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O. E. RASMUSSEN

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REGENERATIVE TELEGRAPH REPEATER

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2 Sheets-Sheet 1

FIG. 1

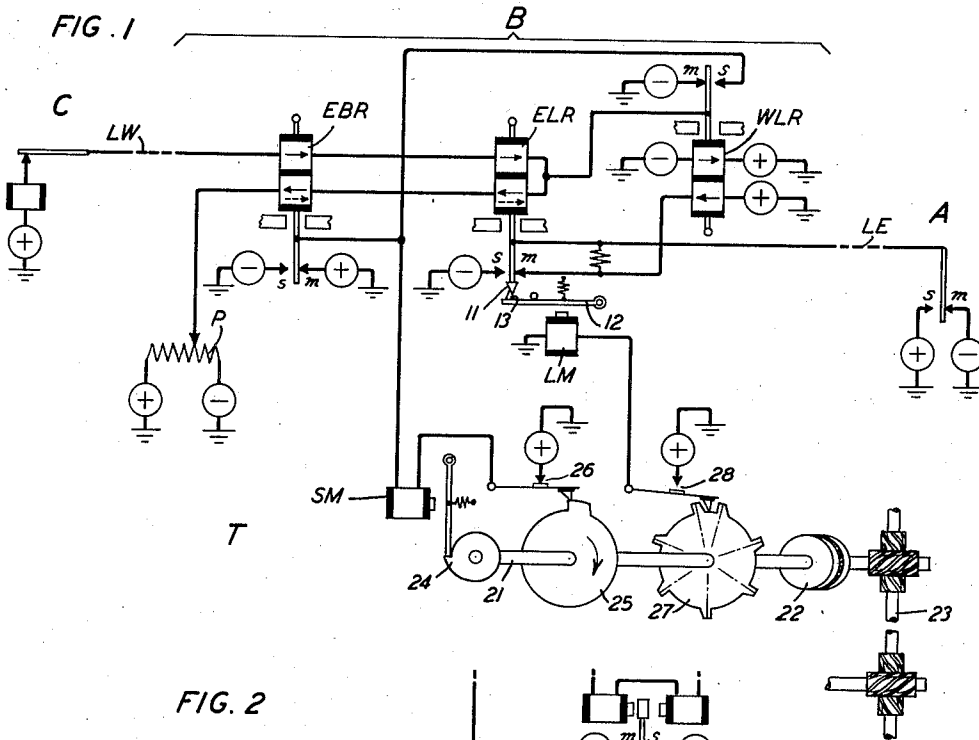
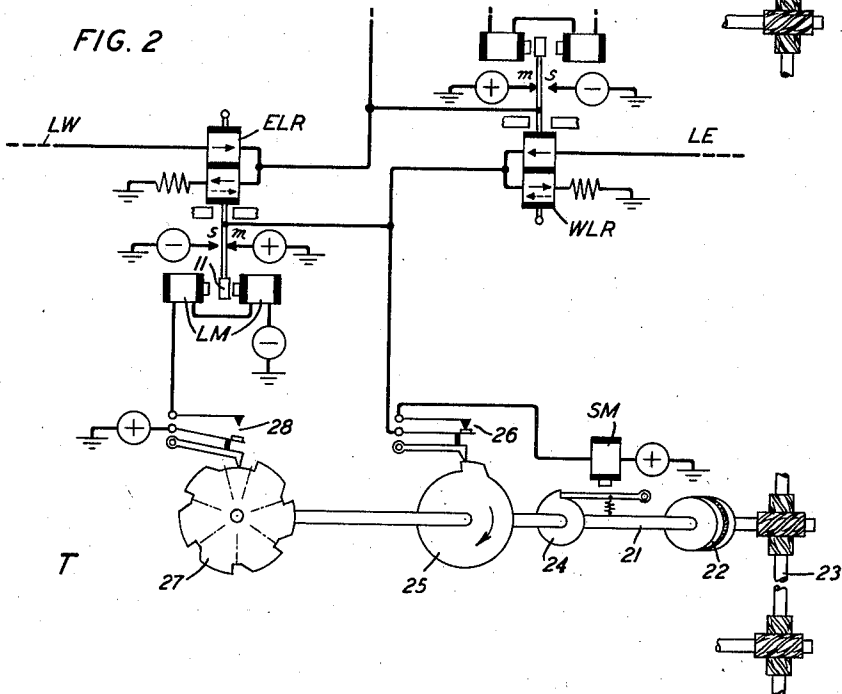


FIG. 2



INVENTOR
O.E. RASMUSSEN
BY *E. V. Griggs*
ATTORNEY

UNITED STATES PATENT OFFICE

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REGENERATIVE TELEGRAPH REPEATER

Osvald E. Rasmussen, Lincoln Park, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

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14 Claims. (Cl. 178—70)

This invention relates to regenerative signal repeaters and more particularly to telegraph repeating devices of the mechanical regenerative type.

5 An object of the invention is to provide an impulse repeater capable of retransmitting signals of a desired wave shape and frequency in response to received signals which may have become more or less distorted from the desired wave shape in the transmission over a line.

10 Another object of the invention is to provide a mechanical repeater of simple construction and operation.

15 Still another object of the invention is to provide start-stop timing means which may be readily applied to telegraph repeater relays already in the field with a minimum of change in the repeater panel.

20 Still a further object of this invention is to provide a mechanical timing device which may be mounted remotely from the repeater bay so that mechanical vibrations of the device will have no disturbing effect upon the operation of the relays in the bay.

25 The invention may be considered as an alternative to the arrangement disclosed in Patent 1,967,368, issued July 24, 1934 to E. W. Reeve and reference may be had to that patent for a description of the general objects and functions of 30 repeaters of this type.

In accordance with the invention a timing device for a repeater relay comprises essentially a circuit interrupter which is driven through a friction clutch arrangement by means of a motor-driven shaft common to a plurality of similar timing devices for other relays. The locking of the relay is accomplished by an auxiliary locking device which has a winding controlled by the interrupter contacts of the timing device. 40 The locking device may be arranged to hold the armature of the relay in its extreme alternate positions either by means of magnetic attraction or by means of a mechanical lock. The locking device may be of very small dimensions and 45 thus may readily find place on a repeater panel already installed in the field. The relays will require only a slight alteration, if any at all, depending upon the type of relay. The locking device may be connected by a few wires to 50 the timing device which thus may be placed at any convenient place within the repeater station.

55 The invention will now be described as applied to repeating systems of different well-known

types and reference will be made to the accompanying drawings in which,

Fig. 1 is a circuit diagram of a telegraph repeating system similar to that disclosed in Patent 1,990,561 issued on February 12, 1935 to L. A. Mortimer but modified in accordance with the invention by the inclusion of a timing device for causing the repeater to operate on the regenerative principle. In this embodiment a mechanical locking device is provided for the line relay; 10

Fig. 2 shows a simplified repeating circuit modified in a manner similar to the circuit in Fig. 1 but in which the armature of the line relay is electromagnetically locked; 15

Fig. 3 shows diagrammatically a repeating relay of the non-polar type particularly adapted for regeneration of impulses under remote timing control; and

Fig. 4 shows a simplified repeater system in which the line relay functions in a manner similar to that of the relay in Fig. 3 except that the line relay in Fig. 4 is polarized. 20

Referring now particularly to the circuit diagram shown in Fig. 1, the repeater station B is connected by means of a line west LW to a substation C and over a line east LE to a repeater station A and is arranged for repeating signals in either direction, one direction at a time. These stations are operating on a start-stop code which in the present embodiment is assumed to comprise a stop and a start impulse, and five permutation impulses. 25

The repeater station B includes the break relay EBR and line relay ELR for transmission east and the line relay WLR for transmission west. 35

The relay ELR is a polar relay and may be of any desired construction. For the purpose of timing its operation for production of regenerated impulses into the line LE a catch 11 has been attached to the armature of this relay which may be in the form of a knife edge. A locking magnet LM with its armature 12, to which is attached a similar knife edge 13, is located with respect to relay ELR so that the knife edge 13 may lock the edge 11 in either the marking or the spacing position of relay ELR when the armature 12 is retracted by its spring, the edge 11 engaging one or the other face of edge 13 in the respective positions. 40 45 50

The start-stop timing device T is particularly associated with this repeater circuit. It comprises a shaft 21 carrying a number of cams and driven through a friction clutch 22 from a power system 23. The shaft 21 is normally held against 55

rotation by means of the start-stop cam 24 engaging the armature of stop magnet SM when the latter is deenergized. The cam 25 is arranged to control a set of contacts 26 for closing the starting circuit when the timing device is in its normal position as shown in the drawings. The cam 27 is arranged to operate the impulse contacts 28 which control the locking magnet LM.

For a description of the operation of this system during transmission east, it will first be assumed that a marking potential is transmitted from the substation C by a closure of the line LW, in which case the signaling circuit may be traced from minus potential at the marking contact of relay WLR through the line windings of relays ELR and EBR in series over line LW and through the substation equipment to positive potential. At the same time a biasing circuit may be traced from the minus potential at the marking contact of relay WLR through the biasing windings of relays ELR and EBR in series to an intermediate point on potentiometer P; the strength of the line current being twice that of the biasing current, relays ELR and EBR are operated to marking as shown in the drawings. Under this condition the line circuit east is closed at the marking contact of relay ELR and the circuit may be traced from minus potential at the marking contact at repeater A, over the line LE, marking contact of relay ELR, and through the line winding of relay WLR to positive potential, which places also this relay in marking position as shown in the drawings.

This condition corresponds to the rest period or stop impulse of a signal series and the circuit will remain at rest until the start impulse of the next signal series is received, which will be a spacing pulse. During the stop period the timing device is also held stationary, inasmuch as stop magnet SM is connected between the plus potential at the marking contact of relay EBR and the plus potential on contacts 26.

When now a start impulse is received by the opening of the line at substation C, the current through the line windings of relays ELR and EBR will reduce practically to zero and these relays will be operated to spacing by the current in their biasing windings. Relay EBR will actually operate its armature to spacing at the beginning of the start impulse, thereby applying minus potential to the start magnet SM. The relay ELR is, however, prevented from operating at this time by the engagement of the knife edges 11 and 13.

As soon as the start magnet SM attracts its armature, the timing device will commence rotating. The contacts 26 will immediately open the start circuit and keep it open during the major part of a whole revolution. The contacts 28 will be intermittently closed seven times during a revolution, each time operating the locking magnet LM to release the armature of relay LR for operation in either direction.

Thus during the reception of the start impulse the first projection on cam 27 will cause the contacts 28 to close and energize locking magnet LM to withdraw the knife edge 13 at an instant near the center of the start pulse, thereby permitting the armature of relay ELR to swing to spacing position under the influence of the biasing winding. An instant later the contacts 28 are again opened and the locking magnet LM will lock the armature of relay ELR in spacing position, the knife edges 11 and 13 in this case engaging on their alternate faces and insuring

engagement between the armature and the spacing contact of relay ELR, substantially as shown for the marking position.

The distance between the projections on cam 27 and the speed of rotation is such that after the first projection has closed and opened the contacts 28, the contacts will remain open until the next projection closes them near the center of the next impulse received from station C, and each succeeding projection will similarly arrive to operate the contacts 28 in synchronism with the arrival of the centers of the remaining impulses of a signal series.

Assuming that the next impulse from station C is a marking pulse due to the closing of the line LW, the relay ELR will tend to move toward spacing but this operation will not take place until the armature is released by the locking magnet while the second projection on cam 27 closes the contact 28.

The cam 27 will thus release the armature of relay ELR near the center of each of the seven impulses constituting a signal series, thereby permitting the relay ELR to operate only during a short instant at the center of each impulse with the result that corresponding marking and spacing impulses will be transmitted over the line LE of uniform duration.

During reception of the last impulse of the series, which is a marking impulse, the relay ELR will be operated to marking and will remain locked there when the timing device immediately after comes to a stop.

It will, of course, be possible to orient the timing device in any well-known manner so that the projections of cam 27 will close contacts 28 at a time during each impulse at which the impulse passes through its maximum, which usually is near the center of the impulse.

It will be understood from the description just given and from the showing in Fig. 1 that the repeater circuit proper may be a standard repeater. As a matter of fact, the circuit used as an example in this figure is identical with that shown in Patent 1,990,561 already referred to. In order to convert this repeater to function on a regenerative basis it is only necessary to mount the locking magnet LM in the repeater bay and to arrange for a convenient mechanical locking arrangement with the line relay ELR. The timing device T may be located at any desired place in the repeater station and is connected by a few wires to the repeater panel. Where it is desirable to modify a number of repeaters for regenerative operation, a number of timing devices may be mounted together on a rack and driven by the common driving shaft 23 by any convenient means such as an electric motor.

Whereas for the sake of clearness only one timing device is shown in connection with the repeater B with the effect that only the signals transmitted from west to east are regenerated, it is, of course, possible to arrange for timed operation also of relay WLR by the provision of a timing device similar to that shown in the drawings and operating a locking magnet, similar to the locking magnet LM, associated with the armature of relay WLR. In this manner signals transmitted in a direction east to west would also be regenerated by relay WLR in combination with a start-stop mechanical timing device.

In the arrangement shown in Fig. 2 only the line relays ELR and WLR of a two-way repeater circuit are shown. In this circuit signals received over line LW will operate relay ELR to marking 75

or spacing and the relay will retransmit corresponding plus or minus signals over the line LE. Similarly relay WLR will receive signals over line LE for retransmission into the line LW.

5 The relays are shown in marking position as during the reception of a stop impulse.

The timing device T is similar to the device shown in Fig. 1 and the corresponding parts are correspondingly numbered. In this case the contacts 28 are arranged to energize a pair of locking magnets LM associated with the armature of relay ELR and acting upon an extension 11 of magnetic material, attached to the armature of relay ELR to, when energized, hold the extension 11 attracted either in marking or in spacing position depending upon the incoming signals.

During the stop impulse the magnets LM are deenergized since contacts 28 are open, leaving the armature of relay ELR free to respond when a start impulse arrives. Thus at the beginning of a start impulse, arriving over line LW, relay ELR operates to spacing, thereby transmitting a minus signal over the line LE and at the same time starting the timing device by operating the start magnet SM. Immediately upon the passing of the center or peak of the start impulse, the cam 27 will close the contacts 28 thereby energizing the locking magnet LM which consequently will lock the armature of relay ELR in spacing position. Thereafter the armature of relay ELR will be released only momentarily at the center of each succeeding impulse. However, upon reception of the next stop impulse, the contacts 28 will remain open and the armature of relay ELR will again be free to respond to the next start impulse.

A similar timing device and locking arrangement may, of course, be provided for the relay WLR.

40 In Fig. 3 a regenerative arrangement is shown which comprises a repeating relay LR especially designed for regeneration of weak impulses and a timing device T for timing the operation of the relay in a manner very similar to those already described.

The relay LR is a neutral type relay provided with a line winding 18 and also an auxiliary winding 19. The armature 10 is normally held attracted by the line winding in the position shown in the drawings and may be retracted by a spring 41. It carries at its extreme end a contact member 42 connected through a pigtail 43 to the circuit through the start magnet SM and adapted in attracted position of the armature to engage the stationary adjustable contact point 44 connected to a source of negative potential.

Associated with the relay is a contact lever 15 having a horizontal and a vertical arm. The horizontal arm carries a non-chattering contact member 45 connected through a pigtail 46 to the line circuit LE and adapted for engagement with the stationary, adjustable marking and spacing contacts *m*, *s*. The vertical arm of the contact lever 15 ends in a knife edge 11 which operates with a knife edge 13 fastened on the armature 12 of the locking magnet LM. With this arrangement the contact lever 15 is locked against movement when the locking magnet LM is energized and will be free to move when the armature 12 is retracted by the spring 48.

75 A spring connection 16, which in the arrangement shown in the drawings has one end fastened to the armature 10 and the other end gripped by pins 47 on the contact lever 15, serves to impart movement from the armature 10 to the contact

lever 15 and yet permits each of these members to move independently.

The timing device T is provided with the stop cam 24, the contact cam 25 for holding the start circuit open except in the stop position, and the timing cam 27 for momentarily releasing the locking magnet once for each of the seven impulses of a signal series. The timing device in this instance is furthermore provided with a second timing cam 31 for controlling the auxiliary winding 19 of relay LR over a circuit from negative potential through the winding 19, the contact 32, the conducting portions of cam 31, the shaft 21 and slipring 33 to ground. In the drawings the non-conducting portions of cams 15, 25, 31 and 27 are shown in solid black.

The operation of this arrangement will now be described. In the stop condition the line LW is in marking condition and the line current through the winding 18 holds the armature 10 attracted as shown; as will appear from the following description, the contact lever 15 will be locked in marking position, i. e., with the contact member 45 engaging the marking contact and thereby applying minus potential to the line LE. It will be noted that the locking magnet is energized over a conducting segment of cam 27 while the timing device T is at rest. The contact 32 normally resting on an insulated segment 34, the auxiliary winding is currentless.

When now a start impulse arrives, the winding 18 will be deenergized, armature 10 will be retracted to close the starting circuit for the starting magnet SM, thereby causing the timing device to begin rotating at the beginning of the start impulse. Shortly thereafter, the brush 28 will pass over an insulated segment 29 of cam 27 which, with proper orienting, will occur at the center of the start impulse. As a consequence locking magnet LM will be released for a short interval during which the contact lever 15 will be moved to spacing position by the tension set up in the spring connection 16 by armature 10 in its retracted position. Thus a positive or spacing potential will be applied to the line LE for repeating of the start impulse. It will be noted that the brush 32 during the start impulse will be traveling over an insulated segment 34 and that therefore the winding 19 will remain deenergized.

Shortly before the arrival of the center portion of the next impulse, i. e. the first character impulse, the brush 32 will engage a conducting segment 35 on cam 31 and the winding 19 will become energized and attract armature 10 for the short interval of engagement between the brush 32 and the first contact segment 35 of cam 31. Assuming that the first character impulse is a marking impulse, the winding 18 will become energized and will hold the armature 10 attracted when, shortly before the center of the impulse, the winding 19 is deenergized due to the brush 32 again reaching an insulated segment. Thus when immediately thereafter, i. e., at the center of the impulse, the brush 28 passes on to an insulated segment and releases the locking magnet LM, the armature 10, being in marking position, will cause the contact lever 15 to also move into marking position, where it immediately will be locked by the knife edge 13 as the brush 28 passes on to a conducting portion of cam 27.

Shortly before the arrival of the second character impulse over the line LW, the brush 32 will engage a conducting segment of cam 31 to again energize the winding 19 and attract the

armature 10. Assuming that the second character impulse is a spacing impulse, the line winding 18 will at this time be deenergized and will remain so when the brush 32 again reaches the insulated segment of cam 31. Thus, at this instant, both windings 18 and 19 will be deenergized and the armature 10 returns to its retracted position, where it will be when at the center of the impulse the brush 28 reaches the corresponding insulated segment on cam 27. When the locking magnet LM now deenergizes, the tension in spring 16 will cause the contact lever 15 to operate to spacing, where it will be locked immediately after.

It will thus be seen that the actual movement of the armature 10 into marking position is accomplished by the winding 19 and into retracted position by the spring 41. The line winding 18 is required only to hold the armature 10 attracted during the marking impulses after the armature has been presented to the relay magnet by the winding 19; it will permit the armature 10 to be retracted during the currentless spacing impulses. Thus a relay with this provision is capable of operating on a comparatively low line current. This has been made possible by the present arrangement of parts which permits the armature 10 to move without disturbing the retransmitting contacts *m, s*.

The arrangement of the mechanical parts of this relay may, of course, be varied in different ways without a departure from the spirit of the invention. Thus the spring 16 may be replaced by a double spring or by a spiral spring; the armature 10 and the contact lever 15 may be mounted on separate pivots.

The relay winding 12 is preferably connected directly into a line circuit, but may receive the incoming impulses through an intermediate relay.

The arrangement shown in Fig. 4 includes a line relay ELR with mechanical contact operating parts and functions very similarly to the relay shown in Fig. 3. In this case, however, the line relay is of the polarized type.

The circuit shows a simplified repeater including line relay ELR for transmission east and line relay WLR for transmission west, each provided with a timing device T similar to that shown in Fig. 3 for controlling the regenerative action. Only one side of the repeater is fully shown and will be described.

The line relay ELR has a line winding 18 and two auxiliary windings 19 and 20. The armature and spacing contact are connected in the start circuit for the start magnet SM of the timing device T in a manner similar to that shown in Fig. 3. The armature is connected through a spring connection 16 to a contact lever 15 for operation of the contacts 50 controlling the line circuit LE for retransmission of impulses. The contact lever 15 has a knife edge 11 cooperating with knife edge 13 on armature 12 of the locking magnet LM as shown in Fig. 3. The locking magnet LM is controlled over contacts 28 by the cam 27 to release the contact lever 15 at the center or peak of each incoming impulse.

The winding 19 is connected over contacts 32 for control by the cam 31 in a manner similar to that described in connection with Fig. 3. This winding when energized will operate the armature of relay ELR to marking shortly before the release of the contact lever 15, to present the armature for holding in the marking position by the winding 18 during the reception of a marking impulse.

The contacts 32 are arranged to always apply

ground to one or the other of the windings 19 and 20. The winding 20 is connected to operate the armature of relay ELR to spacing position and thus corresponds to the retracting spring 41 in Fig. 3. Thus immediately after the marking winding 19 has been energized during the passing of contacts 32 by a projection on cam 31, the spacing winding 20 will be energized and will tend to move the armature to spacing. The current in winding 20 should be so proportioned that, in the presence of a marking impulse in the winding 18, the armature will remain in marking position, but in the presence of a spacing impulse, when the winding 18 is currentless or receives current in the direction opposite that of the marking pulses, the armature will be moved to spacing by the winding 20. In either case the armature will be in its proper position at the time each of the projections on cam 27 close the contacts 28 to energize the locking magnet LM and release the contact lever 15 for operation in accordance with the tension set up in the spring connection 16 by the armature of relay ELR.

The operation of this arrangement being nearly identical with that shown in Fig. 3, it is not believed to be necessary to give a detailed description thereof.

A special arrangement has however been incorporated in the circuit shown in Fig. 4, whereby one side of the repeater is locked against operation as soon as the timing device of the other side has left its normal position. For this purpose a contact spring has been added to the contacts 26 on the timing device associated with relay ELR, to close a circuit from ground to the marking winding 19 of the relay WLR which thus will remain in marking position as long as the cam 25 holds the contacts 26 operated during a complete rotation; upon return to normal position the circuit will again be opened and permit the relay WLR to operate. The relay ELR will be similarly locked when the timing device for relay WLR leaves its normal position. The object is to prevent mutilation of a signal series by transmission in the opposite direction; accordingly a break signal cannot become effective until the active side of the repeater has finished transmission of a signal series.

In this embodiment the contact combinations 26, 28 and 38 have been shown individually mounted on adjustable brackets which by means of screws and slots arranged in any convenient manner may be shifted for the purpose of orienting the different contact sets independently. Any other convenient arrangement may, of course, be provided for this purpose.

What is claimed is:

1. A regenerative start-stop signal repeating system comprising a relay device having a winding for receiving impulses from a circuit and having an armature and contact means operated by said armature for sending regenerated impulses into another circuit in accordance with the received impulses, start-stop circuit interrupting contact means, and an electromagnetic locking device having a winding and means controlled by the winding for normally preventing operation of said relay contact means by said armature in response to impulses through said operating winding, the second said winding being controlled by said circuit interrupting contact means to momentarily permit the operation of said sending contact means by said armature at intervals in synchronism with the incoming impulses.

2. A regenerative start-stop signal repeating system comprising a relay device having a winding for receiving impulses from a circuit and having contact operating means and contact means for sending regenerated impulses into another circuit, start-stop circuit interrupting contact means, and an electromagnetic locking device having a winding and means controlled by the winding for locking said contact operating means against movement, the second said winding being controlled by said circuit interrupting contact means to momentarily release said contact operating means for operation by said receiving winding at intervals in synchronism with the incoming impulses.

3. A relay having a receiving winding and a contact operating armature, in combination with start-stop timing means for timing the movements of said armature, said timing means comprising a locking device adjacent said armature for preventing said armature from moving and having an operating winding, and start-stop circuit interrupting means connected to said operating winding for momentarily releasing said armature for movement in isochronism with incoming start-stop signals.

4. A regenerative start-stop signal repeating system comprising a retransmitting relay device having an armature, a winding for controlling the operation of said armature and contact means operated by said armature, and start-stop timing means for timing the operations of said contact means by said armature, said timing means including start-stop circuit interrupting means and an electromagnetic device having an armature with mechanical locking means for intermittently preventing the operations of said contact means and having a winding controlled by said circuit interrupting means for timed operations of said locking means.

5. A regenerative start-stop signal repeating system comprising retransmitting relay means having a contact operating lever and a winding for operating said lever and start-stop timing means for timing the operations of said lever by said relay winding to be in isochronism with incoming start-stop signal impulses, said timing means including start-stop circuit interrupting means and an electromagnet having an armature for mechanical locking and releasing of said lever and a winding controlled by said circuit interrupting means for timed operation of said locking armature.

6. A regenerative start-stop signal repeating system comprising retransmitting relay means having a contact operating lever and a winding for operating said lever and start-stop timing means for timing the operations of said lever by said relay winding to be in isochronism with incoming start-stop signal impulses, said timing means including start-stop circuit interrupting contact means and electromagnetic means having pole faces for magnetic locking and releasing of said lever and having winding means controlled by said circuit interrupting means for timed magnetization and demagnetization of said pole faces.

7. A regenerative start-stop signal repeating system comprising retransmitting relay means including a receiving winding for incoming impulses, contact operating means for retransmission of impulses under control of said receiving winding and a control winding for electromagnetically locking said contact operating means against operation, and start-stop timing means

for timing the outgoing impulses and including circuit interrupting contact means for intermittently controlling said control winding to release said contact operating means for substantially instantaneous operation.

8. A regenerative start-stop signal repeating system comprising a relay device having a receiving winding and an armature controlled by said winding and having sending contacts including a contact lever operated by said armature, start-stop timing means for timing the movements of said lever, said timing means including start-stop circuit interrupting means and an electromagnetic device having an armature with mechanical locking means for intermittently releasing said lever for operation by said armature, and a winding controlled by said circuit interrupting means for timed operation of said locking armature in synchronism with impulses incoming to said receiving winding.

9. A regenerative start-stop signal repeating system comprising a biased relay device having an armature and a contact lever operated by said armature for retransmission of impulses, and having a receiving winding for control of said armature in accordance with incoming impulses and having an operating winding for operating said armature from one position to an alternate position and also having electromagnetic means including a control winding for normally locking and intermittently releasing said contact lever, said system further comprising start-stop timing means having first circuit interrupting means for timed operation of said armature by said operating winding independently of incoming impulses and second circuit interrupting means for timed release of said contact lever by said electromagnetic means for operation by said armature into alternate positions in accordance with incoming impulses.

10. A regenerative start-stop signal repeating system comprising a relay device having an armature and a contact lever operated by said armature for retransmission of impulses, and having a receiving winding for control of said armature in accordance with incoming impulses, and having biasing means for normally holding said armature in retracted position, and having an operating winding for operating said armature into attracted position, and also having electromagnetic means including a locking winding for normally locking said contact lever in its alternate positions, said receiving winding being adapted to hold said armature attracted during reception of a marking impulse, said system further comprising start-stop timing means having first circuit interrupting means for periodically operating said armature by said operating winding in unison with a series of incoming marking and spacing impulses, and second circuit interrupting means for periodically releasing said contact lever by said electromagnetic means for operation by said armature into alternate positions near the individual centers of said incoming impulses, said operating winding for each impulse being deenergized by said first interrupting means before the release of said contact lever.

11. A regenerative start-stop signal repeating system comprising a polarized relay device having an armature, a lever operated by said armature and retransmitting contact means operated by said lever, and having a receiving winding for control of said armature in accordance with incoming impulses, a marking winding for inter-

mittently operating said armature to marking position and a spacing winding for operating said armature to spacing, and also having electromagnetic means including a locking winding for normally locking said lever in its alternate positions, said receiving winding being adapted to hold said armature in marking position during reception of an incoming marking impulse, said system further comprising start-stop timing means having first circuit interrupting means for periodically operating said armature by said marking winding in unison with a series of incoming impulses, and second circuit interrupting means for periodically releasing said lever by said electromagnetic means for operation by said armature into alternate positions near the individual centers of said incoming impulses, said marking winding being deenergized before the release of said lever.

12. A regenerative start-stop signal repeating system comprising retransmitting relay means and start-stop timing means therefor, said relay means including a biased armature, a receiving winding for control of said armature, an operating winding for operation of said armature from one position to another, sending contact operating means operable under control of said armature, and a locking winding for normally preventing operation of said contact operating means, and said timing means including first circuit interrupting means for intermittently en-

energizing said operating winding for operation of said armature in unison with incoming impulses and for control by said receiving winding and second circuit interrupting means for said locking winding to intermittently permit operation of said contact operating means shortly after each said operation of the armature.

13. A start-stop regenerative repeater comprising a retransmitting relay having a contact operating armature and start-stop timing means for timing the movements of said armature, characterized in this that said timing means comprises an electromagnetic locking device adjacent said armature for preventing said armature from moving and a start-stop circuit interrupter for controlling said locking device to momentarily release said armature for movement once for each character impulse of an incoming signal.

14. A start-stop regenerative repeater comprising retransmitting relay means having a contact operating lever and start-stop timing means for timing the movements of said lever, characterized in this that said timing means comprises electromagnetic locking means adjacent said lever for preventing said lever from moving and a start-stop circuit interrupter for controlling said locking means to momentarily release said lever for movement once for each character impulse of an incoming signal.

OSVALD E. RASMUSSEN.