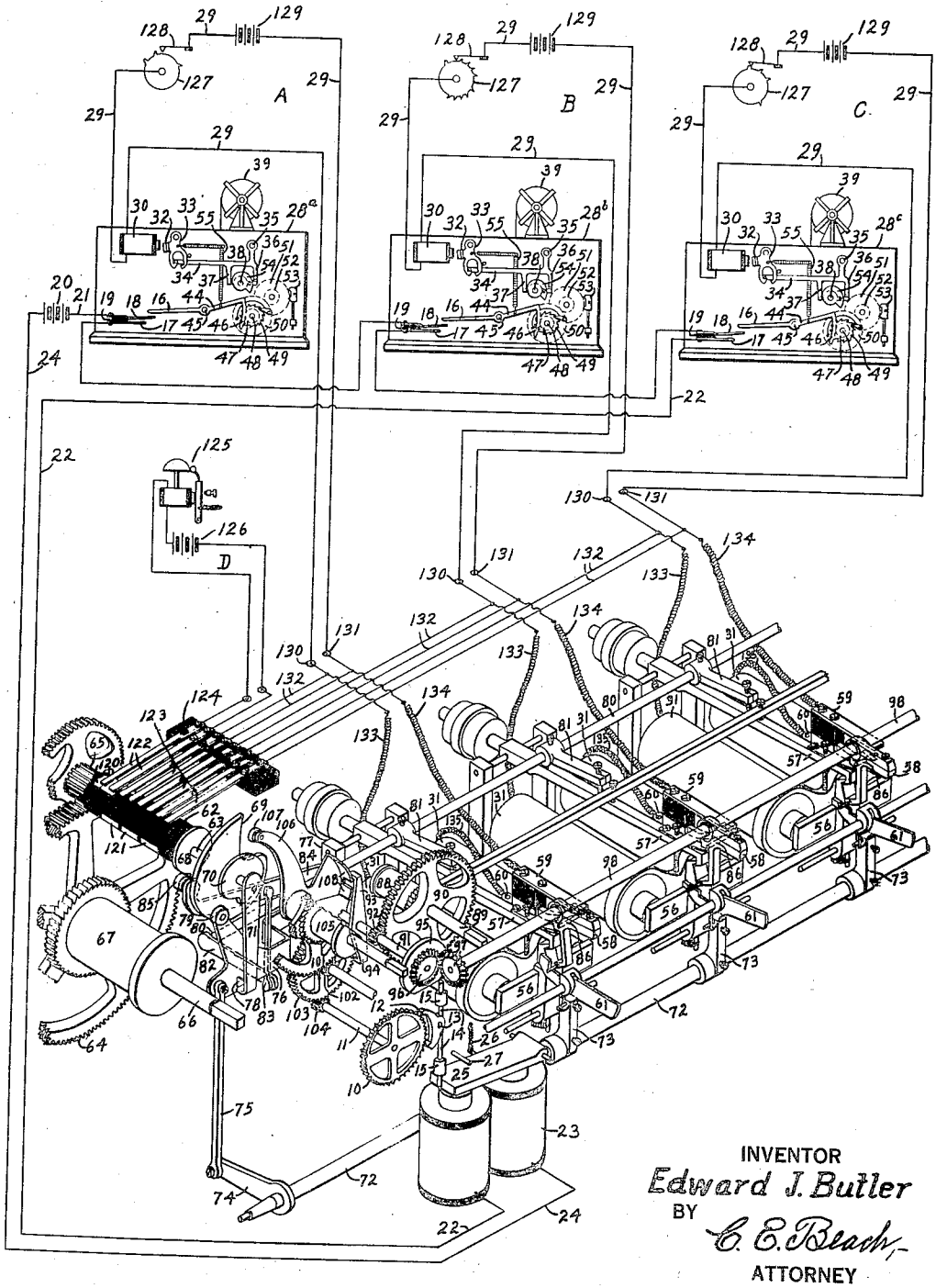
Jan. 4, 1927. 1,613,018

E. J. BUTLER

REPEATER LOCKING DEVICE

Filed May 12, 1919 2 Sheets-Sheet 1

Fig. 1.



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REPEATER LOCKING DEVICE

Filed May 12, 1919 2 Sheets-Sheet 2

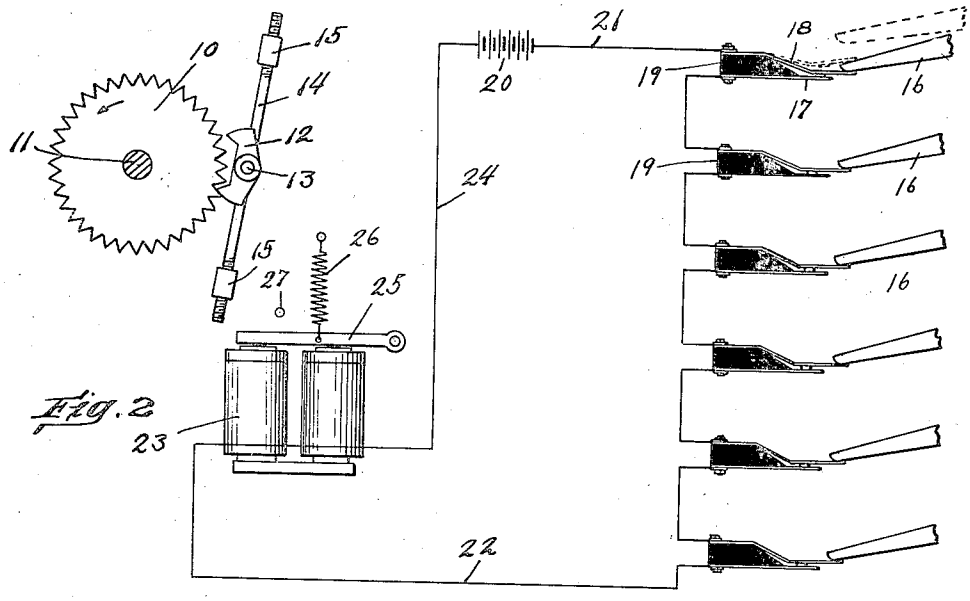


Fig. 2.

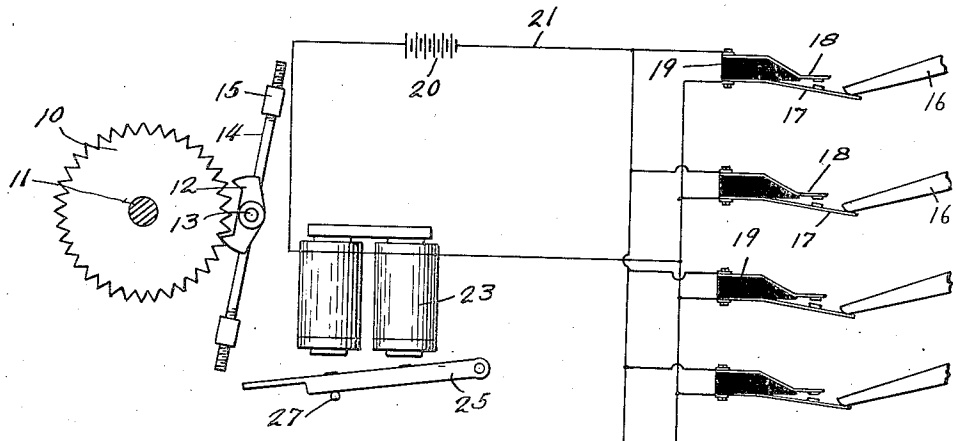


Fig. 3.

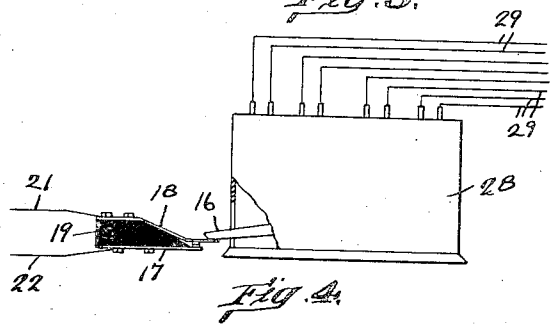


Fig. 4.

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Patented Jan. 4, 1927. 1,613,018

UNITED STATES PATENT OFFICE.

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REPEATER-LOCKING DEVICE.

Application filed May 12, 1919. Serial No. 296,328.

My present invention relates to repeaters, and more particularly to automatic non-interfering repeaters used in fire-alarm telegraph systems, for repeating a signal transmitted over any one of a plurality of street circuits into one or more joker or engine room circuits.

In the repeaters in common use at the present time, a plurality of control or street magnets, one for each signal or street circuit of the system, are associated with the repeater, and are adapted to independently control the joker or engine room signaling keys or equivalent devices. Lockout devices are provided for all of the control or street magnets, and means are provided whereby the control or street magnet associated with a particular street circuit over which a fire alarm signal is being sent allows the armature associated with the control magnet to operate the joker circuits controlling keys, to the exclusion of any other signal that may be subsequently initiated on any of the other circuits. Upon the operation of any control or street magnet the locking device is operated to lock out all of the other control or street magnets, and such locking device constantly tends to move to an unlocked position, the movement being a retarded one and the time taken by the locking device to move from fully locked to fully unlocked position being greater than the space interval between consecutive rounds of signals.

If, while a signal is being sent in over a street circuit in consequence of the pulling of a box in such circuit, a box is pulled on another street circuit, though it is impossible for the second signal to interfere with the first signal being sent, yet as the control of the repeater magnet may be given over to the second street circuit at any intermediate period in the signal in such circuit, incomplete or broken signals are transmitted over the joker or engine room circuits, which result in false alarms or confusion.

The object of my present invention therefore, is the provision of means for preventing the sending of false or broken signals by the repeater of a fire alarm telegraph system.

In carrying out this object I associate a locking device with the retarding element of the repeater locking device, and which is controlled by all of the fire alarm signaling circuits, the arrangement of elements being such that upon the sending of any signal over any of the street circuits associated with the repeater, the controlling magnet's locking device of the repeater will be moved to locking position to lock all controlling magnets against operation, except the one associated with the circuit over which the signal is being sent.

In the accompanying drawing,

Figure 1 is a schematic representation of a repeater system embodying the locking mechanism of this invention;

Fig. 2 is a diagrammatic representation of the locking mechanism of this invention as applied to the repeater system of Fig. 1;

Fig. 3 is a diagrammatic representation of a modified form of the circuit of the mechanism of Fig. 2; and

Fig. 4 is a schematic representation of a plural circuit register which may be employed in lieu of the single circuit registers indicated by Figs. 1, 2 and 3.

Referring to Figs. 1 and 2,—the conductors 29 form parts of signal originating or so-called "street-box" circuits, each of which circuits serially includes the winding of a register magnet (such as the magnet 30 of one of the registers 28^a, 28^b, 28^c) and the winding of a repeater magnet (such as one of the magnets 31). Fig. 1 shows three such circuits, but it will be understood that a desired number of such circuits may be provided, and that each such circuit will suitably control corresponding register and repeater magnets.

The registers 28^a, 28^b and 28^c may be of any desired well-known form which has self-starting and self-stopping mechanism for paper feeding means; suitable contacts, such as 17 and 18, being so associated with such registers as to be abnormally conditioned when such mechanism is positioned to permit operation of the feeding means and to be normally conditioned at all other times.

For purposes of illustration, fragmentary views are shown in Fig. 1 of typical register mechanism arranged in accordance with the disclosure of Patent No. 691,587, issued January 21st, 1902, to Charles Berst; and as registers 28^a, 28^b and 28^c have like mechanism, the mechanism of but one of such registers will be here described in detail. The controlling magnet 30 is associated with an

armature 32 carried by a lever 33, the free end of which lever cooperates with the detent arm 34 so that,—when said arm is in its fully elevated position and said armature is in its retracted position, said lever will be positioned for retaining said arm in such elevated position; when said armature thereafter moves to attracted position, said arm will be permitted to move somewhat downwardly; and, when said armature thereafter moves from attracted to retracted position, said lever will permit said arm to freely fall. The arm 34 is pivoted at 35 and has associated therewith the fingers 36 and 37, which fingers are arranged for cooperation with members moving with the shaft 38 so that,—when said arm is in its fully elevated position, the finger 36 will be disposed in the path of a member moving with the shaft 38 so as to prevent rotation thereof; and, when said arm 34 is in the position which it assumes after complete disengagement thereof by the lever 33, said finger 36 will be withdrawn from the path of such coengaging member and the finger 37 will be disposed in the path of a member moving with the shaft 38 so that, during the rotation of such shaft following the release thereof from the finger 36, movement will be imparted to the arm 34 through the finger 37 such as will raise said arm to its fully elevated position. Suitable marking mechanism may be arranged for operation incident to the rotation of the shaft 38 for suitably marking the tape supplied by the roll 39. Such mechanism is omitted from the drawing in the interests of clearness, and will not be herein described in detail as it forms no part of this invention and those skilled in this art are acquainted with various types of such mechanism which are suitable for intended cooperation with the shaft 38. For like reasons, details are omitted relative to feed rollers for propelling the paper tape supplied by the roll 39, it being understood that desired rollers may be operated by the driving shaft 48 which forms part of the typical paper feeding train which will now be described. The lever 44 is pivoted at 45 intermediate the ends thereof; the end 16 of said lever, which forms a so-called "hopper," is arranged to cooperate with the contacts 17 and 18 for a purpose hereinafter more fully explained; and the other end of said lever carries a toothed sector 46 which engages the pinion 47. The ratchet 49 moves with the pinion 47, and said ratchet and pinion are journaled upon the shaft 48 for rotation independently thereof. The gear 50 is fixed upon the shaft 48 and acts through the pinion 52 to drive the escape wheel 51, which is engaged by the pallet 53 for suitably regulating the speed of rotation thereof. The cam 54 carried by the shaft 38 is arranged to engage the lever 44 for movement thereof in opposition to the pull of the spring 55, and the ratchet wheel 49 is connected to the gear 50 by a spring-pressed dog so that, when the pinion 47 is rotated by movement imparted to the sector 46 by the rotation of the cam 54, said ratchet wheel and pinion may turn independently of said gear and of the shaft 48; and so that, when said pinion is rotated by movement imparted to said sector by the spring 55, the gear 50 will rotate with such pinion at a speed which is suitably retarded by the cooperation of the escapement wheel 51 with the pallet 53. The contacts 17 and 18 are mounted upon the insulating block 19 and are so associated with the free end of the hopper 16 that said contacts will be closed when said hopper is fully depressed, but will be open at all other times.

This invention is suited for use with types of repeaters which comprise means for locking moving parts associated with non-controlling originating circuits throughout periods when such repeaters are acting in response to controlling circuits. A well-known example of such a type of repeater is shown and described in Patent No. 810,912 of January 30th, 1906, to Frederick W. Cole. For purposes of illustration, a fragmentary view of a repeater similar to that of said Cole patent is shown in Fig. 1, which repeater comprises a plurality of originating circuit sections (one for each originating or initiating circuit), a signal repeating train, a locking train, and a retardation device.

Each initiating circuit section includes a magnet 31, an armature 56, a locking member 58 for locking the latch 57 in effective position, contacts 59, 60 operable by a pin 56 carried by said locking member and a catch 61 for retaining said locking member in ineffective position at certain times.

The signal repeating train comprises a cylinder 62, moving with the shaft 63, which is driven by the gear 64 acting through the pinion 65. The gear 64 is mounted upon the shaft 66 and connected to suitable driving means, (such, for example, as a cord and weights, not shown) acting through the drum 67. The cams 68, 69 and 70 and the detent arm 71, are fixed upon the shaft 63 and are so relatively positioned as to accomplish the respective functions hereinafter more fully described. The tripping and resetting shaft 72 (which shaft will, for the sake of brevity, be hereinafter referred to as a trip shaft) carries a series of arms 73, 73, 73 which are situated adjacent the armatures 56, 56, 56, so that movement of any armature away from its associated magnet may cause rotation of said shaft in one direction and so that rotation of said shaft in the opposite direction may serve to move said armatures toward their magnets. The arm 74 is connected through the link 75 to the detent lever 76, which lever is pivotally attached to the post 77 and carries a pin 78

which is normally disposed in the path of the free end of the arm 71. The lever 76 also carries a roller 79 which is arranged to engage the cam 70 for actuation thereby as hereinafter more fully explained. A rock shaft 80 carries the arms 81, 81, 81, which arms are adapted to move the latches 57, 57, 57 of the respective initiating circuit units into effective relationship with the armatures 56, 56, 56 associated therewith. The arm 82 is fixed upon the shaft 80 and is connected through the link 83 with the lever 84 so that, when said lever 84 is moved downwardly by the engagement of the cam 68 with the roller 85 carried at the free end of said lever, said arms 81, 81, 81 will cause their respective associated latches 57, 57, 57 to be moved into effective relationship to the armatures 56, 56, 56.

The locking train comprises a gear 90, which gear is carried by the shaft 89 and is connected to the drum 88 for suitable actuation by a weight and suspension cord (not shown). The shaft 91 carries a pinion 92, detent arms 93 and 94, a cam 95 and a beveled gear 96 which engages the beveled gear 97 for driving the locking shaft 98 which carries the locking members 58 of the respective initiating circuit sections. Each of the members 58 is carried upon the shaft 98 by means of a well-known form of eccentric mounting. Such mounting is so arranged that, when the detent arm 93 is uppermost, the members 58 will be positioned for locking the latches 57 in effective position; and so that, when the shafts 91 and 98 have been rotated for about one-half turn from the position shown, thus bringing the detent arm 94 uppermost, said members 58 will not be in position to lock their associated latches 57 in effective position.

The retardation device comprises the escape wheel 10, fixed upon the shaft 11, and engaged by the pallet 12 which is mounted upon the shaft 13 and moves the pendulum rods 14 carrying the adjustable weights 15. The shaft 11 is driven by the gear 101 acting through the pinion 102, gear 103 and pinion 104. Suitable driving means is provided for the gear 101, such as a weight and cord (not shown) connected to the drum 105. One of the rods 14 extends into the path of the cam 95, so that when said cam is in the position it assumes when the arm 94, engages the track 108, the pallet 12 will be held against such oscillation as would permit rotation of the wheel 10. An arm 106 is frictionally connected to the gear 101, and said arm carries a roller 107 at the free end thereof, which roller is so positioned that it may be suitably operated by the cam 69 as hereinafter more fully explained. The notched track 108 moves with the arm 106 and the notch in said track is so positioned relative to the bent-over ends of the arms 93 and 94 that, when said track occupies the position it assumes when the roller 107 rests against the periphery of the cam 69 at a point of minimum radius, the lower portion of said track will be disposed in the path of the bent-over end of the arm 94 and the notch in said track will be disposed in the path of the bent-over end of the arm 93; and so that when the cam 69 moves said arm 106 away from the position just described, the notch in the track 108 will be presented to the bent-over end of the arm 94 and the upper portion of said track will be disposed in the path of the bent-over end of the arm 93.

The extent of movement imparted to the arm 106 by the rotation of the cam 69 bears such relation to the rate of movement which may be imparted to said arm by the rotation of the gear 101 (as governed by the escapement wheel 10 and pallet 12) that the rotation of said cam, acting through said arm, will impart such movement to the track 108 that, after such cam has come to rest, the notch in said track will not be presented to the bent-over end of the arm 93 until after the expiration of a time longer than the longest interval between the signaling impulses of any signal.

Pairs of contact pens 122, 123, 123, 123 are so mounted upon the insulating block 124 that the free ends of said pens extend over the cylinder 62. The plate 120 is so situated upon the cylinder 62 that, when the arm 71 is positioned for engagement by the pin 78, said plate will interconnect the pens 122; and the plates 121, 121, 121 are so positioned upon said cylinder that they will interconnect the pairs of pens 123, 123, 123, respectively, when the cylinder 62 is in the position which it assumes when the shaft 63 has been so rotated as to carry the arm 71 about one-half a turn from the position in which said arm may engage the pin 78.

The pens 122 are serially included in a normally closed so-called "joker" or "alarm" circuit D, which circuit is responsive to the repeater shown and includes a current source 126 and desired signal manifesting devices such as that typified by the bell 125; so that a signal manifestation will be given in response to each revolution of the cylinder 62.

In each initiating circuit, the conductors 29, 29, 29, 29 serially connect the magnet 30 of the register, the code wheel 127 and contact finger 128 cooperating therewith, and the current source 129 with the repeater terminals 130 and 131. It will be understood that the code wheel 127 and contact finger 128 typify a signal initiating station, and that, under ordinary service conditions, there would be a plurality of such stations in each originating circuit. The initiating circuits A, B and C of Fig. 1 of the accompanying drawings are diagrammatically indicated as

being of the so-called normally closed variety, i. e., the contact finger 128 of each of the initiating stations is normally in electrical contact with a tooth of its associated code wheel 127. Being normally closed circuits, signaling is accomplished by alternately breaking and closing them; breaks constituting the significant change in circuit condition, for reasons well understood by those skilled in this art. For want of a better term, each closure of a normally closed circuit and the break which terminates same (and, similarly, each open circuit period of a so-called normally open circuit and the closure which terminates same) will be hereinafter referred to as an "impulse cycle".

The repeater terminals 130 and 131 associated with each of the originating circuits are connected through a pair of conductors 132 to a corresponding pair of the pens 123; and the terminal 130 of each circuit is also connected through a conductor 133 to one end of the winding of the electromagnet 31 associated with that circuit, while the terminal 131 of each circuit is also connected through the conductor 134 to the contact 59 associated with that circuit. The opposite end of the winding of each electromagnet 31 is connected through the conductor 135 to the associated contact 60.

As shown by Fig. 1,—the various parts are positioned as they would be when rotation of the code wheels 127 of circuits A and B has been so initiated that both of said circuits were first interrupted at substantially the same time, and the second tooth of the code wheel of circuit A has again closed and broken that circuit. It should be noted that, in accordance with usual practice in this art, the code wheel of circuit A would rotate more rapidly than that of circuit B, because of the difference in code numbers; but the extent of rotation shown for both of these code wheels is representative of the elapse of a like time from the starting thereof.

The initial breaks of circuits A and B caused deenergization of the magnets 30 of registers 28^a and 28^b, and of the repeater magnets 31 associated with circuits A and B.

Deenergization of such magnets 30 caused their associated armatures 32 to move to retracted position, resulting in separation of contact 18 from contact 17, of registers 28^a and 28^b.

Separation of such contacts 17 and 18 caused deenergization of magnet 23, whose associated armature 25 thereupon moved to retracted position, thus blocking movement of the pendulum rod 14.

Deenergization of such magnets 31 permitted armatures 56 associated therewith to move in unison to retracted position, and said armatures were thereupon simultaneously restored in accordance with the well-known action of repeating mechanism such as that shown.

Following such restoration, and pending reenergization of their associated magnets, the hooked ends of the associated latches 57 served to prevent said armatures from again moving to retracted position.

Immediately following such initial retractive movement of the armatures 56 of circuits A and B, the cylinder 62 was released and turned a complete revolution; and, during such revolution of said cylinder, the shaft 98 turned one-half of a revolution.

Very soon after the commencement of the revolution of the cylinder 62, the plates 121 connected respective pairs of the contact pens 123, thus shunting the conductors 133 and 134 of the circuits A, B and C.

Immediately after such shunting of conductors 133 and 134, the rotation of shaft 98 caused the locking member 58 associated with circuit C to move downwardly, thus moving its associated latch 57 so as to prevent retractive movement of the associated armature 56, and, acting through pin 86, to move contact 60 away from contact 59.

The latches 57 and the contacts 59 and 60 of circuits A and B were not affected by the downward movement of the locking members 58 incident to the described rotation of shaft 98, because the armatures 56 of such circuits were in retracted position during such rotation, thus maintaining said members in ineffective relationship to both said latches and said contacts.

Ensuing completion of the revolution of the cylinder 62 withdrew the plates 121 from engagement with the pens 123 and current flow in circuit C was thereupon interrupted; the path through conductors 133 and 134 and contacts 59 and 60 having been previously interrupted, as just described.

Upon interruption of current flow in circuit C, magnet 30 of register 28 was deenergized; and its associated armature 32 then moved to retracted position and thereby caused separation of contact 18 from contact 17 of said register.

Upon formulation of the signaling impulse incident to engagement and disengagement of finger 128 by the second tooth of code wheel 127 of circuit A, the magnets 30 and 31 associated with said circuit were energized and then deenergized, thus respectively causing the usual response of the register 28^a in a well-known manner, and another revolution of cylinder 62.

During such second revolution of said cylinder, member 58 of circuit B moved into locking relation with its associated latch 57, and one of the plates 121 temporarily closed circuit C through associated pens 123.

When the cylinder 62 came to rest, after such second revolution thereof, the various parts were positioned as shown by the draw-

ing; circuits A and B being interrupted between their respective associated code wheels 127 and fingers 128, circuit C being interrupted between repeater contacts 59, 60 and 123 associated therewith, and the circuit of locking device magnet 23 being broken between contacts 17 and 18 of registers 28^a, 28^b and 28^c.

Because circuits A, B and C are now broken, their associated magnets 30 and 31 are deenergized, the armatures 32 of registers 28^a, 28^b and 28^c are abnormally positioned as shown, and the repeater armatures 56 are held against retraction by their associated latches 57; and because the circuit of magnet 23 is broken, its associated armature 25 is in abnormal or locking position.

The ordinary routine operation of a signaling system comprising parts such as those indicated by Fig. 1, to the exclusion of those shown by Fig. 2, is well understood by those skilled in this art and for that reason will not be here repeated in detail, other than to point out that, in the absence of the locking device comprising the magnet 23, armature 25, and the means for controlling same governed by the registers 28^a, 28^b and 28^c—if the formulation of signals was initiated simultaneously in two of the initiating circuits and the formulation of the signal then automatically selected to control the operation of the cylinder 62 was completed before the completion of the formulation of the signal of the non-controlling circuit, the circuits responsive to the cylinder 62 (other than such initially non-controlling circuit) would be caused to respond, subsequent to the presentation of the notch in the track 108 to the arm 93 following the last impulse of the signal formulated in the initially controlling circuit, to all signaling impulses thereafter formulated in such initially non-controlling circuit. For example, assuming that circuits A and B are simultaneously broken incident to the formulation of concurrent signals therein, respectively: the armatures 56 of the repeater sections responsive to said circuits will move away from their associated magnets and will thereby swing the locking members 58 associated therewith away from the ends of their cooperating latches 57, so that, when the shaft 98 rotated for one-half a turn incident to the movement imparted to the track 108 resulting from the revolution of the cam 69 responsive to the retraction of said armatures, the pins 86 will pass in front of the free ends of the contacts 60 and will therefore not move the contacts 60 associated with the circuits A and B away from their co-acting contacts 59. If, then, the armature 56 associated with circuit A moves away from its magnet at a time when the corresponding armature associated with circuit B remains at rest, the movement of the arm 73 associated with circuit B, being responsive to the retraction of the armature of circuit A, will so swing the catch 61 associated with circuit B as to permit its cooperating locking member to move into engagement with the latch 57 of circuit B and thereby lock the armature 56 of said circuit against effective retraction throughout the remainder of the signal of circuit A.

At the conclusion of a suitable interval following the completion of the signal of circuit A (as determined by the retardation device comprising the wheel 10 and the pallet 12) the notch in the track 108 will be presented to the bent-over end of the arm 93, and the shafts 91 and 98 will thereupon turn one-half a revolution, thus lifting the locking members out of effective engagement with their respective latches 57. If, when the locking members 58 are lifted, as just described, the formulation of the signal in circuit B is incomplete,—the repeater will act to cause circuits A, C and D to respond to all signaling impulses thereafter formulated in circuit B. This would result, in almost every instance, in the formulation of a fragmentary (and therefore incorrect) signal in circuits A, C and D. For example, if the code wheels 127 were so operated that the intervals between strokes within numerals, between numerals and between rounds are alike for all signals (as is common practice for systems such as that indicated) assuming that each signal is transmitted four times and that the formulation of the signals 21 and 145 are simultaneously initiated in the circuits A and B, respectively; the signal 21 would first be formulated four times in circuits A, C and D, and two rounds of the signal 145 would be concurrently formulated in circuit B; whereupon a portion of the third round of the signal 145 (probably either the last two or three strokes of the 4 and the final 5, depending upon the time measured by the retardation device of the repeater following the last stroke of the signal of circuit A before the repeater is placed in control of circuit B) would be formulated in circuits A, C and D.

The operation of the system shown by Fig. 1 (including the locking mechanism indicated by Fig. 2) would be the same as it would be without such mechanism (as just described) throughout the formulation of the signal in circuit A. However, the operation of the registers 28^a, 28^b and 28^c in response to the signals formulated in such circuits, would cause their respective hoppers 16 to be withdrawn from their coengaging contacts 18, thereby breaking the locking circuit and thus causing deenergization of the locking magnet 23; so that the retardation device including the wheel 10 and pallet 12 would not be permitted to operate, following the completion of the signal of circuit A,

until the expiration of a time measured by the running of the paper feeding train of the register 28^b, which time was longer than the longest interval between the impulses of any signal, and during which time no signaling impulses were formulated in circuit B. The repeater would thus be held locked against signaling impulses of circuit B until after the conclusion of the signal therein, so that the false signal formulation which would have occurred without this locking device will be prevented.

Should any of the circuits A, B and C become disabled by the breaking thereof, the system shown by Fig. 1 (including the locking mechanism indicated by Fig. 2) will first act to render the repeater unresponsive to the circuits then unbroken and to cause such circuits to be opened; and, thereafter, following the expiration of a time longer than the longest interval between the strokes of any signal, said system will act to close the circuits opened by the repeater and to render the repeater responsive thereto.

For example, assuming that the circuit A is disabled by the breaking of conductor 29 thereof; magnet 30 of register 28^a and the magnet 31 associated with circuit A will be deenergized; whereupon said register will act to open the circuit of locking magnet 23 and the repeater will act to open circuits B and C as hereinbefore more fully explained. When circuits B and C are thus opened, magnets 30, 30 of registers 28^b and 28^c will be deenergized, and these registers will thereupon act to cause two additional breaks in the circuit of magnet 23.

Inasmuch as no signaling impulses will follow such initial breaking of circuit A, the running of the paper feeding trains of the registers 28^a, 28^b and 28^c, will each serve to measure a time longer than the longest interval between impulses of any signal, after the expiration of which its contact 18 will be moved into engagement with its contact 17.

When the circuit of the locking magnet 23 has been re-established by the engagement of the contacts 17 and 18 of all of the registers,—said magnet 23 will be reenergized, thus releasing the retardation device including the wheel 10 and the pallet 12; whereupon said device will act to bring the notch in the track 108 into the path of the bent over end of the arm 93, and thus cause restoration of the locking member 58 so as to condition the repeater for response to circuits A, B and C.

From the foregoing, it will be apparent that, after such restoration of the locking member, the repeater will be conditioned for either response to or control of circuits B and C, the same as if circuit A was not broken; and that, upon subsequent repair and resultant closure of circuit A, the magnet 31 associated therewith will be energized, its armature 56 will move to attracted position and thereby permit its cooperating latch 57 to move out of the path thereof, and thereby restore that circuit to normal relationship to the repeater.

If it is desired that the locking circuit shall be normally open, (instead of normally closed as shown in Figs. 1 and 2) the contacts 17 and 18 will be connected in parallel as shown in Fig. 3, and will be so associated with their respective hoppers 16 that such contacts will be separated when said hoppers are normally positioned.

If a plural circuit register is employed, instead of the plurality of single circuit registers indicated by Figs. 1, 2 and 3, the hopper 16 of such register may be arranged to correspondingly control contacts 17 and 18 of the locking circuit, as indicated by Fig. 4.

Although the use of this invention has been herein described in detail in connection with an automatic repeater equipped with facilities for repeating signals from a controlling originating circuit to non-controlling originating circuits,—it will be understood, by those skilled in this art, that this invention is also well adapted for application to repeaters lacking such facilities. In repeaters which lack such facilities,—the contacts 59 and 60 are omitted, the ends of the windings of the electromagnets 31 are connected to the terminals 130 and 131, respectively; and the pens 123, plate 121 and conductors 132 are omitted; although additional contact pens (such as the pens 122) and additional contact plates (such as the plate 120) may be provided for additional alarm circuits (such as the circuit D).

As many other changes may be made in the construction shown by the accompanying drawings and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having thus described my invention, what I claim and desire to secure by Letters Patent, is:—

1. In a non-interference repeater for fire alarm circuits having a repeating mechanism, controlling mechanism therefor responsive to a plurality of circuits, and means responsive to impulsing activity of any of said circuits for causing suspension of the responsiveness of said repeating mechanism

to other of said circuits,—means for thereafter causing termination of such suspension only following inactivity of all of said circuits, said second named means involving mechanism so governed as to be active during inactivity of all of said circuits for conditioning said first named means to cause termination of such suspension of responsiveness irrespective of abnormality of said circuits.

2. In a non-interference repeater for fire alarm circuits, having a repeating mechanism, controlling mechanism therefor responsive to a plurality of circuits, and means responsive to impulsing activity of any of said circuits for causing suspension of the responsiveness of said repeating mechanism to other of said circuits,—means responsive to activity of any of said circuits during suspension of the responsiveness of the repeating mechanism thereto for preventing termination of such suspension of responsiveness throughout the formulation of any intended code signal in any of said circuits, said second named means involving mechanism so governed as to be active during inactivity of all of said circuits for conditioning said first named means to cause termination of such suspension of responsiveness irrespective of abnormality of said circuits.

3. In a non-interference repeater for fire alarm telegraph systems of the class described, including a retardation device for governing restoration of the repeater to normal after actuation thereof in response to any one of a plurality of street circuits,—locking means biased to locking position for preventing actuaton of said retardation device to cause such restoration, means for unlocking said locking means, and means responsive to signaling activity of said circuits for preventing operation of said second named means during such activity of any of said circuits and for permitting such operation during continued abnormal conditioning of any of said circuits.

4. In a non-interference repeater for fire-alarm telegraph systems, the combination of a repeating mechanism arranged for response to a plurality of signal or street circuits, means for governing the responsiveness of such repeating mechanism to said circuits whereby activity of any of said circuits will so abnormally condition said means as to render said mechanism unresponsive to others thereof, means including a retardation device operable for governing restoration of said means to normal, locking means for suspending the operation of said retardation device, electromagnetic means for controlling said locking means, an energizing circuit for said electromagnetic means, a break point in said energizing circuit for each of the signal or street circuits, means responsive to each of the signal or street circuits for controlling the break points associated respectively therewith, and means for maintaining abnormal conditioning of the break point associated with any one of the street circuits throughout the transmission of a signal therein.

5. A multi-originating-circuit non-interference fire alarm repeater including retardation mechanism for governing restoration of control of such repeater by originating circuits after conditioning of such repeater for exclusive control thereof by any one of such circuits, in combination with means constantly responsive to all signaling impulses of all of said circuits for governing the operation of said mechanism, and means active during inactivity of said circuits for causing such restoration of control irrespective of abnormality of any of said circuits.

6. A multi-originating-circuit non-interference fire alarm repeater including retardation mechanism for governing restoration of control of such repeater by originating circuits after conditioning of such repeater for exclusive control thereof by any one of such circuits, in combination with electroresponsive means constantly responsive to all signaling impulses of all of said circuits for governing the operation of said mechanism, and means acting during inactivity of said circuits for causing such restoration of control irrespective of abnormality of any of said circuits.

7. A multi-originating-circuit non-interference fire alarm repeater including retardation mechansm for governing restoration of control of such repeater by originating circuits after conditioning of such repeater for exclusive control thereof by any one of such circuits, in combination with means electroresponsive to all signaling impulses of all of said circuits to suspend operation of said mechanism and involving means for terminating such suspension irrespective of abnormality of any of said circuits.

8. In a non-interference repeater for fire alarm circuts, having a repeating mechanism and controlling mechanism therefor responsive to a plurality of street circuits, means for governing the responsiveness of said repeating mechanism to said street circuits whereby activity of any of said street circuits will so abnormally condition said means as to render said mechanism unresponsive to others thereof, and a retardation device governing restoration of said means to normal after response thereof to any one of said street circuits,—the combination of a locking device for preventing action of said retardation device to cause such restoration, and means responsive to changes from normal to abnormal in the conditioning of any of said street circuits, irrespective of the then responsiveness of the repeating mech-

anism thereto, for rendering effective said locking device and for terminating such effectiveness irrespective of any continued conditioning of any of said circuits.

9. In a repeater: a plurality of originating mechanisms each comprising an electromagnet and a moving device; locking mechanism for all originating mechanisms comprising an independently movable locking member for each originating mechanism, each locking member being so associated with its corresponding originating mechanism as to avoid locking action thereof when the moving device of said originating mechanism is out of its normal position, and lock controlling mechanism comprising means controlled by movement of any moving device out of its normal position for simultaneously effecting actuation of the locking members associated with all originating mechanisms then in normal position; means controlled by the diverse positions of busy moving devices for effecting actuation of remaining unactuated locking members associated with originating mechanisms whose moving devices are in normal position while that of another is in abnormal position; means controlled by each moving device for preventing actuation of the locking member associated therewith when it is the final moving device returned to normal position; repeating mechanism for all moving devices comprising an independent circuit controller for the current path of each originating magnet, each circuit controller being so associated with its corresponding locking member as to be effective only when the locking member is abnormally positioned; and retarded operative mechanism for said lock controlling mechanism for effecting restoration of all actuated locking members only after the lock controlling mechanism has remained inactive for a period longer than the longest interval between responses thereof to any signal, in combination with means responsive to changes in the condition of the circuits of all of said circuit controllers such as are incident to the formulation of signaling impulses therein for suspending action of said retarded operative mechanism, said last named means involving a retarded operative means for thereafter terminating such suspension irrespective of abnormality of any of said circuits only after the expiration of a time longer than the longest interval between the impulses of any signal during which time no signals are formulated in any of such circuits.

10. A repeater comprising a plurality of mechanisms each adapted to independently act in response to signaling impulses in a signal originating circuit individually associated therewith, lock out devices cooperating with said mechanisms, respectively, and operating and restoring mechanism responsive to actuation of any one of said plurality of mechanisms to so operate said devices as to lock against control of said repeater all of said mechanisms which are then inactive; in combination with mechanism responsive to changes in the condition of the circuits associated with said plurality of mechanisms such as are incident to the formulation of signaling impulses for at times restraining action of said operating and restoring mechanism to restore controlling relationship to lock mechanisms, said last named mechanisms involving means for terminating such restraint irrespective of abnormality of any of said circuits only after the expiration of a time longer than the longest interval between the impulses of any signal during which time no signals are formulated in any of the circuits associated with said plurality of mechanisms.

11. A multi-originating circuit fire alarm repeater comprising mechanism for locking moving parts associated with non-controlling circuits throughout periods when such repeater is acting in response to a controlling circuit,—in combination with means for retaining said mechanism in locking position following complete signaling impulse cycles of said circuits, irrespective of the then responsiveness of the repeater thereto, only for a time longer than the longest interval in any signal between such impulse cycles.

12. A multi-originating circuit fire alarm repeater comprising mechanism for locking moving parts associated with non-controlling circuits throughout periods when such repeater is acting in response to a controlling circuit,—in combination with means controllable by signaling impulse cycles of all of the originating circuits associated with said repeater irrespective of continuing abnormality of any of said circuits, for permitting action of said mechanism to restore controlling relationship to non-controlling originating circuits only after the expiration of a time longer than the longest interval between the impulse cycles of any signal during which time no impulse cycles are formulated in any of the originating circuits associated with said repeater.

13. A multi-originating circuit fire alarm repeater comprising means for locking moving parts associated with non-controlling circuits throughout periods when such repeater is acting in response to a controlling circuit,—in combination with recording means responsive to signaling impulses in the various individual originating circuits of said repeater and having usual self-starting and stopping paper feeding mechanism, a device for preventing unlocking action of said repeater locking means, and means so controlled by said paper feeding mechanism

as to render said device effective throughout a suitable portion of the operating cycle of said mechanism.

14. A multi-originating circuit fire alarm repeater comprising means for locking moving parts associated with non-controlling circuits throughout periods when such repeater is acting in response to a controlling circuit,—in combination with recording means responsive to signaling impulses in the various individual originating circuits of said repeater and having usual self-starting and stopping paper feeding mechanism, circuit contacts so controlled by said paper feeding mechanism as to be abnormally positioned during the running of said mechanism, an electromagnetically controlled device for retaining said repeater locking means in its effective position, and an electric circuit including the magnet of said device and so controlled by said contacts as to abnormally condition said device throughout abnormal conditioning of said contacts.

15. A multi-originating circuit fire alarm repeater comprising means for locking moving parts associated with non-controlling circuits throughout periods when such repeater is acting in response to a controlling circuit,—in combination with recorders responsive to signaling impulses in the various individual circuits of said repeater and having usual self-starting and stopping paper feeding mechanism, circuit contacts so controlled by said paper feeding mechanism as to be abnormally positioned during the running of said mechanism, an electromagnetically controlled device for retaining said repeater locking means in its effective position, and an electric circuit including the magnet of said device and so controlled by said contacts as to abnormally condition said device throughout abnormal conditioning of said contacts.

16. In a non-interference repeater for fire alarm circuits, having a repeating mechanism and controlling mechanism therefor responsive to a plurality of street circuits, means for governing the responsiveness of such repeating mechanism to said street circuits whereby activity of any of said street circuits will render said mechanism unresponsive to others thereof, and a retardation device governing restoration of the repeater to normal after response thereof to any one of said street circuits,—in combination with a plurality of registers associated with respective ones of said street circuits, a hopper arranged for usual action in response to changes in the condition of its associated circuits irrespective of continuing abnormality of such circuits, a pair of contacts for each hopper, a control circuit including said pairs of contacts, an electromagnetic device included in said control circuit and arranged to be governed by any of said pairs of contacts, said electromagnetic device arranged to so control said retardation device as to normally permit the operation thereof and to lock said device against operation upon abnormal conditioning of a street circuit.

17. A non-interference repeater for fire alarm circuits, having a repeating mechanism and controlling mechanism therefor responsive to a plurality of street circuits, means for governing the responsiveness of such repeating mechanism to said street circuits whereby activity of any of said street circuits will render said mechanism unresponsive to others thereof, and a retardation device governing restoration of the repeater to normal after response thereof to any one of said street circuits,—in combination with a locking device for preventing action of said retardation device to cause such restoration, controlling means for said locking device comprising an electromagnet for governing said locking device, an energizing circuit for said electromagnet, and means responsive to abnormal conditioning of a street circuit to condition said energizing circuit to cause said locking device to lock said retardation device and unresponsive to continued abnormality of the conditioning of any of said street circuits as to conditioning said energizing circuit for continuance of such locking.

18. A non-interference repeater for fire alarm telegraph systems, having a repeating mechanism, multi-circuit control therefor, means for at times limiting the responsiveness of the repeating mechanism to less than all of such circuits, and a retardation device arranged to prevent restoration of responsiveness of such repeating mechanism to all of such circuits until after the expiration of a predetermined time during which no impulses have been received from the controlling circuit, in combination with means for locking said retardation device against operation rendered effective by signal impulses of all of said circuits and rendered ineffective irrespective of continued abnormality of the conditioning of any of said circuits.

19. In a non-interference repeater for fire alarm telegraph systems having a repeating mechanism with multi-circuit control therefor and means for at times limiting the responsiveness of the repeating mechanism to less than all of such circuits,—means responsive to signaling impulses in said circuits to cause said first named means to continue such limitations as are so established thereby until after the expiration of a predetermined time during which there are no signaling impulses formulated in any of said circuits, and means unresponsive to continued abnormality of any of said circuits for terminating such limitations after such predetermined time.

20. A non-interference repeater for fire alarm telegraph systems including repeating mechanism together with a non-interference mechanism therefor involving a retardation device,—in combination with means for governing the operation of said retardation device, and means for rendering said governing means responsive to changes in the conditioning of all of said circuits incident to signaling impulses therein, irrespective of the then responsiveness of the repeating mechanism thereto, and unresponsive to continuance of either normal or abnormal conditioning of any of said circuits.

21. A non-interference repeater for fire alarm telegraph systems of the class described and including means for restoring the repeater to normal after actuation by any one of a plurality of street circuits, in combination with means responsive to signaling activity of all of such circuits irrespective of continued abnormality of any of said circuits for holding said restoring means from complete repeater-restoring operation while a signal is being formulated in any street circuit associated with the repeater.

In testimony whereof, I have signed my name to this specification.

EDWARD J. BUTLER.