June 13, 1944. A. F. CONNERY ET AL 2,351,014

ALARM FOR SYNCHRONOUS TELEGRAPH CIRCUITS

Filed Dec. 30, 1942 2 Sheets-Sheet 1

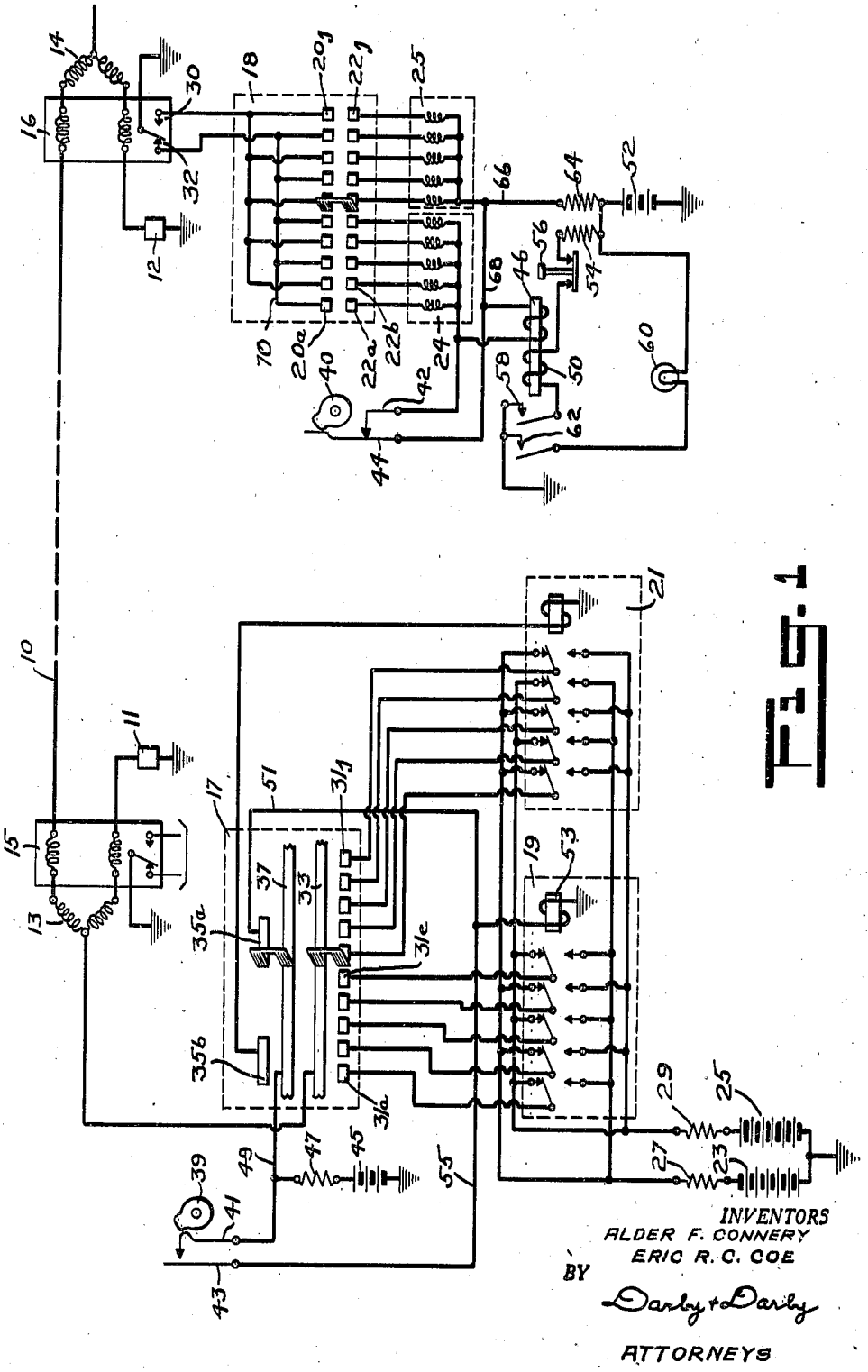

FIG. 1

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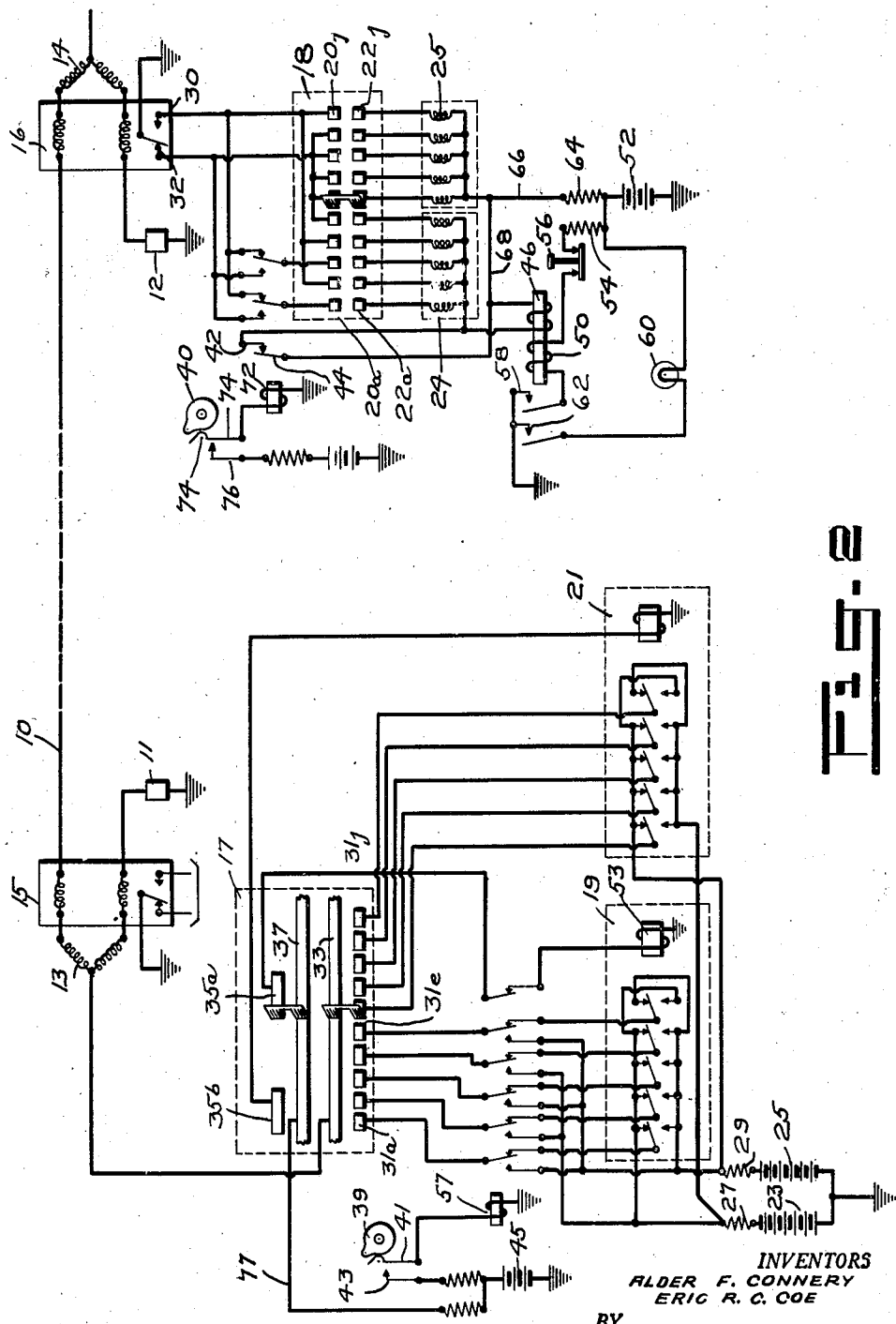

Fig. 2

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Patented June 13, 1944

2,351,014

UNITED STATES PATENT OFFICE

2,351,014

ALARM FOR SYNCHRONOUS TELEGRAPH CIRCUITS

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Application December 30, 1942, Serial No. 470,574

11 Claims. (Cl. 178—53)

The present invention relates to automatic printing telegraphy and particularly to printing telegraph equipment which is synchronously operated. More particularly still, the invention may be utilized in connection with synchronous multiplex telegraph circuits.

Frequently in synchronous telegraphy, and particularly when the interconnecting lines are of considerable length, haphazard signal distortion resulting either from outside interference or from degradation of the duplex balance results in errors in printing of the telegraph receiver. When the duplex balance is disturbed, distortion of the received signal results, even though there be no outside interference. In many instances in such printing telegraph systems, the printer or similar recording device is left unattended and the invention is of particular use in connection with such unattended systems although not in any sense limited thereto. In overcoming these difficulties, we have provided for the automatic detection of error arising from such haphazard signal distortion. In general this is accomplished by sending a special signal from the transmitting station at predetermined intervals of time. This signal is then sought for by a synchronously operating apparatus at the receiving end of the line and arrangements are made such that if the signal is abnormally mutilated an alarm will automatically be given.

It is an object of our invention to provide a synchronous printing telegraph circuit which will automatically signal the presence of haphazard signal distortion in undue degree.

It is a further object of our invention to provide such a circuit which is readily utilized in connection with the normal multiplex printing telegraph circuits and which is simple and inexpensive of installation.

Further objects and features of the invention will appear when the following specification is considered in connection with the appended drawings, in which

Figure 1 is a schematic diagram of the circuit arrangement as utilized with synchronous printing telegraph equipment having transmitters electrically connected to send rapid reversals when the transmitters are in their idle condition. This diagram shows the application of the alarm circuit to a duplexed multiplex circuit. For simplicity, however, equipment for transmission in one direction only is shown.

Figure 2 is a schematic diagram of the circuit arrangement as utilized with synchronous printing telegraph equipment having transmitters electrically connected to send slow reversals when the transmitters are in their idle condition. This diagram also shows the application of the alarm circuit to a duplexed multiplex circuit; again equipment for transmission in one direction only is shown.

As has been indicated in the foregoing description the synchronous telegraph circuits are shown as being of the multiplex type. Although single channel synchronous telegraph equipment may be utilized the multiplex system is the most common form of such synchronous telegraph arrangements.

Referring to the drawings, there is shown in Figure 1 a line **10** which may be either a single line with ground return, as illustrated, or a pair of wires providing a metallic return. This line **10** is balanced for duplex operation in the well known manner by means of artificial networks **11** and **12**. Likewise in conformance with usual practice, there are provided the differential miliammeters **13** and **14** and the differential polar relays **15** and **16**. While differential duplex circuits have been illustrated, it will be understood that a bridge type duplex circuit can equally well be used. The transmitting equipment is connected to the split of the duplex in the usual manner and the receiving equipment operated from the contacts of the differential line relay **15** or **16**, likewise in the usual manner. The transmitting equipment shown at the left in Figure 1 comprises the distributor **17** together with the tape transmitters **19** and **21**, which transmitters are fed from the usual split signalling battery **23**, **25** through protective resistance **27** and **29**.

The distributor **17** (of which but four rings are illustrated) comprises ten sending segments designated **31***a* through **31***j*, a common ring cooperating with the sending segments and designated **33**, sixth pulse magnet segments designated **35***a* and **35***b* and the common ring therefor designated **37**.

It will, of course, be understood that this distributor is adapted for two channel transmission and that if a greater number of channels is to be utilized there will be additional sending segments and additional sixth pulse magnet segments, there being five additional sending segments for each channel and, of course, a single additional sixth pulse segment for each channel.

As stated hereinabove, Figure 1 illustrates the arrangement when the transmitters are connected to send rapid reversals when in their idle position. For this reason alternate contacts of each of the transmitters **19** and **21** are connected

to one pole of battery, for example to the negative pole of battery as indicated at 23 while the intervening contacts are connected to positive battery as indicated by the connection to battery 25. Specifically the first, third and fifth upper contacts of transmitter 19 are connected to positive battery while the second and fourth contacts are connected to negative battery. Again the first, third and fifth contacts of transmitter 21 are connected to negative battery and the second and fourth contacts to positive battery. The lower contacts of both transmitters are connected in each instance to the battery opposite in polarity to that connected to the corresponding upper contact. The armatures of the transmitters are connected in the usual manner directly to the corresponding sending segments 31*a* to 31*j*.

The above has described the normal two channel multiplex transmitting arrangement, it being understood that in transmitting, tape is supplied to the two tape transmitters which are operated in accordance with the perforations in the tape. In applying our invention to this arrangement the transmitter (as for example transmitter 19) of one channel is adapted to be held operated, that is to be held to its idle side or with the armatures against the corresponding upper contacts, for a predetermined portion of the transmission, for example during one distributor rotation in each ten, whereby rapid reversals are transmitted over the line after each group of nine character signals of the same channel.

This is accomplished by providing a cam 39 which is driven from the shaft of distributor 17 through a set of reducing gears which reduce its speed to some exact sub-multiple of the speed of the distributor brush shaft, if the distributor is of the brush type, or in any event to one-tenth of the speed of operation of the distributor. As stated above, we have found a speed of one-tenth that of the distributor to be advantageous. The cam 39 cooperates with a pair of contacts 41, 43 and is arranged to close these contacts and hold them closed during slightly more than one distributor revolution.

At the receiving end of the circuit there is provided the usual equipment comprising a distributor 18 having two segmented rings. Of course, this receiving distributor is provided with numerous other solid and segmented rings for correction and like purposes which, however, are well known and do not enter into the description of this invention. Connected to each group of segments 22*a* through 22*e* and 22*f* through 22*j* is a receiving recorder which may be either a common telegraph printer, frequently known as a teletypewriter, or a reperforator or a "translator." This latter piece of equipment is a device for converting the five unit code of synchronous multiplex telegraphy to the five unit code utilized for start-stop operation. One example of such a translator is that shown in Hallden Patent No. 2,196,069 of April 2, 1940. In the diagram of Figure 1 the telegraph printers are schematically illustrated by a showing of their magnet coils at 24 and 25.

At the receiving terminal a cam 40, similar to the cam 39, is provided, the cam being similarly driven at the same sub-multiple of the distributor speed as is the cam 39. This cam is provided with a pair of normally closed contacts 42 and 44 which are in shunt to the operating winding of an alarm relay 46. Relay 46 is in addition provided with a locking winding 50, the circuit for which extends from battery 52 through protective resistance 54, thence through break key 56 to the winding 50 and through locking contact 58 to ground. In addition an alarm circuit is connected from battery 52 through lamp 60 to contact 62 of relay 46 and thence to ground.

The operation of the circuits above described can most readily be understood by describing the operation of the entire system during the period when the special signal is being sent and received. As the brushes of distributor 17 approach the position shown in Figure 1, a character signal will have just been transmitted over the first or A channel and the brushes will just have connected common ring 37 to segment 35*a* thus causing a flow of current from battery 45 through protective resistance 47 and conductor 49 to ring 37 and thence through the brush 35*a* and conductor 51 to the operating or stepping magnet 53 of transmitter 19. This will cause the transmitter to move all of its armatures to their upper contacts in the normal manner and would normally when the distributor brush left segment 35*a* cause the stepping magnet to de-energize advancing the perforated tape to the next position and permitting the pins of the transmitter to cause the positioning of the armatures upon their upper or lower contacts in accordance with the perforations in the tape at the new position. However, while the brush is traveling over segment 35*a*, cam 39 closes contacts 41 and 43 thereby completing a circuit from battery 45 through resistance 47 and thence over conductor 77 and through contacts 41 and 43 and conductor 55 to the operating or stepping magnet 53. This retains the transmitter in its idle position with the armatures against the upper contacts and due to the alternate arrangement of these contacts with respect to the split battery 23, 25, as heretofore described, the next signal sent out on the first or A channel will be one of rapid reversals. Prior to this time, the character signal already set up on transmitter 21 is sent to the line in the usual manner. Following the transmission of the rapid reversals during the period when transmitter 19 is held in its idle position the brushes of the distributor again make contact with segment 35*a* and shortly thereafter cam 39 in its continuing rotation in a counter-clockwise direction reaches a position such that contacts 41, 43 are opened. Thus when the brush leaves segment 35*a* the circuit to magnet 53 is completely broken and this magnet assumes its normal periodic operation until such time as cam 39 has completed a rotation and returns to substantially the position illustrated in Figure 1.

When the rapid reversals are received at the receiving polar differential relay 16, they, of course, cause operation of that relay to connect ground to alternate ones of the receiving segments 20 when in one position and to the intervening segments when in the other position. The relay 16 is adapted to have its armature move to the right hand contact 30 when a positive signal is received and to move to the contact 32 when a negative signal is received. Thus, if the received signals are in exact synchronism with the transmitted signals and there has been no shift of the crossover between signals resulting from signal distortion, whenever the relay is on its right hand contact 30, it will complete circuits to the second or fourth receiving segments 20 of the distributor 18 and since the brush will, at that time, lie on a first, third or fifth segment 20 of the distributor, the circuit will be interrupted at this point. However, when there has been

signal distortion, the relay armature may move to contact **30** at a time when the brushes are on an even numbered segment **20** of the distributor **18** and conversely may move to contact **32** at a time when the brush lies on an odd numbered segment of the distributor. Of course, if the signal exists during a sufficient interval of the time taken by the brush in traversing the receiving segment, magnets of the printer or other recorder will be affected and an erroneous recording will result.

However, there is provided, as has been stated, an alarm relay **46** which at the time when the rapid reversals are being sent, as above described, is connected in series with the printer magnets **24** due to the fact that the shunt around the operating winding of the relay has been broken by the opening of contacts **42**, **44** under control of cam **40**. If, for example, a negative signal is received such that the tongue of relay **16** moves to contact **32** while the brush of the receiving distributor lies on the contact segments **20***a*, **20***c* or **20***e* of the first or A channel, a circuit will be completed from battery **52** through protective resistance **64** and over conductors **66**, **68** through the operating winding of relay **46** and thence through the first magnet of the printer **24** and over segment **22***a*, distributor brush and segment **20***a* to conductor **70** and thence to relay contact **32** and through the armature of the relay **16** to ground. If the position of the tongue on contact **32** and the passage of the brush over the above mentioned first, third and fifth segments **20***a*, **20***c* and **20***e* coincide for a sufficient interval of time, relay **46** will be operated. Relay **46** will then lock over the locking circuit previously traced. At the same time the alarm light **60** will be lighted and will remain lighted until the alarm relay **46** is restored to normal condition by depressing the break key **56** and thereby breaking the locking circuit for the relay.

It will be understood that the alarm relay **46** is operable on shorter impulses than are the magnets of the printer **24**. Thus even though the haphazard distortion results in an impulse too short to operate the printer erroneously, still the relay will operate and will give an alarm. Therefore, the condition which has resulted in the distortion, for example the degradation of the duplex balance, may be corrected before actual message errors have occurred. This result is achieved by a sacrifice of but 5% of the line time in the case of a two channel multiplex and proportionately less in the case of a three channel multiplex. Of course, the amount of line time utilized for transmission and reception of the special signal may be adjusted by varying the rate of rotation of the cams **39** and **40** with respect to the corresponding distributors although, as stated hereinabove, the rate must be maintained at an exact sub-multiple of the distributor speed.

Figure 2 shows the application of the invention to a system which is slightly different from that of Figure 1 in that the transmitters of this system are arranged to send out slow reversals during idle periods. In this figure the same reference characters have been used as were utilized in Figure 1, different characters being given only to additional equipment. The transmitters **19** and **21** of Figure 2 have their contacts connected to the split battery **23**, **25** in a slightly different manner from those of Figure 1. Thus, as is shown in Figure 2, the first, second, third and fourth upper contacts of transmitter **19** are connected to negative battery while the fifth upper contact is connected to positive battery. The first, second, third and fourth upper contacts of transmitter **21** are connected to positive battery and the fifth upper contact to negative battery. Of course, as before, the lower contacts are connected to the pole of battery opposite to that of the corresponding upper contact. Obviously with this arrangement when the transmitters are operating idly the signals transmitted to the line will comprise five units of time during which a negative signal is transmitted over the line followed by five units of time of positive signal and so on alternately. While the idle signal from the A channel consisting of four negative impulses followed by one positive impulse could be used as the special signal there would in that case be only one crossover in the signal. We have found it advantageous to provide a special signal having a larger number of crossovers. Therefore, with this arrangement there is provided a relay **57** which relay is operated when cam **39** closes contacts **41**, **43**. When relay **57** operates its armatures move from their right hand position, as shown, to their left hand positions thereby closing circuits through the left hand ones of the relay contacts. As a result thereof and as is obvious from the circuit arrangements shown, the A channel transmitter **19** is disconnected from the sending segments **31***a* to **31***e* and in place thereof these segments are connected alternately to positive and negative battery over the contacts of relay **57**. Further, when relay **57** operates, it breaks the circuit from the sixth pulse segment **35***a* of the A channel to the operating magnet **53** of transmitter **19**. This occurs just subsequent to the distributor brush making contact with segment **35***a* wherefore the stepping magnet **53** is normally operated following the transmission of the five character impulses of the preceding character. Then following the transmission of the character from the B channel through the medium of transmitter **21**, alternating positive and negative impulses are transmitted through the sending segments **31***a* through **31***e* and the common ring **33** to the split of the duplex and thence over line **10** to the receiving terminal. After the reversals have been transmitted, as described, the distributor brush will again approach contact **35***a*. At this time, however, relay **57** will have opened the stepping magnet circuit wherefore when the brush makes contact with segment **35***a* it does so ineffectively. Following this, and after the brush has left segment **35***a*, cam **39** permits contacts **41** and **43** to open and thereby break the circuit to relay **57** restoring the contacts of this relay to normal. To summarize, the stepping magnet is operated to place the tape in the transmitter in its new position prior to the sending of the special signal, but this new signal present in the transmitter is not transmitted until after the special signal has been sent.

At the receiving terminal, the circuit is substantially the same as that shown in Figure 1 except, however, that a relay **72** is provided, this relay being operated by cam **40** and contacts **74**, **76**. The relay **72** is provided with a plurality of contacts of which contacts **42**, **44** are identical to those of Figure 1 and serve the purpose of removing the shunt from the operating winding of alarm relay **46**. The remaining contacts of relay **72** are connected to the contacts of the receiving relay **16** in such a manner that when relay **72** is operated the first, third and fifth distributor seg-

ments 20 will be connected to the left hand contact 32 of the receiving relay 16 and the second and fourth segments will be connected to the right hand contact 30.

Although the operation of the circuit just above described is so similar to that described in connection with Figure 1 as to be immediately apparent a brief resume thereof may be helpful.

After the transmission of each nine character signals over the A channel from transmitter 19, cam 39 closes contacts 41, 42 thereby causing operation of relay 57. The operation of this relay breaks the circuit to the operating magnet 53 of transmitter 19 immediately after this circuit has been broken through the sixth pulse magnet segment 35a. The transmitter is, therefore, stepped to its next position and remains there during the succeeding rotation of the distributor brush arm. During this rotation, rapid current reversals are sent over the line owing to the alternate connection of segments 31a through 31e with positive and negative battery. These rapid current reversals are received at the receiving relay 16 at a time when the cam 40 has closed contacts 74, 76 and, therefore, at a time when relay 72 is operated. If the signal is without undue distortion owing either to outside interference or to degradation of the duplex balance, the armature of relay 16 will lie upon contact 32 whenever the brush of distributor 18 lies on either the second or fourth segments 20 of the receiving distributor and upon contact 30 when the brush is on either the first, third or fifth segments. If, however, there has been any undue distortion there will be times during which the armature of relay 16 will lie on contact 32 while the brush is on the first, third or fifth distributor segments or on contact 30 when the brush is on the second or fourth segments. Since the shunt is at this time removed from the operating winding of alarm relay 46, at contacts 32, 34, there will result an operation of the relay 46 if the impulse is of sufficient duration. As described in connection with Figure 1, this relay will lock in its operating position and will, in addition, operate the lamp 60 to indicate that the single distortion is approaching the limit for accurate recording. Also as before, the relay will so operate even though the received distorted signal is insufficient to cause errors of operation of the receiving recorders which, of course, may be printers, reperforators, translators, etc.

It will be understood that the embodiments of the invention described are preferred embodiments only, and that many modifications may be employed without departing from the spirit of our invention. For example, the invention may be utilized in connection with a single channel type of synchronous telegraph system such as has been mentioned hereinabove. Furthermore, the invention may be utilized with a regenerative repeater of the rotary type, although in this instance the circuit of the alarm relay 46 would be "leaked off" of the circuit interconnecting the receiving and transmitting equipment of the regenerative repeater instead of being in series with the recorder magnets as in the case of its use with a synchronous receiving terminal set.

Of course, the alarm signal which has been described as a lamp may be of any convenient type, either audible or visible.

Whenever the word "recorder" is used in the claims, it will be understood that it is intended to include not only the printing telegraph receivers, reperforators and translators, as mentioned in the specification, but also the circuits interconnecting the receiving and sending equipment of a rotary regenerative repeater as mentioned hereinabove.

What is claimed is:

1. In a synchronous telegraph system, in combination, a transmitting terminal comprising a transmitter and a distributor, a receiving terminal comprising a receiving relay, receiving distributor and a recorder, means for periodically interrupting transmission from said transmitter, means for transmitting a special signal during said period of interruption, circuit means controlled jointly by said receiving relay and receiving distributor for normally rendering inoperative the recorder during substantially undistorted reception of the special signal, an alarm device in circuit with the recorder, and means operating synchronously with the transmitter interrupting means for rendering said alarm device operative during transmission of the special signal whereby an alarm is given when said special signal is abnormally distorted during transmission.

2. In a synchronous telegraph system, in combination, a transmitting terminal comprising a transmitter and a transmitting distributor, a receiving terminal comprising a receiving relay, a receiving distributor and a recorder, means driven by the transmitting distributor at an exact sub-multiple of the speed thereof for holding the transmitter in its idle position during the revolution of the distributor whereby a signal comprising rapid reversals of current is transmitted to the line circuit, means controlled jointly by said receiving relay and receiving distributor for normally rendering the recorder inoperative during substantially undistorted reception of the said rapid reversals of current, an alarm device in circuit with said recorder, and means driven by the receiving distributor at an exact sub-multiple of the speed thereof and in synchronism with the driven means at the transmitting terminal for rendering said alarm device operative during transmission of said rapid reversals, whereby when rapid reversals are abnormally distorted during transmission said alarm device is operated.

3. In a multiplex telegraph system, in combination, a transmitting terminal comprising a plurality of transmitters and a transmitting distributor, a receiving terminal comprising a receiving relay, a receiving distributor and a plurality of recorders, means for periodically interrupting transmission from one of said transmitters, means for transmitting a special signal during said period of interruption, circuit means controlled jointly by said receiving relay and receiving distributor for normally rendering inoperative the recorder associated with the transmitter from which transmission is interrupted during substantially undistorted reception of the special signal, an alarm device in circuit with the said associated recorder and means operating synchronously with the transmitter interrupting means for rendering said alarm device operative during transmission of the special signal whereby an alarm is given when said special signal is abnormally distorted during transmission.

4. In a multiplex telegraph system, in combination, a transmitting terminal comprising a plurality of transmitters and a transmitting distributor, a receiving terminal comprising a receiving relay, a receiving distributor and a plurality of recorders, means driven by the trans-

mitting distributor at an exact sub-multiple of the speed thereof for holding one of the transmitters in its idle position during a revolution of the distributor, whereby a signal comprising rapid reversals of current is transmitted to the line, circuit means controlled jointly by said receiving relay and receiving distributor for normally rendering the recorder associated with the held transmitter inoperative during substantially undistorted reception of the said rapid reversals of current, an alarm device in circuit with the said associated recorder, and means driven by the receiving distributor at an exact sub-multiple of the speed thereof and in synchronism with the driven means at the transmitting terminal for rendering said alarm device operative during transmission of said rapid reversals, whereby when rapid reversals are abnormally distorted during transmission said alarm device is operated.

5. In a multiplex telegraph system, in combination, a transmitting terminal comprising a plurality of transmitters and a transmitting distributor, a receiving terminal comprising a receiving relay, a receiving distributor and a plurality of recorders, relay means for disconnecting one of the transmitters from the corresponding distributor and supplying said distributor with current from a current source in such manner as to provide transmission of a special signal consisting of rapid current reversals, means driven by the transmitting distributor to periodically operate said relay, said means being driven at a speed which is an exact submultiple of the distributor speed, a circuit joining said receiving relay and said receiving distributor, means at said receiving terminal operable in synchronism with the relay means at the transmitting terminal and driven at a speed which is an exact sub-multiple of the speed of the receiving distributor, said means serving to alter the said circuit connection in such manner that the receiving relay and receiving distributor jointly render the recorder associated with the disconnected transmitter inoperative during substantially undistorted reception of the rapid current reversals, an alarm device in circuit with the said associated recorder rendered operative by the operation of said means, said alarm device being operated upon reception of abnormally distorted rapid current reversals.

6. In a multiplex telegraph system, in combination a transmitting terminal comprising a plurality of transmitters and a transmitting distributor, a receiving terminal comprising a receiving relay, a receiving distributor and a plurality of recorders, means driven by the transmitting distributor at an exact sub-multiple of the speed thereof for holding one of the transmitters in its idle position during a revolution of the distributor, whereby a signal comprising rapid reversals of current is transmitted to the line, circuit means controlled jointly by said receiving relay and receiving distributor for normally rendering the recorder associated with the held transmitter inoperative during substantially undistorted reception of the said rapid reversals of current, an alarm relay in circuit with the said associated recorder, means driven by the receiving distributor at an exact sub-multiple of the speed thereof and in synchronism with the driven means at the transmitting terminal for rendering said alarm relay operative during transmission of said rapid reversals, whereby when rapid reversals are abnormally distorted during transmission said alarm relay is operated, and means operated by said alarm relay to give an alarm signal.

7. In a multiplex telegraph system, in combination, a transmitting terminal comprising a plurality of transmitters and a transmitting distributor, a receiving terminal comprising a receiving relay, a receiving distributor and a plurality of recorders, means driven by the transmitting distributor at an exact sub-multiple of the speed thereof for holding one of the transmitters in its idle position during a revolution of the distributor, whereby a signal comprising rapid reversals of current is transmitted to the line, circuit means controlled jointly by said receiving relay and receiving distributor for normally rendering the recorder associated with the held transmitter inoperative during substantially undistorted reception of the said rapid reversals of current, an alarm relay in circuit with the said associated recorder, means driven by the receiving distributor at an exact sub-multiple of the speed thereof and in synchronism with the driven means at the transmitting terminal for rendering said alarm relay operative during transmission of said rapid reversals, whereby when rapid reversals are abnormally distorted during transmission said alarm relay is operated, means operated by said alarm relay to give an alarm signal, means to maintain said alarm relay operated after actuation thereof, and manually controlled means to release said relay.

8. In a multiplex telegraph system, in combination, a transmitting terminal comprising a plurality of transmitters and a transmitting distributor, a receiving terminal comprising a receiving relay, a receiving distributor and a plurality of recorders, cam means driven by said transmitter at an exact sub-multiple of the speed thereof, contact means operated by said cam means, said contact means being arranged in a circuit in shunt to the normal transmitter magnet operating circuit and serving to maintain the transmitter operating magnet operated during a revolution of the transmitting distributor to cause said transmitter to transmit an idle signal over the line, circuit means controlled jointly by said receiving relay and receiving distributor for normally rendering the recorder associated with the held transmitter inoperative during undistorted reception of the said idle signal, a normally short circuited alarm device in circuit with the said associated recorder, cam means driven by the receiving distributor at an exact sub-multiple of the speed thereof and in synchronism with the driven means at the transmitting terminal, contact means operated by said cam means and effective to remove the short circuit from said alarm device and render it operable, said alarm device being operated upon reception of distorted idle signals to give an alarm signal.

9. In a multiplex telegraph system, in combination, a transmitting terminal comprising a plurality of transmitters and a transmitting distributor, a receiving terminal comprising a receiving relay, a receiving distributor and a plurality of recorders, cam means driven by said transmitting distributor at an exact sub-multiple of the speed thereof, contact means operated by said cam means, said contact means being arranged in a circuit in shunt to the normal transmitting magnet operating circuit and serving to maintain the transmitter operating magnet operated during a cycle of operation of the transmitting distributor

to cause said transmitter to transmit an idle signal over the line, circuit means controlled jointly by said receiving relay and receiving distributor for normally rendering the recorder associated with the held transmitter inoperative during undistorted reception of the said idle signal, a normally short circuited alarm relay in circuit with the said associated recorder, cam means driven by the receiving distributor at an exact sub-multiple of the speed thereof and in synchronism with the driven means at the transmitting terminal, contact means operated by said cam means and effective to remove the short circuit from said alarm relay and render it operable, said alarm relay being more sensitive than the recorder and being operative to give an alarm upon the reception of distorted rapid current reversals whereby an alarm is given when substantial distortion occurs and before distortion is effective to produce erroneous recording.

10. In a multiplex telegraph system, in combination, a transmitting terminal comprising a plurality of transmitters and a transmitting distributor, a receiving terminal comprising a receiving relay, a receiving distributor and a plurality of recorders, relay means for disconnecting one of the transmitters from the corresponding distributor, interrupting the stepping of said transmitter and supplying said distributor with current from a source in such manner as to cause transmission of a special signal comprising rapid current reversals, means driven by the transmitting distributor to periodically operate said relay, said means being driven at a speed which is an exact sub-multiple of the distributor speed, circuits joining said receiving relay and receiving distributor, a relay in circuit with the recorder associated with the interruptible transmitter, said relay serving to alter the connections between said receiving relay and receiving distributor to thereby render the associated recorder inoperative during undistorted reception of the special signal, an alarm device in circuit with the said associated recorder, said alarm device being rendered operable upon operation of said relay, and cam means driven by the receiving distributor at an exact sub-multiple thereof and in synchronism with driven means at the transmitting terminal to operate said relay whereby distorted special signals cause operation of said alarm device.

11. In a multiplex telegraph system, in combination, a transmitting terminal comprising a plurality of transmitters and a transmitting distributor, a receiving terminal comprising a receiving relay, a receiving distributor and a plurality of recorders, relay means for disconnecting one of the transmitters from the corresponding distributor interrupting the stepping of said transmitter and supplying said distributor with current from a source in such manner as to cause transmission of a special signal comprising rapid current reversals, means driven by the transmitting distributor to periodically operate said relay, said means being driven at a speed which is an exact sub-multiple of the distributor speed, circuits joining said receiving relay and receiving distributor, a relay in circuit with the recorder associated with the interruptible transmitter, said relay serving to alter the connections between said receiving relay and receiving distributor to thereby render the associated recorder inoperative during undistorted reception of the special signal, an alarm relay in circuit with the said associated recorder, said alarm relay being rendered operable upon operation of said relay, cam means driven by the receiving distributor at an exact sub-multiple of the speed thereof and in synchronism with the driven means at the transmitting terminal to operate said relay, said alarm relay being more sensitive than the recorder, and an alarm device operative by said alarm relay to give an alarm signal upon the reception of distorted signals prior to the distortion reaching such magnitude as to be effective to produce erroneous recording.

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