R. H. MANSON.

RELAY AND CIRCUITS THEREFOR.

APPLICATION FILED APR. 25, 1907.

1,030,415. Patented June 25, 1912

4 SHEETS—SHEET 1.

Fig. 1.

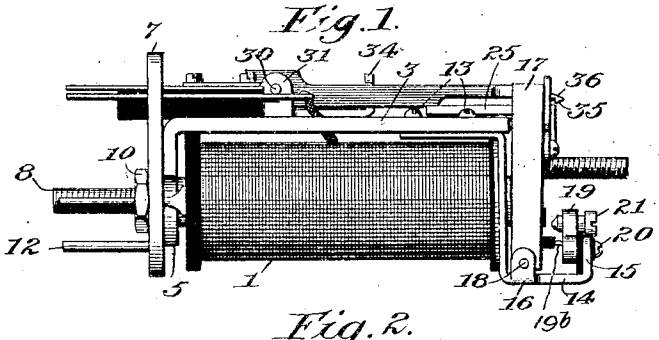


Fig. 2.

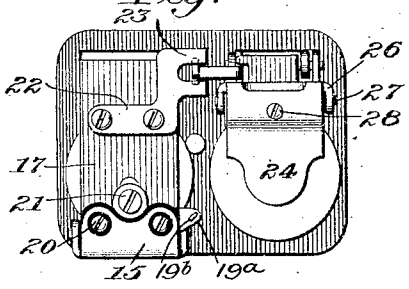


Fig. 3.

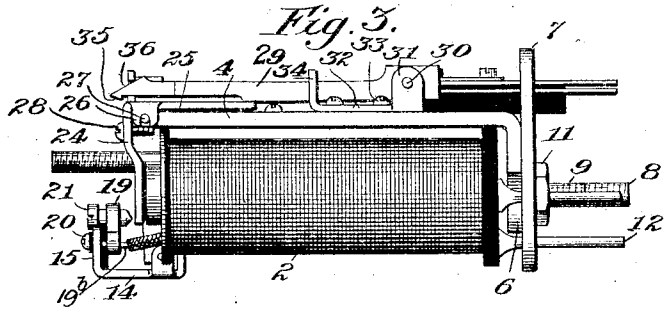
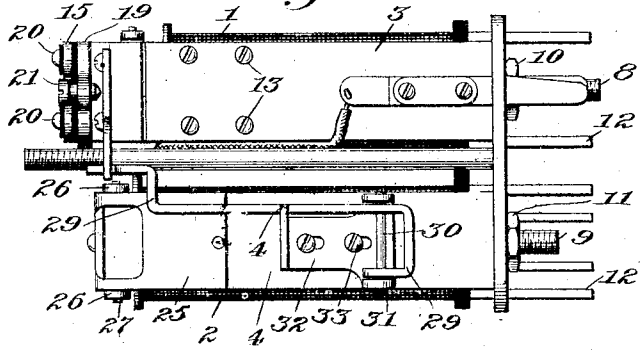


Fig. 4.



Witnesses:

Geo. E. Gauett

James H. Mann

Inventor:

Roy H. Manson

By Edward E. Clement

Atty.

R. H. MANSON.

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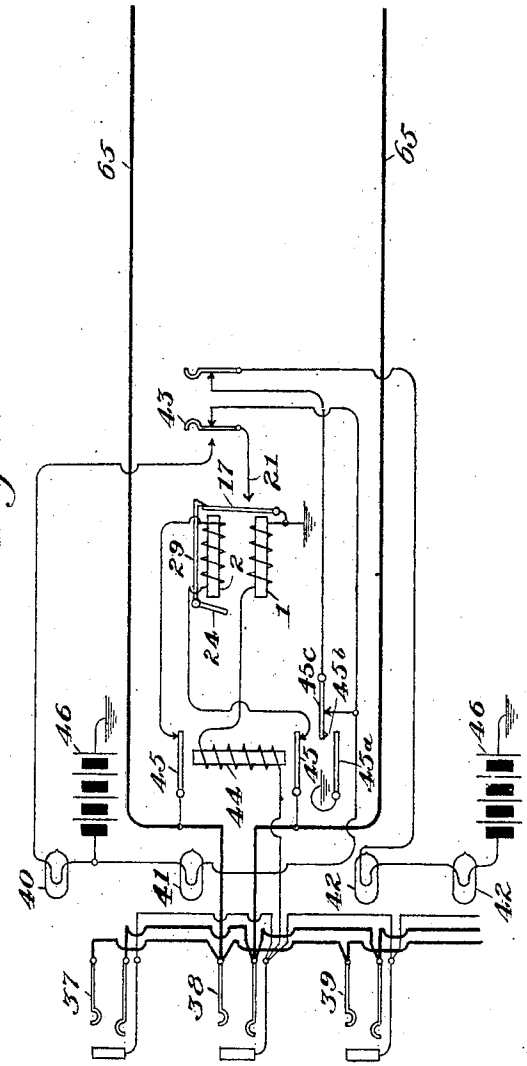
4 SHEETS—SHEET 2.

Fig. 5.



Witnesses:

Geo. E. Gauett

James H. Ware

Inventor:

Ray H. Manson

By Edward E. Clement

Atty.

R. H. MANSON.

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4 SHEETS—SHEET 3.

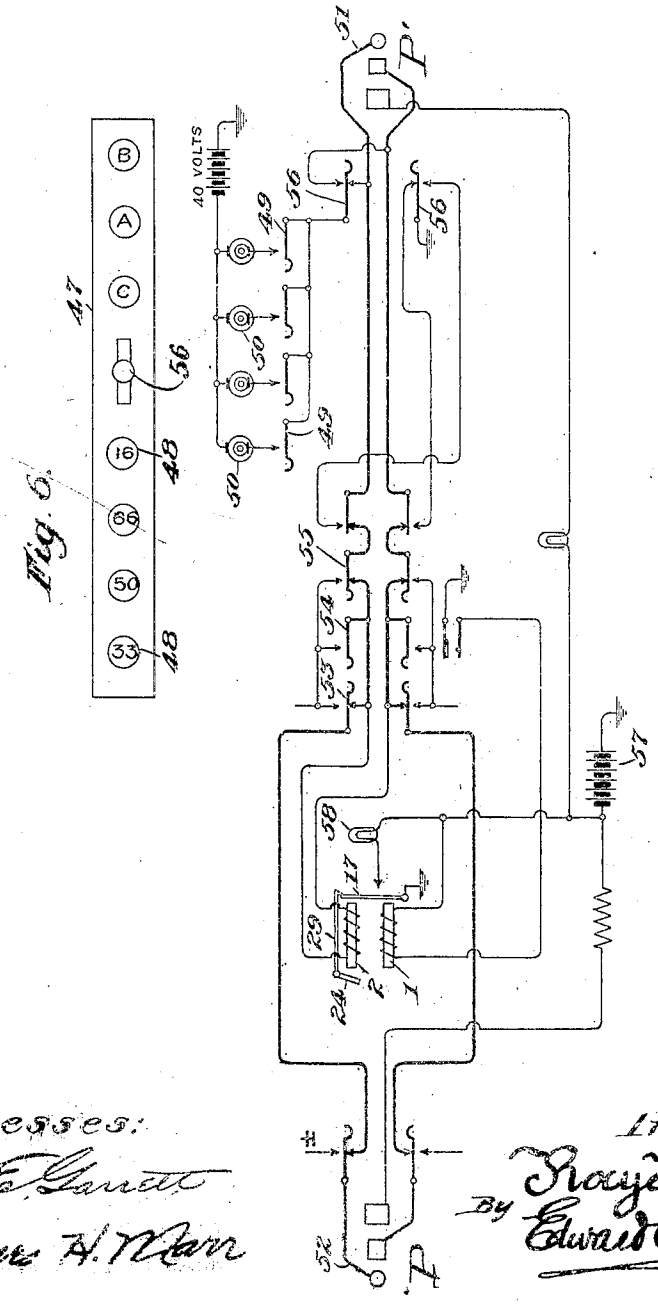

Fig. 6.

Witnesses:

Geo. E. Garrett

James A. Marr

Inventor:

Royal H. Manson

By Edward C. Clement

Atty.

R. H. MANSON.

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4 SHEETS—SHEET 4.

Fig. 7.

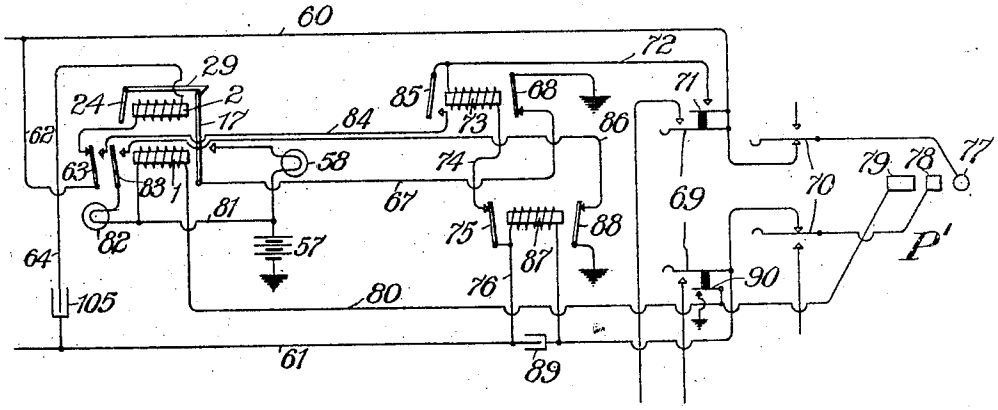
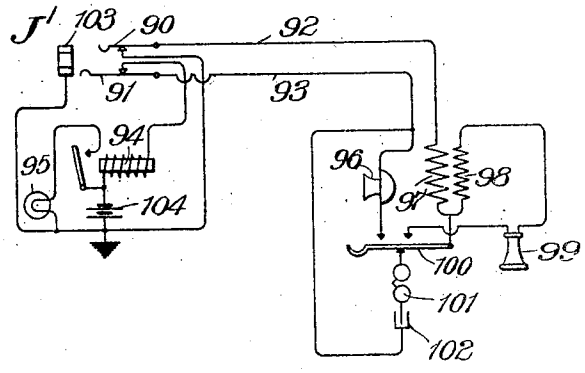


Fig. 8.



Witnesses:
Fred W. Fochs.
Leonard W. Novander.

Inventor:
Ray H. Manson.
By Brown & Williamson
Attorneys.

UNITED STATES PATENT OFFICE.

RAY H. MANSON, OF ELYRIA, OHIO, ASSIGNOR TO THE DEAN ELECTRIC COMPANY, OF ELYRIA, OHIO, A CORPORATION OF OHIO.

RELAY AND CIRCUITS THEREFOR.

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Application filed April 25, 1907. Serial No. 370,255.

To all whom it may concern:

Be it known that I, RAY H. MANSON, a citizen of the United States, residing at Elyria, in the county of Lorain and State of Ohio, have invented certain new and useful Improvements in Relays and Circuits Therefor, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to improvements in self-restoring drop relays for lamp signal toll boards, and it consists in the constructions, combinations, and arrangements herein described and claimed.

An object of my invention is to provide a drop relay in which the armature is operated by gravity, supplemented by the action of a positive releasing device which operates to force the armature away from the core if it should be retained by residual magnetism.

A further object of my invention is to construct a drop relay in which the working parts are on one side only of the mounting strip, thereby providing a device which can be located with other relays of modern design, and which can be readily adjusted and inspected when in use.

A further object of my invention is to provide a relay of great sensitiveness which can be used on the longest toll lines, and which can also be effectively used on the so-called "ring down trunks" for connecting private branch exchanges with the main switch board.

In the accompanying drawings, forming part of this application and in which similar reference symbols indicate corresponding parts in the several views: Figure 1 is a side elevation of my improved relay; Fig. 2 is an end elevation showing the working parts; Fig. 3 is an elevational view of the side opposite that shown in Fig. 1; Fig. 4 is a plan view of the device; Fig. 5 is a diagrammatic view showing the use of the relay in toll line circuits; Fig. 6 is a diagrammatic view showing the use of the relay in toll cord circuits; Fig. 7 is a diagrammatic view showing the use of the relay in a ring down trunk circuit for connecting a main exchange with a private branch exchange; Fig. 8 is a diagrammatic view showing a private branch exchange line circuit for use with the trunk circuit shown in Fig. 7.

Referring to the drawings, 1 and 2 indicate electromagnets disposed in parallel arrangement. Extending longitudinally of the electromagnets and immediately above them are the metal frame plates 3 and 4, which are bent at right angles at one end to form downwardly projecting arms, 5 and 6. These arms abut against the ends of the electromagnets and are securely clamped between them and a mounting plate 7 by a common securing means, such as the threaded bolts 8 and 9 and the nuts 10 and 11. The mounting plate 7 is perforated at suitable places to provide outlets for the terminals 12 of the magnet coils.

Secured to the forward end of plate 3 by means of screws 13, is a perforated Z-shaped member 14, provided with an upturned flange 15 at its forward lower end. Arms 16 are bent upward from the sides of the member 14 to provide bearings for the armature 17, which is pivoted on said arms at 18 in such manner that its center of gravity lies forward of its pivot. The armature 17, therefore, tends to tilt forward and is kept from doing so only when held by the attraction of the core of the electromagnet 1, which projects through the perforation in the Z-shaped member 14 in close proximity to said armature.

A plate 19, having an extension 19^a to which one end of a wire 19^b is soldered, is secured to the upright flange 15 by means of screws 20, and is suitably insulated therefrom. Carried by said plate 19 is an adjustable contact screw 21, adapted to form an electrical contact with the armature 17 in its tilted position. An L-shaped plate 22, having a laterally extending yoke 23 on one of the arms thereof, is secured to the upper end of the armature for a purpose hereinafter explained. Adjacent to the forward end of the electromagnet 2 is an armature 24 having a lateral extension 25 at its upper end, said extension being provided with downwardly extending slotted arms 26, adapted to pivotally support said armature on pivot pins 27 carried by plate 4. A retaining screw 28 passing through the armature and underneath the plate 4 prevents displacement of the armature while permitting its ready removal without interfering with the free pivotal operation of the armature and its lateral extension 25. A retaining hook 29 is pivoted on a pintle 30, held on the upright arms 31 of a slotted plate 32, which is adjustably secured to the plate 4

by screws 33. At one end of the plate 32 there is provided an upturned flange having an extension 34 adapted to limit the upward movement of the pivoted hook. At its forward end the retaining hook is provided with a lower cam surface 35 and an upper cam surface 36 adapted to engage the lower and upper arms respectively of the yoke 23. When the magnet 2 is energized, the armature 24 is attracted and the lateral extension 25 at the top of the latter, and which forms with it a bell crank lever, lifts the retaining hook, allowing the armature 17 to drop against the contact screw 21. It will be noted that, owing to the construction of the hook, there is a camming action on the upper arm of the yoke 23, and the armature is forced away from the coil against any tendency of residual magnetism to retain it. When a circuit is closed through the restoring coil 1 the armature 17 is drawn toward the core and the retaining hook keeps it from dropping back against the contact screw when the current is broken. Moreover, the armature 17 on being drawn toward the magnet acts through the medium of the hook 29 to force the armature 24 away from the magnet 2.

Figs. 5 and 6 show the application of my invention to toll line and toll cord circuits. In Fig. 5 the toll line is designated by the numeral 65. The line is connected in multiple with a series of jacks 37, 38 and 39. Jack 37 is arranged on a local board and is for night use. Jack 38 is an answering jack and 39 is a multiple jack. Three signal lamps 40, 41 and 42, are positioned in proximity to the three jacks respectively, the lamp 40 being the night answering lamp, 41 the regular answering lamp and 42 are "busy" lamps. A night switch key is shown at 43. The cut-off relay 44 is in direct circuit with the restoring coil 1, while the armatures 45 make or break the circuit through the line coil 2, as they are actuated by the magnet 44. The armature 45^a is also actuated by the magnet 44 to close the circuit at the point 45^b. Batteries 46 are provided in the lamp circuits, which may of course be identical with the main exchange battery. The other end of the toll line may include magneto drops of the ordinary type or relays arranged to operate lamp signals. In Fig. 6 is shown a button strip 47 provided with switch buttons 48 adapted to operate switches 49, to throw into circuit the generators 50 for selective ringing. This arrangement is for the purpose of ringing through the service trunks and calling the local subscribers. The calling plug 51 and the answering plug 52 are connected in circuit with a series of listening keys 53, 54 and 55, adapted to be operated through the medium of the buttons A, B and C on the button strip 47. The generators 50 may be connected either with the sleeve side or the tip side of the calling plug 51 by means of the switch 56. The line coil 2 is permanently bridged across the line wires and is wound to a high resistance to prevent short circuiting the voice currents. The signal lamp circuit includes the battery 57 and the lamp 58, and the circuit is closed when the armature 17 drops. The restoring coil 2 is also operated by the battery 57.

In operation, when a call comes in over line 35, the drop magnet 2 is energized, the shutter 17 falls, and if the night switch 43 is in the normal position shown, a circuit will be completed for the calling lamp 41 and the busy lamps 42 as follows: battery 46, lamp 41, to the switch 43, through wire 21 to the armature 17, and so to ground and back to battery. Also from battery 46, lamps 42, switch 43, contact 45^c, back to the switch 43 to wire 21 and back to battery. The operator will then plug in with the answering plug P, and in doing so completes a circuit through the sleeve contact of this plug and the thimble of the jack to the cut-off relay 44 and the restoring magnet 1 of the drop relay which may be traced as follows: from the battery 57 (Fig. 6) to the sleeve of plug P, to the jack thimble, to the magnet 44, to the magnet 1 to ground and back to battery. Both magnets becoming energized, the armatures 45 are drawn in so as to disconnect the drop magnet 2 from the line and at the same time the shutter 17 pulls up and latches so the lamp 41 is extinguished. The pulling up of the armatures 45 also pulls up the armature 45^a completing the circuit of the busy lamps, without depending upon the drop relay connection 17—21. The number of the wanted subscriber having been ascertained, the calling plug P^1 is inserted in the desired jack, and the ringing keys are manipulated so as to connect one or the other generator 50 to the main key 56, and by working this one way or the other, current is thrown out upon either the sleeve or tip side of the line as the case may be. I am thus enabled to bridge four-parties on each side of the line or eight in all.

It will be noted that three keys on the strip in Fig. 6 are marked "A," "B," and "C." Key A is for listening on the answering half of the cord and at the same time cutting off the calling half; key B is for listening bridged across the cord circuit; and key C for listening on the calling half and at the same time cutting off the answering half of the cord circuit. It should be noted that it is necessary to interpose a service trunk between the calling cord and the local switchboard, assuming all of the circuits described herein to be on a toll board, and I therefore provide a lamp shown in Fig. 6 which may be called a "supervisory and

ringing lamp," in a local circuit. The trunk line is not shown.

When the reversing key 56 is in its normal position the frequency generators are connected to line over the tip side of the cord and a return path is through the sleeve side of the line to the ground side of generator through the lower half of the key 56. When the key 56 is operated the generator current goes to line from the sleeve side and the return path is to ground, either direct to the generator or by means of the tip side of line to the lower half of the key. This reversing key is usually provided by mounting extra springs on the listening key, the same being operated by the motion of the listening cam in a direction opposite to that used in listening. This scheme is of advantage because the reversed position of the cam is always restored or changed to normal every time the cord circuit is put up, when the operator listens in. Thus there is no chance for mistakes whereby the cam could be left in a reversed position when the operator rings.

The coil 2 is bridged across the cord circuit for clearing out purposes, and the coil 1 connected to a pair of contacts mounted on the listening key B so as to be closed when it is operated. Thus when either subscriber rings off, the bridged magnet 2 in the cord circuit of Fig. 6 takes current, throws down the drop, and closes the circuit of the lamp 58 through the battery 57. When the operator presses the listening key to bridge her telephone and ascertain if the parties have really finished their conversation, she closes the contacts of the circuit 1 and thereby restores the drop. By the withdrawing of the plugs P and P^1, all the parts assume their normal position.

The above illustrations serve to show some of the uses to which my improved relay is adapted. It can also be used effectively on the so-called ring down trunks for connecting private branch exchanges with the main switch board. Here the trunk is a regular subscribers' line and is operated as such, the main switchboard operator ringing out on the trunk and operating either an old style drop or a lock-up relay. The former usually occupies too much space in the private branch board and the latter is unsatisfactory, as the generator current has a tendency to prevent the locking winding from being effective, and in order to operate at all must be very delicately adjusted to the exact conditions of the line. My new type of drop relay obviates both of these objections, as its action is positive and allows the use of a lamp signal.

A ring down trunk circuit for connecting a private branch exchange with a main exchange is shown in Fig. 7. In this figure, the trunk conductors 60 and 61 coming from the main exchange terminate in the contacts 77 and 78 of a plug P^1 attached to a connecting cord at the private branch exchange. A key 70 is provided in these conductors for ringing a called subscriber connected to the private branch exchange. The operating winding 2 of the calling drop is connected by conductors 62 and 64 between the conductors 60 and 61, a condenser 105 being inserted in the conductor 64. The conductor 62 extends through armature 63 of the magnet energized by the restoring winding 1 of the drop relay. When the operating winding 2 of the drop is energized from the main exchange by sending ringing current through the conductors 60 and 61, an armature 24 is attracted, which, by means of latch 29, releases the drop shutter 17 by which a signal lamp 58 is lighted from the battery 57 through the following circuit: battery 57, lamp 58, drop shutter 17, wire 67, armature 68 to ground, and thus back to battery 57. The private branch exchange operator then operates key 69, which connects her operator's set, not shown, to the conductors 60 and 61, as a result of which she learns what connection is desired. The operation of the key 69 by means of the spring 71 closes a circuit from the main exchange battery as follows: through conductor 60, spring 71, wire 72, energizing winding of relay 73, wire 74, armature 75 of relay 87, wire 76 to conductor 61, and thence back to the main exchange. This causes the energization of the relay 73, which interrupts the circuit above traced through the lamp 58. The operation of the key 69 also closes a local circuit as follows: battery 57, wire 81, restoring winding 1, wire 80, spring 90 to ground, and thus back to battery 57, as a result of which the drop shutter 17 is restored to its normal position in engagement with the latch 29 and the armatures 63 and 83 are attracted. The armature 63, by engagement with its front contact, closes a locking circuit for the relay 73 as follows: conductor 60, wire 62, armature 63, wire 84, armature 85, winding of the relay 73, armature 75, wire 76 to conductor 61, and thus back to the main exchange. When the armature 83 is moved to its front contact, a circuit is closed through the lamp 82 as follows: battery 57, wire 81, lamp 82, armature 83, wire 86, armature 88 to ground, and thus back to battery 57, as a result of which the ringing lamp 82 is lighted to indicate that the trunk circuit is in ringing condition.

The key 69 is held in its actuated position until the plug P^1 has been inserted in the jack J^1, shown in Fig. 8, corresponding to the called substation. This is for the purpose of maintaining the energization of the restoring winding 1 until its circuit is closed through the plug P^1 and jack J^1 as follows:

battery 57, wire 81, winding 1, wire 80, contact 79 of plug P^1, ring 103 of jack J^1 to ground, and thus back to battery 57. For this condition, the key 70 is operated, which results in sending ringing current in the well-known manner through the line conductors 92 and 93 and the ringer 101 at the called substation. When the called subscriber responds, a circuit is closed from the main exchange through the called substation as follows: trunk conductor 60, tip 77 of plug P^1, spring 90 of jack J^1, line wire 92, primary winding 97, switch hook 100, transmitter 96, line wire 93, spring 91 of jack J^1, sleeve 78 of plug P^1, energizing winding of relay 87 to conductor 61, and thus back to the main exchange, as a result of which relay 87 is energized, which, by the attraction of armatures 75 and 88, opens the energizing circuit of relay 73 and the circuit through the ringing lamp 82, thus restoring this apparatus to its normal condition.

The line circuit shown in Fig. 8 is of the type known as a jack cut-off circuit, in which type the line relay 94 is normally connected to the jack springs 90 and 91 by which the removal of the receiver 99 at the substation serves to call the exchange operator in the following manner: A circuit is closed from battery 104 through the energizing winding of the line relay 94, spring 91, line wire 93, transmitter 96, switch hook 100, primary winding 97, line wire 92 and jack spring 90, and thus back to battery 104. This results in closing a circuit from battery 104 through the line signal lamp 95, as indicated.

By using two separate coils, great sensitiveness can be attained in the drop portion so that the relay can be used on the longest toll lines. The restoring coil, being an entirely separate circuit, has ample power to draw up the heavy armature even when a large air gap is used.

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

1. In a drop relay, a pair of electromagnets in parallel arrangement, a pair of pivoted armatures one for each magnet, and means actuated by one armature for dropping the other armature.

2. In a drop relay, a pair of electromagnets in parallel arrangement, a pair of pivotally mounted armatures one for each magnet, a contact, and means actuated by one armature for dropping the other armature against the contact.

3. In a relay, a pair of electromagnets in parallel arrangement, a frame upon which said magnets are mounted, a pair of armatures mounted on said frame and in permanent relation to said magnets, an electric switch contact controlled by one of said armatures, and means actuated by one armature to force the other armature to control a circuit through said contact.

4. In a relay, a pair of electromagnets in parallel arrangement, a pair of pivotally mounted armatures at one end thereof, a contact, and means actuated by one armature to force the other armature to control a circuit through said contact.

5. In a drop relay, a pair of electromagnets in parallel arrangement, a pair of pivotally mounted armatures one for each magnet, a contact, a retaining hook adapted to be actuated by one armature to release the other armature and to drop it against the contact.

6. In a drop relay, a pair of electromagnets, a pair of pivotally mounted armatures, one of said armatures having a laterally extending yoke, a contact, a pivoted retaining hook adapted to be actuated by the first mentioned armature and arranged to engage the arms of said yoke to forcibly release the armature and to drop it against said contact.

7. In a drop relay, a pair of electromagnets disposed in parallel arrangement, common mounting means for said magnets at one end thereof, a separate pivoted armature for each magnet arranged at the opposite end, and means actuated by one of said armatures for forcibly releasing the other armature.

8. In a drop relay, the combination of a mounting plate, a pair of frame plates, a pair of electromagnets disposed in parallel arrangement and secured at one end to said frame plates, an armature having a lateral extension pivotally mounted on one of said frame plates, a Z-shaped member attached to the other frame plate, a second armature mounted on said Z-shaped member and having a laterally extending yoke, a contact screw, a hook mounted on one of said frame plates and arranged to be actuated by said first mentioned armature to engage the arm of the yoke on said second armature to forcibly release said armature and to drop it against said contact screw.

9. In a magneto relay, a pair of electromagnets in parallel arrangement, a pair of armatures therefor, a signal controlled by one armature, means for normally detaining said armature in inoperative condition, and means controlled by the other armature to release the same and set the signal.

10. A signal device comprising in combination a pair of electromagnets in parallel arrangement, a signal controlled jointly thereby, and interlocking connections between the said magnets whereby the signal may be displayed and retired in due sequence.

11. In a signal device, a pair of electromagnets, a base upon which said magnets

are mounted, armatures for said magnets mounted on said base in permanent relation to said magnets, said armatures so related to each other that the operation of one armature forces the other armature to its retracted position.

12. In a signal device, a pair of electromagnets, and armatures for such magnets interconnected so that the operation of either armature forces the other armature to its retracted position, each armature mounted upon a different pivot and adapted to be moved independently of the other during a part of its movement.

13. In a signal device, a pair of electromagnets, and armatures for such magnets interconnected so that movement of either armature moves the other armature from one of its positions to the other, each of said armatures mounted upon its associate magnet and adapted to move relative to the other armature.

14. In a signal device, a pair of electromagnets, an armature for each of such magnets, and interconnecting mechanism between such armatures such that the operation of one armature forces the other armature to its retracted position, said mechanism including a cam and a catch lever.

15. In a signal device, a pair of electromagnets, an armature for each of such magnets, and interconnecting mechanism between such armatures such that the operation of either armature forces the other armature to its retracted position, said mechanism including a catch member associated with each armature and permitting movement of one armature relative to the other.

16. In a signal device, a pair of electromagnets, an armature for each of such magnets, and detachable interconnecting mechanism between such armatures such that movement of either armature moves the other armature from one of its positions to the other, such armatures being so related to each other that each may move independently of the other.

17. In a signal device, a pair of electromagnets, an armature for each of such magnets, and detachable interconnecting mechanism between such armatures adapted to positively communicate motion from one of such armatures to the other, such armatures being so related to each other that each may move independently of the other.

18. In a signal device, a pair of electromagnets, an armature for each of such magnets, and detachable interconnecting mechanism between such armatures adapted to positively communicate motion from either of such armatures to the other, such armatures being so related to each other that each may move independently of the other.

19. In a signal device, a pair of electromagnets in parallel arrangement, armatures for such magnets so disposed opposite adjacent ends thereof that the operation of one armature forces the other armature to its retracted position, and link mechanism associated with said armatures connecting them together during a part of the movement of one and permitting relative movement between said armatures during another part of the movement of said armature.

20. In a signal device, a pair of electromagnets in parallel arrangement, armatures for such magnets so disposed opposite adjacent ends thereof that the operation of either armature forces the other armature to its retracted position and link mechanism associated with said armatures connecting them together during a part of the movement of one and permitting relative movement between said armatures during another part of the movement of said armature.

21. In a signal device, a pair of electromagnets in parallel arrangement, armatures for such magnets so disposed opposite adjacent ends thereof that movement of either armature moves the other armature from one of its position to the other, and link mechanism associated with said armatures connecting them together during a part of the movement of one and permitting relative movement between said armatures during another part of the movement of said armature.

In testimony whereof I affix my signature in presence of two witnesses.

RAY H. MANSON.

Witnesses:
GEO. A. SCOVILLE,
S. J. ROBERTS.