Nov. 10, 1942. D. L. CLAY ET AL 2,301,523

TELEPHONE OR LIKE SYSTEM

Filed Oct. 7, 1940 2 Sheets-Sheet 1

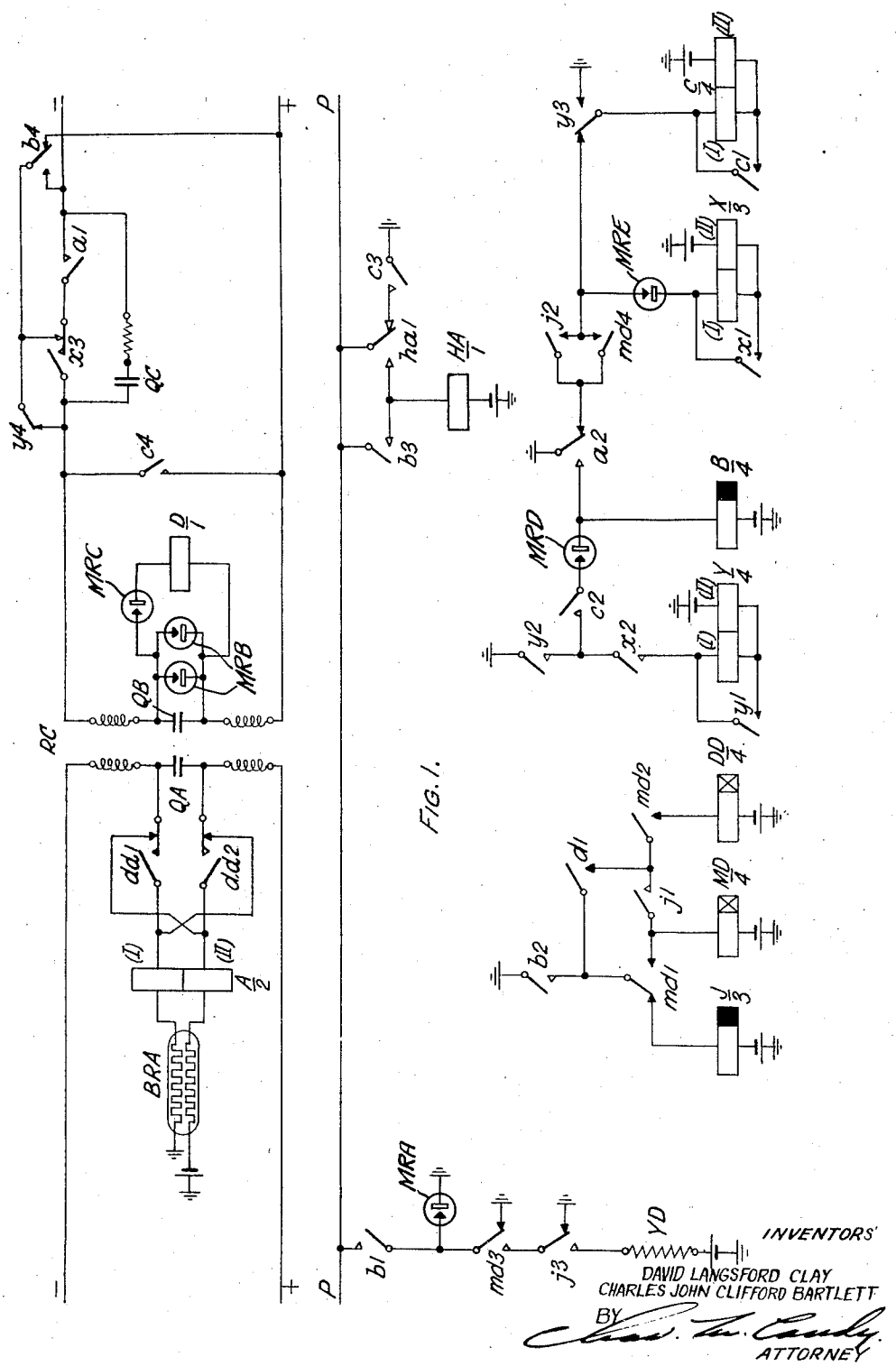


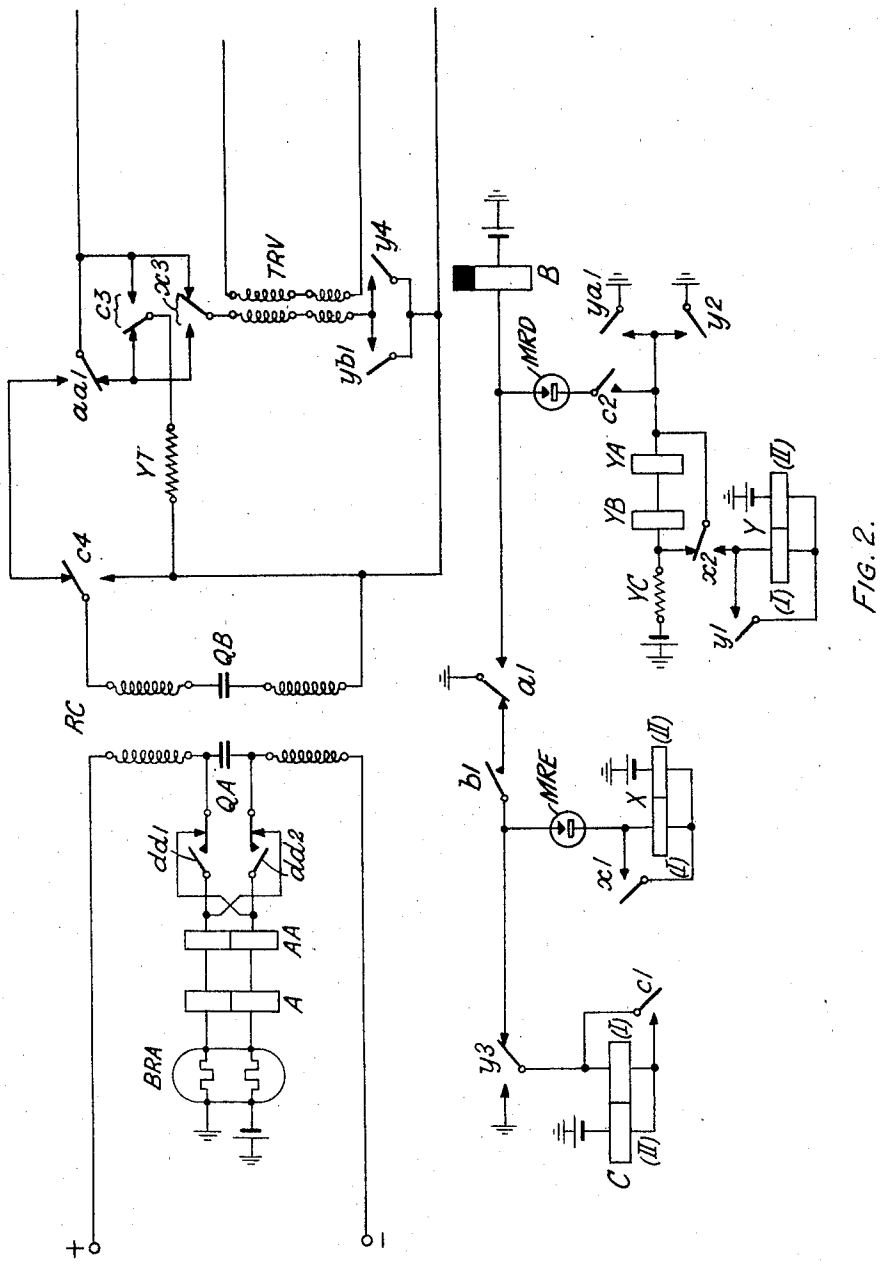
FIG. 1.

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Patented Nov. 10, 1942

2,301,523

UNITED STATES PATENT OFFICE

2,301,523

TELEPHONE OR LIKE SYSTEM

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Application October 7 1940, Serial No. 360,039
In Great Britain October 16, 1939

10 Claims. (Cl. 179—16)

The present invention relates to telephone and like signalling systems and more particularly to feeding-bridge circuits in or for such systems.

Many such feeding-bridge circuits have to provide for the repetition of dialled or like impulses, a usual arrangement being one in which an impulse-receiving relay is connected in or associated with the incoming side of the feeding-bridge and a contact of this relay, or of a relay controlled thereby, is included in the circuit outgoing from the bridge. It is with feeding-bridge circuits of this character that the present invention is concerned.

With the types of feeding-bridge circuit commonly employed in practice, trouble is often experienced owing to the production of undesired current surges during and as a result of impulse repetition which involves direct-current impulses on one or both sides of the bridge. Such undesired current surges are in general caused by interaction between the incoming and outgoing sides of the bridge and by the discharge of energy stored in inductive windings and/or condensers. They are likely to be especially troublesome in systems where they may reach a voice-frequency signal receiver of the kind liable to be temporarily paralysed by a strong input current. One of the objects of the present invention is to provide a feeding-bridge circuit in which the trouble caused by surges of the nature referred to is obviated or minimised.

It has become a usual practice to arrange, in the case of feeding-bridge circuits where impulse repetition involves direct-current impulses on one or both sides of the bridge, that changes are effected in the bridge circuit consequent on the commencement of the receipt of a train of impulses, such changes enduring until repetition of the train is completed and being such as to limit the production and/or transmission of harmful current surges during impulse repetition. In a typical case, for example, it is arranged that on the commencement of the first impulse of a received train a back contact of an impulse-receiving relay connects a short-circuit across the line wires of the outgoing side of the bridge, and that the subsequent operation of a slow-releasing dialing relay connects a further short-circuit across these line wires. Such an arrangement, however, suffers from the disadvantage that a surge capable of interfering with the correct repetition of the first impulse may be transmitted in the brief time period which elapses between the commencement of the receipt of this impulse and closure of the first-mentioned short-circuit. Interference of this nature is especially liable to occur in a system employing a voice frequency signal receiver of the kind previously referred to. The disadvantage under discussion could of course be overcome by modifying the arrangements so that the change in condition of the feeding-bridge circuit is initiated by a preparatory signal transmitted in advance of an impulse train, but for a variety of reasons. It is not usually practicable to adopt this method of operation.

The main feature of the present invention provides inter alia a means whereby the disadvantage referred to in the last paragraph may be overcome.

According to this feature, a feeding-bridge circuit incorporates impulse-repeating arrangements which are such that each outgoing impulse train is as a whole substantially displaced in time with reference to the corresponding received train although no recording of the number of impulses in a received train is carried out. The kind of displacement contemplated is one which permits a change of circuit condition initiated by the commencement of a received train of impulses, and requiring time for its completion to be completed prior to the commencement of the outgoing train corresponding to the said received train. In the applications of the invention which are especially contemplated, circuit changes operating to prevent the transmission of surges through the bridge concerned are brought about as a consequence of the commencement of the receipt of a train of impulses, and a sufficient delay is introduced between the said commencement and the commencement of the outgoing train, as to ensure that the first impulse of the outgoing train commences with the outgoing circuit in a stable condition and is not interfered with by a surge or surges.

In the preferred method of carrying out the invention the requisite delay is obtained by arranging that the first impulse of each received train is not directly repeated but is in effect absorbed in the impulse-repeating arrangements at the feeding-bridge, and that a suitably-timed compensatory impulse is transmitted by these arrangements at the end of each train. In the special case where the received train comprises only one impulse, the said compensatory impulse forms of course the whole of the outgoing train. The first impulse of each received train may in this method be regarded as a preparatory signal by means of which the feeding-bridge circuit may be made completely ready for the repetition

of any subsequent impulses. For example, the first impulse of each received train may bring the feeding-bridge circuit to a condition in which the transmission of troublesome surges is entirely prevented, this condition lasting until repetition of the train has been completed. Further, in the case where the feeding-bridge circuit is used in an outgoing junction relay set which is arranged to repeat received direct-current impulses as pulses of voice-frequency current, the voice-frequency signal receiver at the distant end of the junction will have time during the said absorption of the first impulse to recover from the effects of surges produced on the commencement of this impulse. It should also be pointed out that the first impulse of a received train is the one most likely to suffer from distortion, so that yet another advantage may be gained by arranging to absorb this impulse.

The features of the invention are exemplified in the two outgoing junction relay sets embodying it which will now be described with reference to the accompanying drawings:

Fig. 1 of the drawings shows the complete circuit of an outgoing junction relay set which is designed to repeat received direct-current "break" impulses as similar impulses, while Fig. 2 shows parts of the circuit of an outgoing junction relay set which is designed to be used in conjunction with a voice-frequency signal receiver and to repeat received direct-current "break" impulses as pulses of voice-frequency signal current.

Referring firstly to the relay set shown in Fig. 1, this is designed to be connected at the outgoing end of an inter-exchange junction which serves as a link between automatic switching equipments at the two exchanges concerned, and as is usual in such relay sets, it has incoming positive, negative and private wires for connection to the multiple of a group of selectors in the same exchange as itself and outgoing positive and negative wires for connection to the two wires of the junction. In the drawings, the incoming wires appear at the top on the left, the private wire being designated P. The outgoing wires appear at a corresponding position on the right, the private wire connection shown in this case being intended simply for extension to a distributing frame for use for the purposes of local testing. The principal functions of the relay set are to supply loop currents backwards towards the originating end of the connection, to control the loop circuit which extends forwards to the succeeding exchange, and to control the holding of the switches in the local exchange. It is of course adapted to repeat both received impulses and supervisory signals.

The relay set has a feeding bridge of the kind in which the incoming and outgoing circuits are coupled together by a so-called repeating coil RC. This repeating coil has two windings in the incoming circuit and two windings in the outgoing circuit, the first-mentioned windings being connected in series via a condenser QA and the second-mentioned windings being connected in series via a condenser QB.

The connections on the incoming side of the feeding-bridge are such that the incoming positive wire is normally connected to earth in a circuit over winding (I) of a high-speed low-impedance impulse-receiving relay A and one element of a two-element ballast resistance BRA, and the incoming negative wire is normally connected to battery in a circuit over winding (II) of relay A and the other element of BRA. Condenser QB on the outgoing side of the bridge has a low-impedance back-bridge relay D connected across it. The relay is connected to operate as a polarised one, the necessary polarisation being effected by including a dry-plate rectifier MRC in series with the actual relay which is of the non-polarised type. The sense in which rectifier MRC is connected is such that during the initiation and setting up of a call over the junction, loop current flowing in the right-hand windings of the coil RC is caused to pass mainly or entirely through the oppositely-connected two-element rectifier MRB so that relay D remains unoperated. Rectifier MRB provides a low-impedance loop for the impulse-receiving relay at the distant end of the junction at important times during such initiation and setting up.

When the relay set is in circuit at an exchange and is free with its apparatus at normal, it tests free to a searching selector by reason of the absence of earth on the incoming private wire. When the relay set is seized for a call by such a selector, the high-speed impulse-receiving relay A is operated in a circuit which includes the impulsing loop which is controlling the setting up of the call. The actual operating circuit is earth, the upper element of ballast resistance BRA, winding (I) of relay A, contact *dd*2 in its resting position, the lower left-hand winding of repeating coil RC, the incoming positive wire, the impulsing loop referred to, the incoming negative wire, the upper left-hand winding of repeating coil RC, contact *dd*1 in its resting position, winding (II) of relay A, the lower element of ballast resistance BRA, battery, earth. Contact *a*1 on operation closes a short-circuit across the outgoing junction wires and this completes a comparatively low-impedance circuit for initially operating the impulse-receiving relay at the distant end of the junction. The short-circuit referred to is one which passes over back contacts *x*3 and *b*4. Contact *a*2 on operation closes an obvious operating circuit for the release relay B of the relay set, which relay is as usual of the slow-to-release type. On the operation of relay B, its contact *b*1 connects earth derived over back contact *md*3 to the incoming private wire, and contact *b*3 connects a battery-connected switching relay HA to this wire, the result being that relay HA is operated. The earth connected to the incoming private wire serves for engaging and holding purposes. Contact *b*2 closes the operating circuit of a metering relay J, and contact *b*4 changes the connections on the outgoing side of the feeding bridge so that the short-circuit across the outgoing junction wires is replaced by a loop circuit including rectifier MRB and the two right-hand windings of repeating coil RC. Relay HA on operation locks up in a circuit over front contact *ha*1. Relay J is of the slow-to-release type, and as soon as its operation is completed to prepare various circuits, the relay set is in a condition to repeat trains of "break" impulses to the automatic equipment at the distant end of the junction.

When the impulse-receiving relay A releases on the commencement of the first "break" period of the first train of impulses to be received, its contact *a*2 opens the circuit of relay B and closes operating circuits for a dialling relay C and a first control relay X. The circuit for relay C is earth, back contact *a*2, contact *j*2, back contact *y*3, low-resistance winding (I) of the relay, high-

resistance winding (II) of the relay, battery, earth, while the circuit for relay X is earth, back contact *a2*, contact *j2*, rectifier MRE, low-resistance winding (I) of the relay, high resistance winding (II) of the relay, battery, earth. In this particular case, the opening of contact *a1* is without effect owing to the circuit provided over contact *y4* and front contact *b4*. When the dialling relay C operates, its contact *c1* short-circuits the low-resistance winding (I) of the relay to render the relay slow to release, and contact *c4* closes a short-circuit across the outgoing side of the feeding-bridge and across the outgoing junction wires. Contact *x1* on operation short-circuits the low-resistance winding (I) of relay X to render the relay slow to release. Rectifier MRE is included in the circuit of relay X in order to ensure that the release lag of this relay is not unduly increased by the presence of a shunt circuit through relay C. When the impulse-receiving relay A is again operated at the end of the "break" period, contact *a2* opens the circuits in which relays C and X were operated, closes once again the circuit of relay B, and closes an operating circuit for a second control relay Y. The operating circuit of relay Y is earth, front contact *a2*, rectifier MRD, contacts *c2* and *x2*, low-resistance winding (I) of the relay, high-resistance winding (II) of the relay, battery, earth. Contact *y1* on operation short-circuits the low-resistance winding (I) of relay Y to render the relay slow to release, contact *y2* closes a holding circuit for the same relay, contact *y3* closes a holding circuit for relay C, and contact *y4* renders contacts *a1* and *x3* capable of opening the low-impedance loop circuit across the outgoing junction wires. It should be noted that so far no impulse has been transmitted over the junction. Rectifier MRD is included in the circuit of relay Y in order to ensure that the release lag of this relay is not unduly increased by the presence of a shunt circuit through relay B and in order to prevent earth over contact *y2* from holding relay B. As usual, the release relay B holds during the receipt of "break" impulses. The relays concerned with impulse repetition are designed so that if the received train contains more than one impulse, the operation during the remaining impulses of the train will be as follows:

With impulsing of normal speed and ratio, relays X and Y both remain operated during any remaining impulses of the received train, and such impulses are directly repeated over the junction wires by contact *a1*. In these circumstances, the impulsing loop across the junction wires is completed over contact *c4*, contact *x3* in its operated position and contact *a1*. Relays X and Y remain operated as stated by virtue of the facts that relay Y is held as long as contact *x2* remains closed and that back contact *a2* does not remain open sufficiently long to permit the slow release of relay X to be completed.

If the speed of the received impulses is unduly low, or if such impulses have an unduly high "make" to "break" ratio, relay X releases at some point of time during each of any intermediate "make" periods of the received impulse train owing to the fact that back contact *a2* has remained opened sufficiently long to allow the slow release of the relay to be completed. When relay X so releases, it, at contact *x3*, terminates the "make" condition in so far as the outgoing junction is concerned, with the result that a repeated "break" is lengthened and a measure of impulse correction is effected. The release lag of the first control relay X may be about 50 milliseconds, while that of the second control relay Y may be about 80 milliseconds.

It will be clear from the description just given that if the received train contains more than one impulse, received impulses other than the first are in effect directly repeated over the junction wires, as "break" impulses such repetition being effected either by the action of contact *a1* alone or by the combined action of this contact and the series-connected contact *x3*. It has been found that the presence of the spark-quenching combination comprising a condenser QC in series with a resistance exercises a beneficial effect on impulse repetition.

After the receipt of the least "break" period of the received train, the impulse-receiving relay A remains steadily operated and relays X and Y release in turn. Relay X releases owing to the fact that contact *a2* remains steadily operated and relay Y releases as a result of the opening of contact *x2*. In order that the necessary compensatory impulse shall be transmitted over the junction, contacts *x3* and *y4* are arranged so that the loop for the impulse-receiving relay at the distant end of the junction is opened at contact *x3* on the completion of the slow release of relay X, and remains open until it is again closed at contact *y4*. The slow release of relay C is initiated by the opening of front contact *y3*. When this slow release is completed, contact *c4* opens the short-circuit across the outgoing side of the feeding-bridge.

Subsequent impulse trains are repeated in a similar manner.

If the called party is free, ringing tone current is received over the junction and is transmitted through the repeating coil bridge to the calling party. When the called party answers the call, contacts at the distant end of the junction effect a reversal of current in the line wires in the well known manner, and this brings about the operation of the polarised back-bridge relay D. The closing of contact *d1* initiates the slow operation of a metering delay relay MD, the operating circuit being earth, contacts *d1* and *j1*, winding of the relay, battery, earth. Relay MD on operation locks up in a circuit over contact *b2* and front contact *md1*, and owing to its slow operating property serves to ensure that metering is not effected unless the reversed current condition in the outgoing line wires persists for a reasonable time. The opening of back contact *md1* initiates the slow release of the metering relay J, the closing of contact *md2* initiates the slow operation of an answering supervisory relay DD, and the changing over of contact *md3* connects booster battery potential to the incoming private wire in place of the usual holding earth so that if the calling party is a subscriber belonging to the exchange in which the relay set is situated, the meter of this party is operated in series with resistance YD. When relay DD operates, contacts *dd1* and *dd2* effect a reversal of current in the incoming line wires to repeat the answering supervisory signal in case this should be necessary, and when the slow release of relay J is completed, the falling back of contact *j3* restores the usual holding condition on the incoming private wire. Release of the switching relays connected to the incoming private wire during the changing over of the contacts *md3* and *j3* which effect the application and termination of the booster battery condition is pre-

vented by the presence of a holding earth applied over a dry-plate rectifier MRA which opposes flow of current from the booster battery. The condition of the circuit immediately subsequent to metering is that relays A, B, HA, D, MD and DD are operated.

If at the end of the call the calling party clears first, then relay A releases and at contact *a2* opens the circuit of relay B and closes the operating circuits of relays X and C. The operation of relay X is without effect in this instance, and the operation of relay C is only of interest by virtue of the fact that contact *c3* prepares a circuit for earthing the incoming private wire. On the completion of the slow release of the release relay B, the falling back of contact *b4* opens the loop across the outgoing junction wires, releasing relay D and initiating the release of the apparatus at the distant end of the junction. The opening of contact *b2* releases relays MD and DD, and the opening of contact *b3* opens the operating circuit of relay HA. The opening of contact *b1* temporarily removes the holding earth from the incoming private wire and releases the switching relay HA and the selector switching relays held locked to this earth, thus causing the immediate commencement of the release of the apparatus preceding the relay set. The switching relay HA is arranged to release rather more slowly than the said selector switching relays, and when it does release, at its contact *ha1* it completes a circuit over contact *c3* for again earthing the incoming private wire to guard the relay set from seizure by a searching selector. The opening of contact *md4* initiates the slow release of relays X and C. On the completion of the slow release of relay C, the opening of contact *c3* disconnects the guarding earth from the incoming private wire and the relay set is ready for use on another call. Owing to the sequence of operations just described, the relay set is guarded for a certain period after the outgoing loop has been opened. If this period is insufficient to allow the selector at the distant end of the junction to return to normal, a junction guard relay circuit can be fitted.

If the called party clears before the calling party, the polarised back-bridge relay D is released by the usual reversal of current in the line wires of the junction, and at its contact *d1* releases the answering supervisory relay DD. The consequent falling back of contacts *dd1* and *dd2* effects a reversal of current in the incoming line wires to repeat the clearing signal in case this should be necessary. When the calling party clears, relay A releases and at contact *a2* opens the circuit of relay B and closes the operating circuits of relays X and C. On the completion of the slow release of relay B, the falling back of contact *b4* opens the loop across the outgoing junction wires and so initiates the release of the apparatus at the distant end of the junction. The opening of contact *b2* releases relay MD, and the opening of contact *b1* temporarily removes the holding earth from the incoming private wire. Release of the connection then proceeds in the same manner as in the case considered in the preceding paragraph.

If the called party is not free when called, busy tone current is received over the junction and is transmitted through the repeating coil bridge to the calling party. When the calling party clears, relay A releases, and release of the connection proceeds in a manner similar to that just described.

Referring now to Fig. 2, this, as has already been stated, shows only parts of the circuit of an outgoing junction relay set. The parts are those concerned with impulse repetition and exemplifying an application of the present invention. The relay set is designed to be used in conjunction with a voice-frequency signal receiver and to repeat received direct-current "break" impulses as pulses of voice-frequency signal current.

In addition to the parts shown, the full relay set would include suitable private wire arrangements, arrangements for controlling the transmission to the apparatus at the distant end of the junction of seizing and clearing signals in the form of pulses of voice-frequency current, and arrangements adapted to function in an appropriate manner in response to voice-frequency answering supervisory and clearing signals received by the signal receiver. Relays B and C have contacts in addition to those shown in the figure and certain of the direct connections shown in the figure are actually connections over relay contacts. In short, the drawing is designed to show in a very simple manner the conditions existing during impulse repetition, and does not include parts or circuit elements which are not concerned in such repetition. Contacts *dd1* and *dd2* are contacts of an answering supervisory relay which is not shown in the figure and which corresponds to relay DD in Fig. 1. The elements BRA, RC, QA, QB, MRD and MRE correspond to the similarly designated elements in Fig. 1.

The relay set is designed to be connected at the outgoing end of an inter-exchange junction which serves as a link between automatic switching equipments at the two exchanges concerned. The incoming positive and negative wires appear at the top on the left, and the wires outgoing to the junction appear at a corresponding position on the right. In this case the feeding bridge has two impulse-receiving relays connected on its incoming side, these being a main impulse-receiving relay AA and an auxiliary impulse-receiving relay A. Each of these relays is a high-speed relay having as its sole contact a simple change-over contact, and may be a relay of the kind described in United States Patent No. 1,992,610 granted February 26, 1935.

When the relay set is taken into use, relays AA and A are operated over a preceding loop circuit, and contact *aa1* completes the connection of the outgoing side of the bridge to the outgoing junction and contact *a1* operates the release relay B of the set. Contact *b1* prepares the operating circuits of relays X and C, and contacts of relay B not shown in the drawing mark the relay set engaged and initiate the transmission of a seizing signal to the apparatus at the distant end of the junction and perform other necessary operations. Only the operation of the circuit during impulse repetition will be dealt with in this description. Relay C is a dialing relay, and relays X and Y are respectively first and second control relays corresponding to relays X and Y in Fig. 1.

When the two impulse-receiving relays AA and A release on the commencement of the first "break" period of a received train of impulses, contact *a1* closes the operating circuits of relays X and C, and contact *aa1* breaks the connection between the junction wires and the bridge and connects a 600 ohm terminating resistance YT across the junction wires. The change of con-

nections effected by the falling back of contact *aa1* is quickly followed by further changes in the connections on the outgoing side of the feeding bridge, these changes being those effected by the operation of contacts *c3* and *c4*. Contact *c3* renders the connection of resistance YT across the junction wires independent of contact *aa1* and contact *c4* short-circuits the outgoing side of the bridge. Contact *c1* on operation short-circuits the low resistance winding (I) of relay C to render the relay slow to release. Similarly, contact *x1* on operation short-circuits the low-resistance winding (I) of relay X to render the relay slow to release. When the impulse-receiving relays AA and A are again operated at the end of the "break" period referred to, contact *a1* opens the circuit of relay X, and closes operating circuits for the second control relay Y and for two relays YA and YB auxiliary to Y. Each of relays YA and YB is a high-speed relay having as its sole contact a simple change-over contact, and may be a relay of the kind previously referred to. The function of the said two high-speed relays is to secure an earlier closing of certain circuits than could be provided for by contacts of relay Y acting alone. This provision is made in case received impulses should for any reason have "make" periods short than the operating lag of relay Y. The operating circuit for relay Y is earth, front contact *a1*, rectifier MRD, contact *c2*, front contact *x2*, low-resistance winding (I) of the relay, high-resistance winding (II) of the relay, battery, earth. The operating circuit for relays YA and YB is earth, front contact *a1*, rectifier MRD, contact *c2*, winding of relay YA, winding of relay YB, resistance YC, battery, earth. Contact *ya1* on operation closes a holding circuit for relays Y, YA and YB. Contact *yb1* on operation closes a point in a circuit for feeding voice-frequency signal current to the junction, this circuit being one containing the secondary winding of a transformer TRV which has its primary winding connected to a suitable source of voice-frequency current. Contact *y1* short-circuits the low-resistance winding (I) of relay Y to render the relay slow to release, contact *y2* closes a further holding circuit for relays Y, YA and YB, contact *y3* closes a holding circuit for relay C, and contact *y4* closes a path in parallel to that provided by contact *yb1*. It should be noted that so far no impulse has been transmitted over the junction in response to the received train. As usual, the release relay B holds during the receipt of "break" impulses. The relays concerned with impulse repetition are designed so that if the received train contains more than one impulse, the operation during the remaining impulses of the train will be as follows.

With impulsing of normal speed and ratio, relays X and Y both remain operated during any remaining impulses of the received train, and by the action of contact *aa1* such impulses are directly repeated over the junction wires as pulses of voice-frequency signal current. The circuit in which the voice-frequency current is fed to the junction is over the upper junction wire, back contact *aa1*, front contact *x3*, secondary winding of transformer TRV, contacts *yb1* and *y4* in parallel, and lower junction wire. Relays X and Y remain operated as stated by virtue of the facts that relay Y is held as long as front contact *x2* remains closed and that back contact *a1* does not remain open sufficiently long to allow the slow release of relay X to be completed.

If the speed of the received impulses is unduly low, or if such impulses have an unduly high "make" to "break" ratio, relay X releases at some point of time during each of any intermediate "make" periods of the received impulse train owing to the fact that back contact *a1* has remained open sufficiently long to allow the slow release of the relay to be completed. When relay X so releases its make-before-break contact *x3* closes an alternative circuit for feeding the voice-frequency signal current to the junction wires. The result of this is that the pulses of voice-frequency signal current transmitted over the junction wires are lengthened so that a measure of impulse correction is effected. The release lag of relay X may be about 50 milliseconds, while that of relay Y may be about 80 milliseconds.

It will be clear from the description just given that if the received train contains more than one impulse, received impulses other than the first are in effect directly repeated over the junction wires as pulses of voice-frequency signal current, such repetition being effected either by the action of contact *aa1* alone or by the combined action of this contact and contact *x3*.

After the receipt of the last "break" period of the received train, the impulse-receiving relays AA and A remain steadily operated, and relays X, YA and YB, and Y release in turn. During the release period of relay Y, a pulse of voice-frequency signal current is fed to the junction wires via contact *y4* and back contact *x3*, the release period of relay X being used to measure off the appropriate silent period preceding this pulse. The distant apparatus thus receives the necessary compensatory impulse. The slow release of relay C is initiated by the opening of front contact *y3*. When this slow release is completed, contact *c4* opens the short-circuit across the outgoing side of the feeding bridge and completes the connection of this side of the bridge to the outgoing junction wires.

We claim:

1. The method of repeating received impulse trains comprising, absorbing the first part of each received train, repeating the rest of each received train as the first part of the corresponding transmitted train, and then transmitting, as the last part of said transmitted train, as many impulses as were contained in said absorbed part of the received train.

2. In an impulse repeater for a telephone or like system, an incoming circuit over which are received impulse trains each having a variable number of impulses, an outgoing circuit, means for absorbing the first impulse in each train received over said incoming circuit, means for repeating the rest of the impulses in each train over said outgoing circuit, and means effective after the last impulse of a received train has been repeated over said outgoing circuit for transmitting thereover an additional impulse to compensate for said absorption of the first received impulse of the train.

3. In an impulse repeater for a telephone or like system, means for receiving trains of impulses, means controlled by each received impulse train for transmitting a corresponding train having the same number of impulses as said received train, said last means including means controlled by an impulse having a certain position in the received train for repeating that impulse in a different position in the corresponding transmitted train.

4. In an impulse repeater for a telephone or

like system, an incoming circuit and an outgoing circuit, a source of current in said incoming circuit to establish a current flow therein, an impulse receiving device in said incoming circuit, said device responsive to interruptions of said current flow and effective upon each such interruption to interrupt said outgoing circuit, a slow relay, means controlled by said device for energizing said relay responsive to an interruption of the current flow in said incoming circuit and for deenergizing said relay when said current flow in said incoming circuit is re-established, said relay operated due to its energization at the beginning of said interruption and effective to restore only if the current continues to flow in said incoming circuit for more than a certain length of time after it has been re-established at the end of said interruption, and a contact on said relay operated to interrupt said outgoing circuit when said relay restores.

5. In an impulse repeater for a telephone or like system, an incoming circuit and an outgoing circuit, an impulse receiving device in said incoming circuit, means controlled by said device responsive to the commencement of an impulse in said incoming circuit for beginning the transmission of a corresponding impulse over said outgoing circuit, said means controlled by said device responsive to the termination of an impulse in said incoming circuit for terminating the transmission of the corresponding impulse over said outgoing circuit, a slow relay, means controlled by said device for energizing said relay responsive to the commencement of each impulse in said incoming circuit and for deenergizing said relay responsive to the termination of each impulse in said incoming circuit, said relay operated due to its energization upon the commencement of an impulse and effective to restore only if another impulse is not commenced in said incoming circuit within a predetermined interval after the termination of any impulse, and a contact on said relay for commencing the transmission of an impulse over said outgoing circuit when said relay restores.

6. In a repeater as claimed in claim 5, means controlled by said relay when it commences the transmission of said impulse over said outgoing circuit for terminating the transmission of said impulse after a predetermined interval.

7. In an impulse repeater for a telephone or like system, an incoming circuit and an outgoing circuit, a relay in said incoming circuit for responding to impulses received thereover and repeating said impulses over said outgoing circuit, two auxiliary relays, means controlled by said first relay for operating one of said auxiliary relays responsive to the commencement of the first impulse in a received train, means controlled conjointly by said first relay and said one auxiliary relay for operating the other of said auxiliary relays responsive to the termination of the first impulse in a received train, said one auxiliary relay controlled by said first relay to restore after the last impulse in a train has been received over said incoming circuit, said other auxiliary relay controlled by said one auxiliary relay to restore a predetermined interval of time after said restoration of said one auxiliary relay, and means controlled by said restoration of said two auxiliary relays for transmitting an impulse over said outgoing circuit.

8. In an impulse repeater for a telephone or like system, an incoming circuit and an outgoing circuit, a relay in said incoming circuit responsive to impulses received thereover, a second relay, means controlled by said first relay for operating said second relay responsive to the commencement of the first impulse in a received train and to maintain said second relay operated throughout the reception of the impulse train, a third relay, means controlled conjointly by said first two relays for operating said third relay responsive to the termination of the first impulse in a received train, a contact on said first relay included in said outgoing circuit for repeating impulses thereover, means controlled by said third relay for rendering said contact ineffective until said third relay has been operated, thereby to prevent the first impulse in a train received by said first relay from being repeated over said outgoing circuit, said contact effective to repeat the other impulses in said received train over said outgoing circuit, and means effective after the last impulse of said train has been repeated for transmitting over said outgoing circuit an additional impulse.

9. In an impulse repeater for a telephone or like system, an incoming circuit and an outgoing circuit, a relay in said incoming circuit responsive to impulses received thereover, a second relay, means controlled by said first relay for operating said second relay responsive to the commencement of the first impulse in a received train and to maintain said second relay operated throughout the reception of the impulse train, a third relay, means controlled conjointly by said first two relays for operating said third relay responsive to the termination of the first impulse in a received train, a contact on said first relay included in said outgoing circuit for repeating impulses thereover, means controlled by said third relay for rendering said contact ineffective until said third relay has been operated, thereby to prevent the first impulse in a train received by said first relay from being repeated over said outgoing circuit, said contact effective to repeat the other impulses in said received train over said outgoing circuit, said second relay effective to restore under control of said first relay after the last impulse of said train has been received over said incoming circuit, a contact on said second relay thereupon operated and effective to initiate the transmission of an additional impulse over said outgoing circuit, said third relay controlled by said second relay to restore a predetermined interval after said second relay has restored, and a contact on said third relay thereupon operated to terminate the transmission of said additional impulse.

10. In an impulse repeater as claimed in claim 9, a repeating coil inductively coupling said incoming circuit and said outgoing circuit, a fourth relay operated by said first relay responsive to the commencement of the first impulse in a received train, a contact on said fourth relay thereupon effective to alter said outgoing circuit to prevent said repeating coil from interfering with the transmission of impulses over said outgoing circuit, and means controlled by said third relay after it is operated for maintaining said fourth relay operated until said third relay restores.

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