receiving arrangements each of filter networks 26 and 27 is adapted to pass one only of the two frequencies of alternating signal current to contact stops 28 and 29 respectively, a contact lever 30 alternatively making contact with one or the other and conveying the signal currents to the signal receiving relay means 31. The signal re-transmitting means is represented in this case by contact lever 32 making and breaking circuit with contact stop

33. In the arrangement shown the normal position of signal transmitting lever 20 and signal retransmitting lever 32 is in contact with their respective stops and signal impulses are formed by the breaking of their respective circuits. A further switch contact lever 34 is adapted on actuation to make contact with stop 35 and short circuit the signal retransmitting contact means. Contact levers 23, 30 and 34 are all actuated together by the transmitting apparatus and maintained in their actuated position during the transmission of signals and preferably for a predetermined period following cessation of signaling. Transmission of signals is effected with one frequency of alternating current supplied by oscillator 22. During this transmission contact lever 30 is maintained in contact with the stop 28 or 29 connected to the filter network responsive only to the second frequency of alternating current but the receiving apparatus at the distant station responds to the signals transmitted through the network which passes these signals at the distant station and the un-actuated lever 30 to the signal receiving relay means. The signal re-transmitting means 32 at the distant station is controlled as in the previous example and the un-actuated levers 23, 30 and 34 cause signals formed of alternating signal current of the second frequency to be transmitted to the line circuit, which signals are then returned to the originating station receiving network responsive to this frequency the actuated lever 30 and the receiving relay means 31 of that station.

The broad functions of the switch means actuated during the transmission of signals from a station in this case may therefore be considered as:—

(a) Changing the output frequency of a source of alternating current from one frequency used for re-transmission to a second used for transmission.

(b) Tuning the receiving signal selective means or networks at that station to a second frequency so that it will not be influenced by the transmission of signals at the other frequency, and

(c) Rendering the signals re-transmitting means inoperative to re-transmit a second time the signals as returned from the distant station.

In Fig. 3 another method of applying the principles of the present invention is shown in which signal impulses of alternating current are also employed. Such an arrangement is more costly but it would be convenient where multi-channel voice frequency facilities are available. In view of the explanations of the method of operation of the systems shown in Figs. 1 and 2 it is considered that as the arrangement shown in Fig. 3 involves the same principles and only differs slightly in circuit arrangements, further explanation is not necessary as similar reference numerals have been employed for parts corresponding to the systems shown in Fig. 2.

In Figs. 4 and 5 is shown an example of the manner in which the signal retransmitting contact lever 14 of Fig. 1, or the corresponding contact lever 32 of Figs. 2 and 3 can be actuated under the control of signals as received through the actuation of a series of permutation members which further effect the selection of a printing character in the signal receiving apparatus. The particular signal translator mechanism here shown, although forming no essential part of the present invention, is thought to possess novel

features and may be otherwise employed as a translator mechanism generally in telegraph apparatus, as already understood in the art.

Referring to Fig. 4, the armature 40 of a relay or magnet responsive to received signals, actuates a clutch releasing pawl 41 and a sliding bar 42 from one to the other of two positions. Pawl 41 effects the coupling of a cam shaft 43 to a driving shaft 44 for rotation in synchronism with the received signal. Slidably mounted on suitable splines on shaft 43 are a series of five independent cam members 45—49 corresponding to five permutation elements of a received signal.

Each cam member 45—49 comprises a pair of cam discs 50 and 51 each having a raised cam portion 52 and 53 respectively which pass between the sides of a corresponding notch 54 in the sliding bar 42. The raised cam portions 52 and 53 of the discs of each cam member are maintained in their proper relative phase positions by the splines on shaft 43 and according to the one or other position of sliding bar 42 in response to each successive signal element when the raised cam portions 52 and 53 are entering the respective notch 54, during rotation of cam shaft 43, the corresponding cam member 45—49 is actuated to one or the other longitudinal position on the shaft. Each cam member also comprises a locking flange 55 which is adapted to run in one or the other of two grooves in a locking bar 56 in the one or the other longitudinal position of the cam member, a portion of the circumference of each locking flange being cut away, as shown more clearly in Fig. 5, to permit the corresponding cam member to move longitudinally on the shaft 43 when cam portions 52 and 53 are engaging notch 54.

For the selection of a printing character from the setting of the five cam members 45—49, a cam 57 on each member is conveniently adapted to engage, preferably during the reception of a stop impulse of the signal code combination, with one or the other offset arms 58 or 59 of a corresponding notched permutation member 60, according to the longitudinal position to which the cam member carrying cam 57 has been actuated. One of a plurality of printing characters can be selected by the setting of the series of notched members 60 as already well known.

For actuating signal retransmitting contacts for the purposes of the present invention, a second sliding bar 61 actuating a signal retransmitting contact lever 14 is provided with a series of notches 62 adapted to be engaged in succession by the raised cam portions 52 and 53 of the discs 50 and 51 of each cam member after each member has been actuated to its one or other position in response to a received signal code element and locked by the engagement of flange 55 with bar 56. A further pair of discs 63 and 64 in this case fixed to shaft 43 carries suitable raised cam portions engaging a further notch 65 in bar 61 for invariably actuating bar 61 during rotation of shaft 43 for the retransmission in the correct phase relation with the permutation elements of the start and stop impulses.

It will thus be seen that the arrangement shown in Fig. 4 forms a signal regenerator which retransmits in regenerated form the signals as received and as used for the purposes of the present invention these retransmitted signals are received at the station from which they were originally transmitted and serve as a check on the setting up of the series of permutation members

which select the printing character corresponding to that signal.

What is claimed is:

1. A telegraph system comprising a first signalling station having signal transmitting means and a second signalling station having signal responsive means operable by signals transmitted from the first station, signal transmitting means, and means operable by said signal responsive means for re-transmitting to said first signalling station the signals as received therefrom, the signal transmitting means at the first station being entirely free from control of the second station.
2. A telegraph signalling station comprising signal responsive means, means operable by said signal responsive means for re-transmitting received signals, signal transmitting means operable independently of said signal re-transmitting means, and means for rendering inoperative said signal re-transmitting means during operation of said signal transmitting means.
3. A telegraph signalling station comprising signal responsive means, signal transmitting contacts, other contacts operable by said signal responsive means for retransmitting received signals, and switch means actuated during operation of said signal transmitting contacts for disconnecting the circuit of said other contacts.
4. In a telegraph system, a first signalling station, and a second signalling station comprising a printing apparatus having a series of permutation members operable in accordance with the elements of each signal combination received from said first signalling station, signal transmitting apparatus at said second station for communicating with said first station, means actuated in accordance with each setting of said series of permutation members in the printing apparatus for re-transmitting signals to said first station, and means actuated by said signal transmitting apparatus during transmission of signals to render inoperative the signal retransmitting means.
5. In a telegraph system, a first signalling station and a second signalling station, independent signalling channels between said stations for simultaneous signalling in both directions, a printing apparatus at each signalling station having a series of permutation members operable in accordance with the elements of each signal combination received over one of said channels, signal transmitting apparatus also at each station, and having contacts associated with another said channel, signal re-transmitting contacts at each station operable in accordance with each setting of said series of permutation members and also associated with said other channel, and means actuated during operation of said transmitting apparatus to render inoperative said signal retransmitting contacts.
6. In a telegraph system a first signalling station and a second signalling station a duplexed line circuit connecting said stations for simultaneous signalling in both directions, a printing apparatus at one station and having a series of permutation members operable in accordance with the elements of each signalling combination received over said duplexed line circuit, a signal transmitting contact tongue at the same station, a signal retransmitting contact tongue

also at that station and operable in accordance with each setting of said series of permutation members, and switch means actuated during operation of said signal transmitting contact tongue to connect the circuit thereof to said line circuit and to disconnect said retransmitting contact tongue therefrom.

7. In a telegraph system, a line circuit, signal responsive means signal transmitting contacts, other contacts operable by said signal responsive means for retransmitting received signals, switch means actuated during operation of said signal transmitting contacts for connecting said signal transmitting contacts to said line circuit, and other switch means actuated on cessation of operation of said signal responsive means for disconnecting said retransmitting contacts from the line circuit.

8. In a telegraph system, a duplexed line circuit, signal responsive means at a signalling station and having a series of permutation bars operable in accordance with the elements of each received signal combination, a double current signalling battery, a signal transmitting contact tongue and a signal retransmitting contact tongue, and switch means having alternative contacts connected to said transmitting and retransmitting contact tongues respectively and a switch lever connected to said line circuit and actuated to one position during operation of said transmitting tongue to connect the transmitting tongue in the line circuit and to the other position following cessation of transmission.

9. In a telegraph system a duplexed line circuit contact tongue, switch means having alternative contacts connected to said transmitting and retransmitting contact tongues respectively and a switch lever connected to said line circuit and actuated to one position during operation of said transmitting tongue to connect the transmitting tongue in the line circuit and to the other position following cessation of transmission and other switch means actuated by said signal responsive means intermediate said retransmitting contact lever and the first said switch means.

10. In a telegraph system, a first signalling station and a second signalling station, means for transmitting signals from either station to the other on one frequency of alternating current, means for retransmitting signals from either station to the other on another frequency of alternating current, and change over switch means at either station and actuated during transmission of signals therefrom.

11. In a telegraph system, a signalling station comprises a source of alternating current at either of two frequencies signal transmitting contacts, an alternating current selective device for separating received signals at either of the two frequencies, signal receiving means responsive to one of said frequencies, signal retransmitting contacts operable by said receiving means, and switch means actuated during operation of said signal transmitting contacts and having three switch blades which effect respectively a change of output frequency of said source of alternating current, a change to the second frequency selected by said selective device, and render inoperative said signal retransmitting contacts.

RONALD GEORGE GRIFFITH.

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DISCLAIMER

1,923,724.—*Ronald George Griffith*, Croydon, England. TELEGRAPH SYSTEM. Patent dated August 22, 1933. Disclaimer filed April 24, 1935, by the assignee, *Creed and Company, Limited*.

Hereby disclaims claim 1 of said Patent No. 1,923,724, said claim being in the following words:

A telegraph system comprising a first signalling station having signal transmitting means and a second signaling station having signal responsive means operable by signals transmitted from the first station, signal transmitting means, and means operable by said signal responsive means for re-transmitting to said first signaling station the signals as received therefrom, the signal transmitting means at the first station being entirely free from control of the second station.

[*Official Gazette May 14, 1935.*]