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A. M. NEEPER.

FIRE ALARM AND POLICE TELEGRAPH SYSTEM.

No. 370,885. Patented Oct. 4, 1887.

Fig. 2.

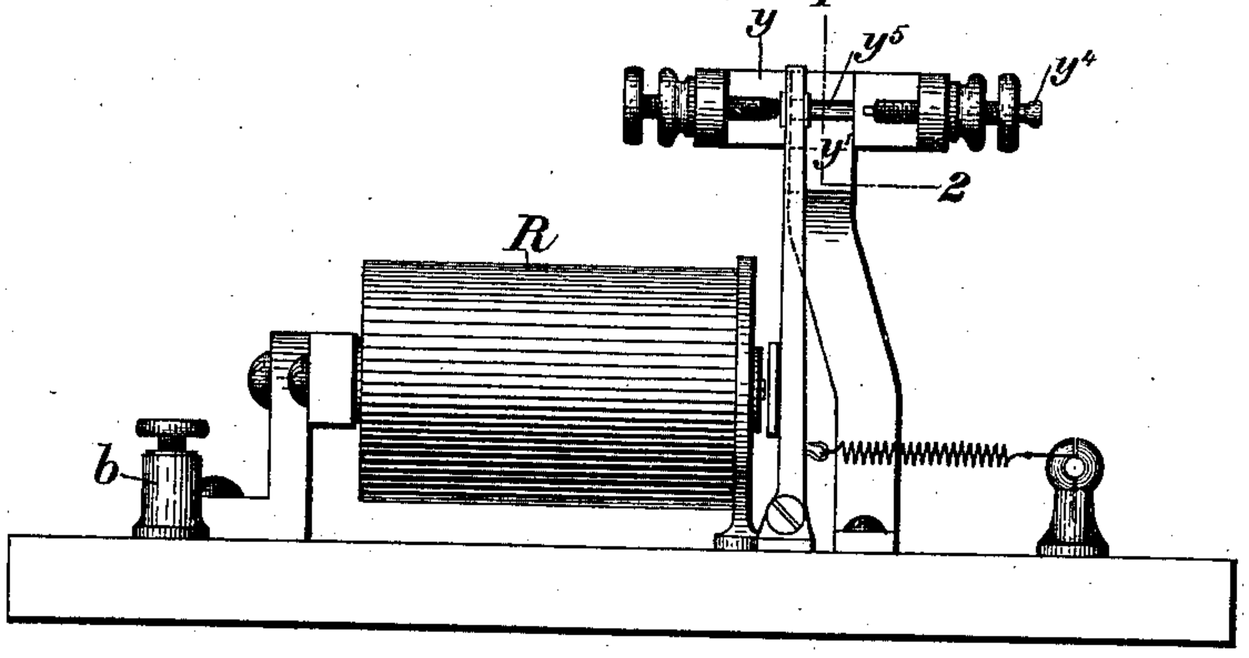

Fig. 1.

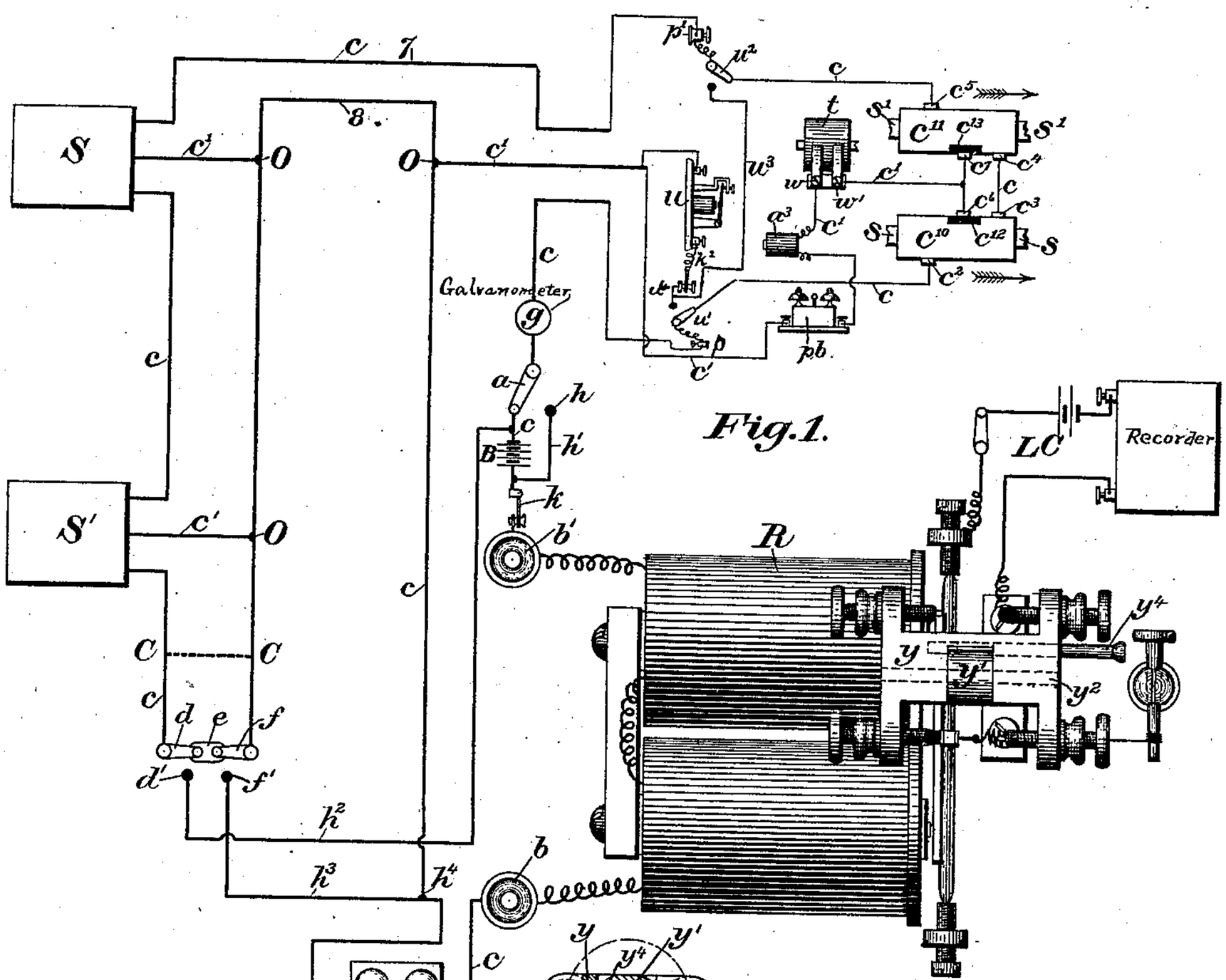

Fig. 3.

Witnesses.
A. Mulladison
Edwin W. Smith

Inventor:
Alexander M. Neeper

(No Model.) 2 Sheets—Sheet 2.

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FIRE ALARM AND POLICE TELEGRAPH SYSTEM.

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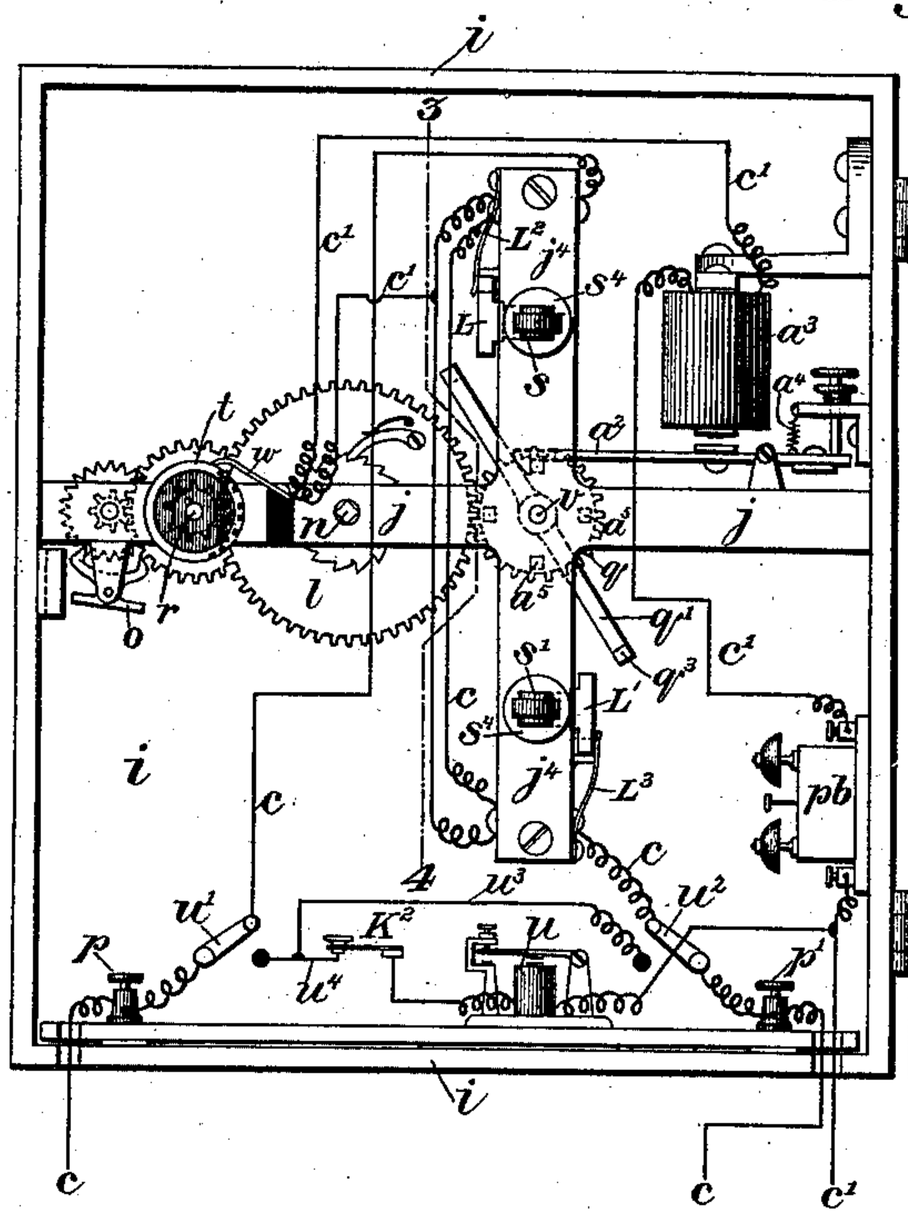
Fig. 4.



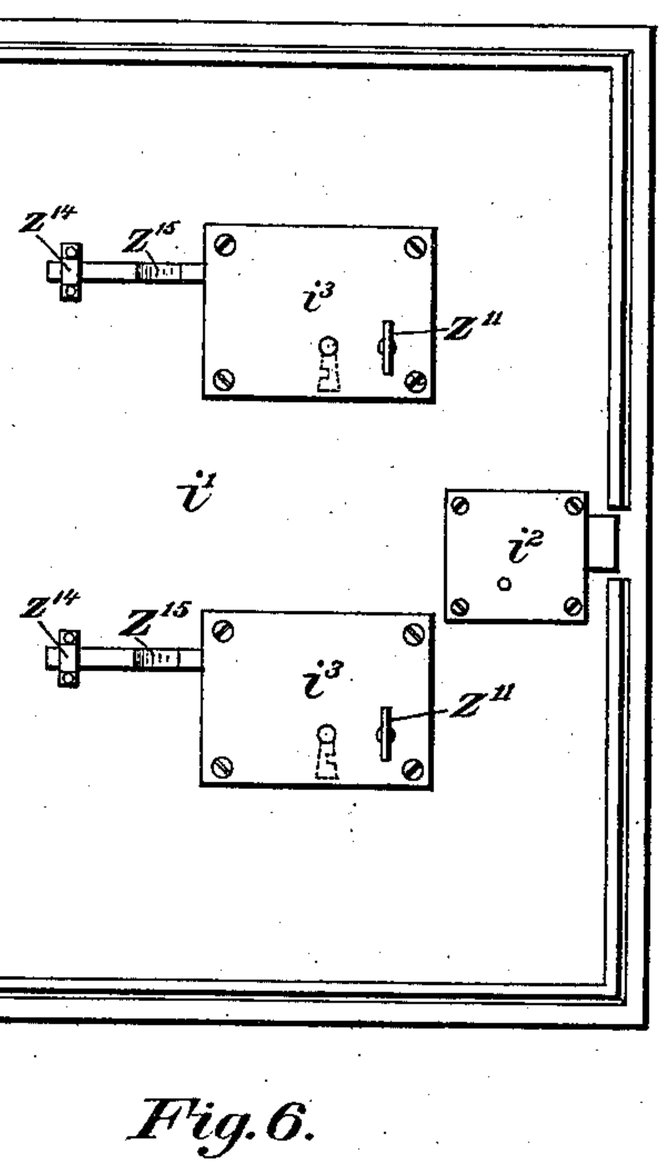
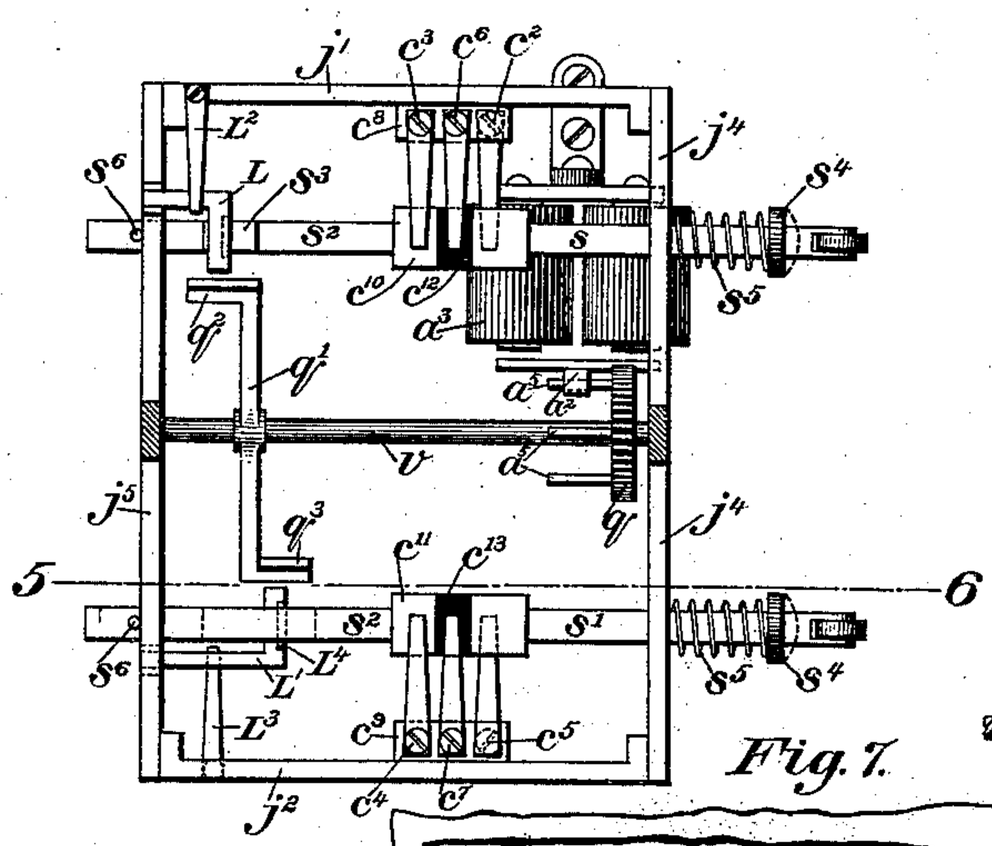


Fig. 6.

Fig. 5.



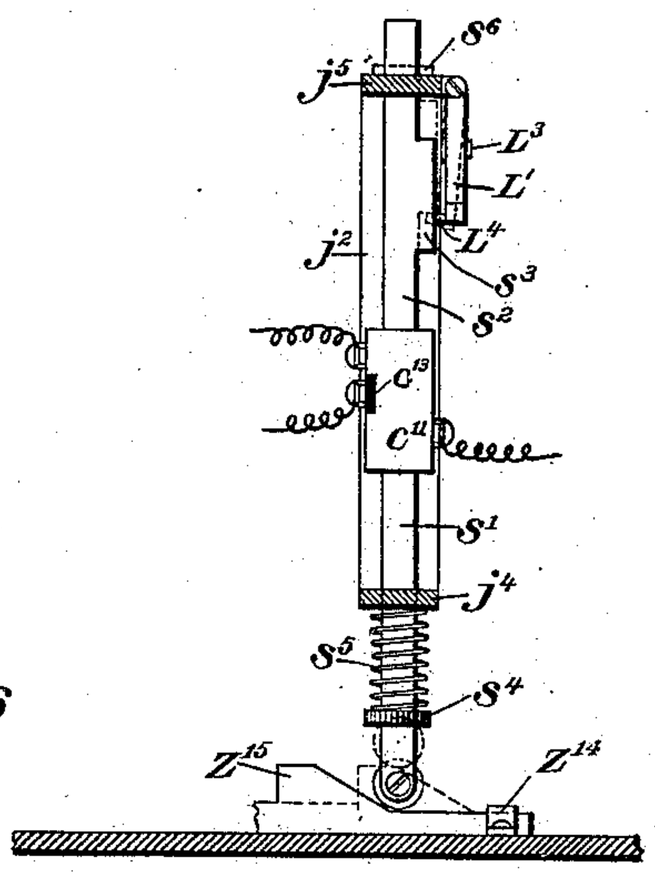
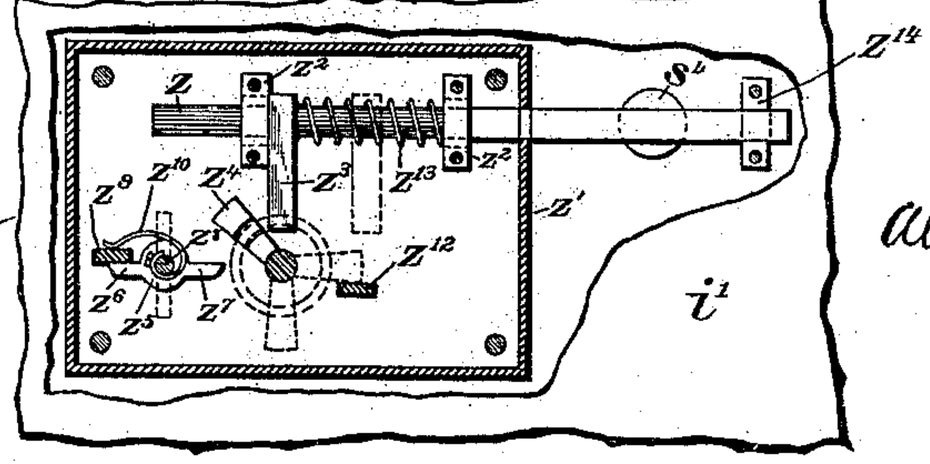


Fig. 7.



Witnesses.
P. Middleton
Edwin W. Smith

Inventor.
Alexander M. Neeper

UNITED STATES PATENT OFFICE.

ALEXANDER M. NEEPER, OF PITTSBURG, PENNSYLVANIA.

FIRE-ALARM AND POLICE TELEGRAPH SYSTEM.

SPECIFICATION forming part of Letters Patent No. 370,885, dated October 4, 1887.

Application filed November 27, 1886. Serial No. 220,038. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER M. NEEPER, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Fire-Alarm and Police Telegraph Systems; and I do hereby declare the following to be a full, clear, and exact description thereof.

My improvement relates to the arrangement of the circuits and the construction and operation of the transmitting stations of fire-alarm and district telegraphs.

Heretofore in fire-alarm and district telegraphs the circuits have been so arranged as to connect the transmitting-stations either in series or in multiple arc, and in such manner that stations connected on the same line when operated simultaneously, or within a short interval of time, so interfered with one another in the transmission of their separate signals that either one or both of the signals were unintelligible at the central or receiving station; or where the more recent plan is used an instrument at the central station so controls the circuits centering there as to allow but one circuit and but one transmitting-station upon that circuit to operate at any one time, rendering all other circuits temporarily inoperative; but this is done at the risk of losing a signal on an attempt at transmitting which may have been made at a moment while the line upon which the station is situate is thus temporarily inoperative, no provision being made to hold more than one signal while another is transmitted and transmit the retained signals after the running signal shall have been received without further manipulation of the signal-station by the person turning in the alarm.

It is also the practice to so connect stations that cutting or breaking a signal-wire renders useless many or in many cases all signal-stations on the circuit, so cut or broken.

The objects of my improvements in arranging the circuits, and in the construction and operation of apparatus appertaining to fire-alarms and district telegraphs, are to enable signals to be correctly transmitted to the central or receiving station from one or more signal-stations connected in the same circuit whose means for transmitting their several signals have been operated simultaneously or closely following each other, so that each signal-station so operated shall transmit its signal in rotation irrespective of any control over the circuit by instruments or operators at the receiving-station, to enable the signals to be transmitted upon an open or closed circuit and without the use of ground-connections; to enable the operator at the receiving-station, in case of the opening of a closed circuit, to quickly arrange it so that the stations will transmit their signals over an open circuit, and to enable the operator when signals are simultaneously transmitted to the central or receiving stations on two or more lines to so control the circuits as to hold the signals on all of the lines until he can receive in rotation the signal of each circuit without interference from the others.

My invention consists, principally, of an arrangement of circuits for fire-alarm or district telegraphs by which signals can be transmitted by closing an open circuit or opening a close circuit, and in such manner that a signal-station, while transmitting its signal, temporarily takes the current from all other stations on the same circuit, and after it has sent in its signal automatically restores the current to the other stations on the same circuit, thereby enabling them to transmit their signals when any of them have been operated while temporarily deprived of current, the signal being retained by the station until the current is restored to it, as above described. Thus, by means hereinafter stated, I am able to render the signal-stations non-interfering in themselves without control of operators or instruments in the receiving-station, and in addition to keep the signal-circuits always ready for the reception and transmission of signals.

I will now describe my invention by reference to the accompanying drawings, in which—

Figure 1 is a diagram of my improved circuit and a plan view of my improved relay. Fig. 2 is a side elevation of the relay. Fig. 3 is a sectional view of the standard and yoke of the relay on line 1 2. Fig. 4 is an elevation of my transmitting or signal station. Fig. 5 is a sectional view of Fig. 4 on the line 3 4. Fig. 6 is a sectional view of Fig. 5 on the line

5 6. Fig. 7 is a detail view of the releasing mechanism shown in Fig. 4 at i^3, the door being broken away.

Like letters of reference indicate like parts in each.

My improvements in arranging the circuits in fire-alarm or district telegraphs, or in any system of telegraph where a predetermined signal is to be transmitted from a local point to a receiving-station, are as follows: The main circuit is arranged in a loop in which are connected receiving relay-battery and signal-stations constructed as follows: a conductor, *c*, made of any suitable wire or conductor, is connected to the positive pole of a main battery, B, which may be any of the ordinary batteries which are adapted to work on a closed circuit, whence it is led to contact-stud, with which switch *a* is in contact, through switch *a*, galvanometer *g*, to binding-post *p* of the signal-circuit, which will be hereinafter described. Thence passing through the same to the binding-post *p'*, it continues, connecting the circuits of the signal-stations *s* and *s'* in series until it reaches a switch, *d*, which is so constructed as to make contact with the conducting-plate *e* or contact-stud *d'*. This completes one side of the loop, which is seen to be connected with one pole of the battery and led from the central office, connecting the signal-stations in series until it reaches switch *d*, which, with plate *e*, switches *d* and *f*, and contact-studs *d'* and *f'* are situate at the central office. From plate *e*, by means of *f*, which can make contact with *f'*, *c* continues again, passing out of the central office and runs parallel to that portion of itself which connects the stations in series until it reaches one binding-post of magneto-generator *m*, through and from the other post of which it continues until it reaches relay R at binding-post *b*, and through the same to the post *b'*, which is connected to the key *k*, from which *c* connects with the negative pole of the main battery B. From that portion of *c* in which no signal-stations are connected branches *c'* are carried into the stations, whose use and functions will be fully described in connection with the signal-station and its circuit. The loop *c* is constructed with three branches situate within the central office—viz., *h'*, which begins at stud *h*, which is constructed to make contact with switch *a*, and ends in *c* between battery B and key *k*; h^2, which begins at *d'* and ends in *c* between battery B and switch *a*, and h^3, which begins at *f'* and ends in *c* at h^4.

I will now describe my improved signal-station, an elevation of which is shown in Fig. 4.

i is a box made of any suitable material, preferably of metal, and is provided with a door, *i'*, having spring-lock i^2 and two releasing mechanisms, i^3. To the sides of *i* is fixed by suitable supports the +-shaped frame *j*, constructed of two +-shaped pieces of metal joined by suitable cross-pieces of the same material. In the horizontal portion of the frame *j* a train of gear-wheels is placed, the large wheel *l* carrying a drum containing a spring, which is wound up by turning the shaft *n*, and furnishes the motive power to operate the station. To the left of *l* in the drawings the construction is that usual in gearing adapted to operate an escapement, which in this case is provided with a regulating-fan, *o*. To the shaft *r* is fixed a circuit-breaker, *t*, having a broad conducting periphery (broken at intervals to make the signal) insulated from its hub and adapted to allow contact of the contact-fingers *w w'*, (shown more clearly in Fig. 1,) said contact-fingers being mounted on a block of insulating material fixed to the outside of the frame *j'*. The circuit-breaker *t* is mounted on the shaft *r* in such position with relation to the contact-fingers *w w'* that while the armature a^2 of the electro-magnet a^3, Figs. 4 and 5, is passing pins a^5 a^5 a^5 a^5 of wheel *q* the circuit will at all times be closed. This is for the purpose of preventing a^2 from engaging any one of the pins a^5 a^5 a^5 a^5 by holding it up to the action of the energized electro-magnet a^3, as hereinafter more fully described.

To the right of *l*, and so proportioned to it that while its shaft *v* makes one revolution the shaft *r*, carrying the circuit-breaker *t*, makes four (or any number greater or less, as desired) revolutions, is the wheel *q*, which is provided in this case with four pins, a^5, which extend from it parallel to its shaft *v*, and are of such length as to be engaged by armature a^2 of electro-magnet a^3, fixed to box *i*, when the magnet is not magnetized. The armature a^2, engaging either of the pins a^5 of the wheel *q*, will prevent its revolution and the action of the clock-work to operate the station; but if the armature be attracted by electro-magnet a^3, so as to release wheel *q*, then the clock-work will operate, and by revolution of circuit-breaker *t* the signal will be transmitted. In the normal condition of the circuit electro-magnet a^3 gets no current, being connected in branches *c'*, Fig. 1, which, although connected at their ends O with the main circuit *c*, are open normally at their other ends, as will be presently described. Electro-magnet a^3 is shunted into the main circuit and energized by the operation of shunts or switches *s s'*, whose construction is as follows: They are inserted in the vertical part of the frame *j* above and below the wheel *q*. They are placed at such distances from the cross-pieces *j' j²* of frame *j* as to enable contact-springs c^2 c^3 c^4 c^5 c^6 c^7, which are mounted on blocks of insulated material, c^8 c^9, fixed to *j' j²*, respectively, so as to make contact with contact-plates c^{10} c^{11} of shunts *s* and *s'*, respectively. They have (Fig. 6) a shaft, s^2, made of any non-conducting material, so that c^{10} c^{11} are insulated from the shaft s^2, which has a shoulder, s^3, and, being square in section, are inserted in square holes in j^4 and j^5, and fitted therein so as to move freely longitudinally. They have metal collars s^4, between which and j^4 and around the shaft s^2 is placed a spiral spring, s^5, and a

pin, s^6, to act as a check on s^5. The contact-plates c^{10} and c^{11} are made of metal sleeves, which are slipped over the shafts of s and s', and in one side have insulation-pieces c^{12} and c^{13} fixed respectively. To j^5 are hinged on either side two L-shaped levers, L and L′, pressed against shoulders s^3 s^3 on the shafts of s and s' by the springs L^2 L^3, respectively. L′ is fixed (Fig. 4) to the right and L to the left of j^5. L is of such size as to engage lug q^2 on arm q', which is mounted on and revolved by shaft v, and L′ of such size as to be engaged by lug q^3 on arm q' when the same is in revolution. Each of said levers has a lug, L^4, Fig. 6, (shown also in Figs. 4 and 5 in dotted lines,) which, when shaft s^2 is pushed in against spiral spring s^5, will engage shoulder s^3 and hold shaft s^2 in the position into which it is pushed until it is released, as hereinafter described.

q' is an arm placed on shaft v, and is of such length as to clear in its revolution the shafts of shunts s and s'. It has two lugs, q^2 and q^3, which extend from either side and are of sufficient length to engage the vertical arms of levers L L′, Fig. 5. It is affixed to shaft v at such an angle to a plane passing through shunts s and s' and shaft v as to just clear the vertical arm of levers L and L′ when the station is at rest. The lugs q^2 and q^3 extend from either side of q', and the levers L and L′ are made of different lengths and placed on different sides of j^5 for the purpose of having the lugs of q' engage the levers L and L′ but once in one revolution of the shaft v, and that at a time just prior to the completion of any one revolution of said shaft v. When lugs q^2 and q^3 engage the vertical arms of levers L and L′, by reason of the revolution of q' they press the levers L and L′ against their springs L^2 and L^3 and release the hold of L^4, Fig. 6, on shoulder s^3 on shaft s^2, when the action of spiral spring s^5 restores shaft s^2 to its normal position and the main and branch circuits c and c' to their normal condition when the station is at rest.

pb is a polarized bell used in connection with magneto-generator m, Fig. 1. It is connected in branch c' in series with the electro-magnet a^3.

u is a telegraphic sounder, one end of whose coils is connected with c', the other being connected with key k^2, whose anvil is connected with wire u^4, at whose extremity is a stud in such position as to be capable of contact with switch u'. From u^4 springs a branch, u^3, at whose extremity is a stud capable of contact with the switch u^2. When switch u' is shunted, the main current is carried through sounder u to branch c', thus short-circuiting c at the station where the switch is operated, when by manipulation of key k^2 communication can be had with the receiving-station. The sounder is primarily intended for testing when the line is broken. For example, if c be broken between the receiving-station and post p and u' shunted u would remain unaffected. In that case, as hereinafter described, switch d, Fig. 1, will have been shunted to d', and u, when u^2 is shunted, will get current through post p', when the armature of u will be drawn down and the shunting of u' and u^2 and the action of u will show on which side of the station the break in c is. When a break occurs in that portion of c between f and h^4, Fig. 1, f will have been put in contact with f'. When looking for such a break, the line-man at the signal-station will request the operator at receiving-station, by means of key k^2, to break contact between f and f', when if he continues to get current through sounder u the break will be beyond the station from which he is communicating. If he gets no current through u, the break is between that station and the receiving-station.

Referring now to Figs. 1, 2, and 3, where the relay which I propose to use in the operation of my improved fire and district telegraph is shown, the relay is constructed in the usual well-known manner, the electro-magnets being wound so that the current passes through them in series, and so as to act in concert in attracting their common armature, but differs from the ordinary relay in the construction of its standard and the yoke which it carries, which bears the stops used in closing the local circuit LC by means of the vibrations of its armature. The difference consists in the construction of the yoke, which carries two pairs of stops for the armature of the usual conducting and non-conducting type, each pair being composed of one conductor and one non-conducting stop, and the pairs being arranged on the yoke in reverse order. The yoke is mounted on a pin, y^2, and is capable of a half-revolution about the head of the standard which bears it, so as to enable one pair of stops to be substituted for the other in case the line is operated on an open or on a closed circuit. In Fig. 1, y is the yoke, which is made of any conducting substance and with four arms, which bear two pairs of stops in reverse order, equidistant from the central line of the body of the yoke. A recess is cut in the side of the body of the yoke for the reception of the head of the standard y'. The yoke is mounted on a pin, y^2, (shown in dotted lines, Fig. 1, and in section, Fig. 3,) which is supported by the standard at y', Fig. 3, and is equidistant from the axes of the two pairs of stops in such manner as to allow it to revolve in a semicircle about the head of the standard, as indicated by dotted arc of a circle in Fig. 3. Yoke y is provided with a second hole at y^3, in which is inserted pin y^4, which also rests in one of two semicircular grooves, which are concentric with the hole at y^3 in yoke, and cut in both sides of the head of the standard at y^5. The office of pin y^4 is to adjust and hold in position yoke y when it has been revolved in either direction about the head of the standard. The armature of the relay is connected with one extremity of the local circuit LC, which consists of a battery and recording-instrument and necessary con-

nections, the other extremity being connected to the yoke-bearing standard. As shown in Fig. 1, the relay is connected in a closed circuit and its armature is attracted. If the main circuit in which it is connected be permanently open or broken, the armature will be retracted and the local circuit permanently closed. If the line then is to be operated on an open circuit and the record made of the closings of the main line, the pin y^4 is withdrawn and the yoke y revolved in a semicircle on y^2 and the pin y^4 inserted in y^3, and the groove on the opposite side of the head of the standard at y^5, Fig. 2. By this operation the order of stops is reversed and the retracted armature-bar rests upon an insulated backstop and the local battery is open and in readiness to operate on the closings of the main line.

The box-circuit is shown diagrammatically in Fig. 1, s and s' representing shunts broken away, c^{10} and c^{11} their contact-plates, c^2 c^3 c^4 c^5 c^6 c^7 their contact-springs, t the circuit-breaker, with its fingers w w', with which a^3, the releasing electro-magnet, and pb, the polarized bell, are connected in series in the branch c', which connects with c at O and with c^6 and c^7, which normally rest on insulation c^{12} and c^{13} of contact-plates c^{10} and c^{11}, u the sounder, and u' u^2 u^3 u^4 its connecting wires and switches, as hereinbefore mentioned.

It will be observed that c enters the box-circuit at post p, and current passes through u' to c, to spring c^2, to contact-plate c^{10}, to spring c^3, to c, to spring c^4, to contact-plate c^{11}, to spring c^5, to c, to switch u^2, to post p', and so on, and, by reason of taking the path indicated, meets with no resistance other than that of the connections just mentioned, none of the magnets in the several stations being traversed by the main current when the line is in its normal condition and the stations at rest.

A modified arrangement of the circuits is made by connecting the two sides of c at C C, as indicated by dotted lines, Fig. 1, when the loop need not enter the central station twice, and the two branches h^2 and h^3 and switches d and f and contact-plate e are dispensed with.

To operate the system and transmit a signal, the shunt s must be forced in, and this is effected manually or by means of a releasing mechanism. (Shown in Figs. 4, 6, and 7.)

In Fig. 7, z is a rod, partly round and partly rectangular in section, held to the side of a case, z', by two guides, z^2 z^2, said case being rectangular in shape, and fastened to the door i' by suitable means. From the rod z depends an arm, z^3, in the path of a key, z^4, inserted from the outside of box i.

z^5 is a ring having two lugs, z^6 z^7, supported on a pin, z^8, fixed to door i'. The ring z^5 is held with the lug z^6 in contact with the stop z^9 by spring z^{10}. The pin z^8 is fixed in such position, and the lug z^7 is of such length, that it will engage the key z^4 when it is inserted and turned, and will allow the key z^4 to be turned toward z^3, but not back again past the lug z^7 until it has been removed from the path of the key by operation of the thumb-latch z^{11}, Fig. 4. This thumb-latch is fastened through the back of case z' to the ring z^5 in such manner as to allow said ring to turn upon the pin z^8. The key z^4, being continued in revolution, encounters z^3 and pushes it to the right until it occupies the position indicated by the dotted lines in Fig. 7, when it drops below z^3, and is stopped in its revolution by stop z^{12}, which is inserted into the case z', after which the rod z is retracted by spiral springs z^{13}, and the key z^4 is held between the stop z^{12} and the arm z^3. The rod z, after it leaves the case z', is held against the inside of the door i' of the box i by guides z^{14}, Fig. 6, and has on its inner or free side an inclined plane, z^{15}, so situate as to engage rollers on the shafts when the door of the box i is shut. (See Fig. 6.) When the key z^4 is inserted and turned, as above described, the inclined plane on z is forced into the position indicated by dotted lines in Fig. 6, and the shaft is moved longitudinally and the clock-work of the station released in the manner presently described.

It will be observed that when the key z^4 is turned until it has passed z^7 it cannot be withdrawn until access is had to the thumb-latch z^{11}, and that it must be turned sufficiently to press in s' before a signal will be transmitted when it is held between z^{12} and z^3. No access is had to the inside of the box i until a person having a key to the lock i^2 arrives on the ground, when the door may be opened and the rod z pulled by the hand to the right to release the key from between z^{12} and z^3, and then by the operation of the thumb-latch, lug z^7 be turned from its path, when it can be removed. The object in thus retaining the key in the releasing mechanism is to prevent tampering with the station and mechanism and the transmission of useless signals, the keys being numbered and a record kept of the names of the persons to whom they are distributed, so that the person whose key is used may be held to account for the signal transmitted. When the shunt s is pushed in, in the manner just described, the current no longer traverses c through the entire circuit, but is shunted through the branch c' of the station operated, the continuity of c being broken at that station. For instance, in Fig. 1, when s is pushed in the direction of the arrows, the spring c^3 is shifted onto insulation c^{12}, thereby breaking the continuity of c, and the spring c^6 is shifted onto contact-plate c^{10}, thereby affording a path for the current through c^6, c', t, a^3, pb, and c to the receiving-station, the effect being to open and short-circuit c through the parts just named of the station operated. When the current is shunted in the manner just described, it will flow through electro-magnet a^3, which then attracts its armature, withdrawing it from pin a^5 of wheel q, thereby allowing the clock-work to operate and rotate the circuit-breaker t, transmitting the signal in the usual well-known manner. When a signal is received at

the receiving-station, the operator there by the operation of the magneto-generator *m* causes the polarized bell to sound a signal, indicating that the receiving-station has received the signal from the station. When a signal has been thus transmitted and the receiving-station has indicated its reception, the motor-spring of the station continues to operate the station until stopped in the following manner: When the shunt *s* is pushed in it is held by lever L in the manner hereinbefore described for a certain period of time, the length of which is determined by the rotation of the arm *q'* on the shaft of wheel *q*. As hereinbefore described, *q'* just before it makes a complete revolution releases shunt *s* from rotation by the lever L, and it is drawn into its normal position by spiral spring s^5, which operation restores the main circuit *c* and breaks the branch circuit *c'*, thus demagnetizing a^3, whose armature then engages the pin a^5 of the wheel *q* and checks the operation of the clock-work of the station and leaves it in readiness for the transmission of another signal, provided the spring be wound up sufficiently. The stations when thus operated on a closed circuit, as described, cannot possibly interfere with one another in the correct transmission of all their separate signals, no matter in what space of time or order their several signals are transmitted, because if S', Fig. 1, be transmitting its signal and S be operated, and while it is operating the station shown diagrammatically be called upon to transmit its signal, the effect will be as follows: The clock-work of S' being in operation, but the wheel *q* therein not having made one complete revolution, as soon as shunt *s* of S is pushed in to send in its signal, all current is taken from S', the main line *c* being broken at S, and the electro-magnet a^3 of S', losing its magnetism, ceases to attract its armature, which engages the next succeeding pin a^5 of wheel *q*, and the remainder of the signal S' is retained until its electro-magnet is again energized by the restoration of current in it. The same effect takes place at S when the station shown diagrammatically is operated, the main line *c* being thereby broken at that point. Suppose, as hereinbefore set forth, the stations are constructed so as to repeat their signals four times, and at the moment S was released, S' had sent in two of its signals, and at the moment the third station was released S had sent but part of one round of its signal, then the third station, being between the first break in *c* and the battery B, will be temporarily the only station whose electro-magnet a^3 will get current, which causes the releasing of its clock-work, as described, and it proceeds to send in four rounds of its signal, and then by the automatic operation of its shunt *s* and arm *q'* on lever L, as described, the main line *c* is restored at that station. The moment this occurs the electro-magnet a^3 of S receives current, its shunt *s* being still retained in the position in which it had been pushed, because its arm *q'* had not made the one complete revolution necessary to release it, and S proceeds to send in the three remaining rounds of its signal, one being lost by the third station taking its current in the manner described. As soon as S has sent in the remainder of its signal, the current is restored to S', which in the same manner proceeds to send in the two rounds of its signal remaining to be sent. So it will be seen that no matter in what order or number the the signal-stations on any line are operated, all of them will correctly transmit the separate signals in the order of their position in the series in the circuit.

Should *c* be cut or broken, the operator will first arrange the yoke of the relay so that its retracted armature-bar will rest against an insulated stop in the manner herein described, then shunt switches *a*, *d*, and *f* to studs *h*, *d'*, and *f'*, respectively, when it will be seen that a loop consisting of switch *a*, galvanometer *g*, that portion of *c* between *g* and switch *d*, switch *d*, branch h^2, battery B, and branch *h'* will be formed, when, if *g* indicate current, it will show the break or cut has not occurred in the side of loop *c*, in which the stations are connected in series, and that it is between switch *f* and post *b* of the relay. Having ascertained generally which portion of *c* the break is in, the operator will immediately shunt switch *a* to its normal position when the circuit is closed, and at his option leave *d* in contact with *d'*; but he must necessarily preserve the contact between *f* and *f'*. For suppose the break to have occurred in *c* between the points of connection with it of branches *c' c'* of S and S', then all stations whose branches *c'* have connection with *c* between the break and post *b* of the relay will close the circuit through their branches *c'* when their shunts *s* are pushed in, as has been described; but the branch *c'* of S' being between the break and switch *f*, when its shunt *s* is pushed in, station S' will have no working connection with post *b* of relay unless *f* be in contact with *f'*, as above described, when the current will flow from battery B to S', through its branch *c'* to *c*, to *f*, to branch h^3, to h^4, and thence, in the manner herein indicated, to post *b* of the relay, and its signal will be transmitted. If when the operator on the occurrence of the break in the line had shunted switches *a*, *d*, and *f*, as described, and the galvanometer indicated no current passing, it would show that the break was situate at some point in the loop formed when said switches are so shunted. In that case he would immediately shunt switch *a* to its normal position, as above, and at his option leave *f* in contact with *f'*, but of necessity leave *d* in contact with *d'*, and arrange the relay so that it will work on an open circuit. If the break be at 7, Fig. 1, then the stations between that point and the post *b'* of relay being still connected with battery B would make their circuits through their branches *c'* and transmit their signals; but stations beyond point 7 will have no connection with battery

B unless *d* be in contact with *d'*, when they will derive their supply of electricity through branch h^2, when their circuit while transmitting a signal will be from the junction of h^2 with *c*, to *d'*, to *d*, to *c*, to post *p'* of station, (see diagram of station-circuit, Fig. 1,) to c^5, to c^{11}, to c^7, to *c'*, and thence, through circuit-breaker *t*, electro-magnet a^3, *pb*, and *c'*, to post *b* of the relay, whence it flows through the relay and the various connections to negative pole of battery B. Thus it is seen that when a break occurs in *c* between *a* and *d* those stations situate in *c* between the break and *d* must be operated by pushing their shunts *s'*.

If breaks should occur in both sides of loop *c*—say at 7 and 8—the operator should shunt switches *d* and *f*, so as to put them in contact with *d'* and *f'*, respectively, and arrange the yoke of the relay for operation on an open circuit. There are then two groups of signal-stations on two open circuits, which have magnets, relay, and battery in common, and are operated by pushing in the shunts *s* or *s'*, according to which side of the break 7 they may be situate, as has been described. If it should happen that two signals were to be transmitted simultaneously on the two arms of the circuits formed when breaks 7 and 8 occur, the operator by shunting either of the switches *d* and *f* will hold the signal being transmitted on that arm of the circuit whose switch has been shunted, the signals being retained when the line is open, as has been described. He can then take one round of the signal coming in on the arm of the circuit whose switch has not been shunted, and then open that circuit and close the arm of the circuit first opened and receive the signal temporarily held upon it. The same control can be had over two or more independent circuits when signals are transmitted simultaneously upon them by opening all but one of them and receiving the signal on the one remaining closed, and then opening that and closing another of the series until each one has been closed while the others are opened, when they will transmit their separate signals in the manner of the two arms of the signal-circuit, above described, and this whether they be open or closed.

From the description given of the means of operating the signal-stations on open or closed circuits it will be observed that in no instance are ground-connections used, which in operating district or fire-alarm telegraphs is of decided advantage, an accidental ground upon such telegraphs in most cases rendering a portion of the system inoperative until the ground be removed.

I have not claimed specifically the method of operating district and fire-alarm telegraphs herein described, nor the peculiar construction of the relay-yoke, both of which I believe to be new, and which I intend to make subjects for separate applications for Letters Patent hereafter.

I do not wish to be limited to the mechanical devices specifically shown and described herein, my invention not consisting primarily in them, but rather in the arrangement of the circuits in connection with them or equivalent apparatus, whatever they may be, whereby the objects sought to be attained are effected.

What I claim as my invention is—

1. In a telegraph system for transmitting a predetermined signal, a normally-closed loop-circuit containing a battery and receiving-relay, in one side of which transmitting mechanisms are connected in series and from the other side of which run parallel to that containing the transmitting mechanisms in series are normally-open branches or taps entering each transmitting mechanism, and means therein contained whereby said loop or main circuit is opened and said branch or tap closed, cutting out all of said mechanisms in said series beyond the mechanism operated and rendering them non-interfering in the transmission of their several signals, substantially as and for the purposes described.

2. In a telegraph system for transmitting a predetermined signal, a normally-closed loop-circuit containing a battery and receiving-relay, in one side of which transmitting mechanisms are connected in series and from the other side of which run parallel to that containing the transmitting mechanisms in series are normally-open branches or taps entering each transmitting mechanism, and each containing an electro-magnet, and the means therein contained whereby said loop-circuit is opened and said branch or tap closed and the electro-magnet therein contained excited for the purpose of transmitting the signals of said transmitting mechanism and rendering the same non-interfering in the transmission thereof, substantially as and for the purpose specified.

3. In a telegraph system for transmitting a predetermined signal, a normally-closed loop-circuit containing a battery and receiving-relay, in one side of which transmitting mechanisms are connected in series and from the other side of which run parallel to that containing the transmitting mechanisms in series are normally-open branches or taps entering each transmitting mechanism, and the means in said loop-circuit and mechanism contained whereby said loop or main circuit is opened, said branch or tap closed, and the loop and branch circuits restored automatically to their normal condition for the purpose of short-circuiting said loop-circuit during the transmission of a signal from each of said transmitting mechanisms, thereby rendering the same non-interfering, and after the transmission of each signal to restore said loop and branch circuits to their normal condition, substantially as and for the purposes described.

4. In a telegraph system for transmitting a predetermined signal, a normally-closed loop-circuit containing a receiving-relay and battery, in one side of which transmitting mechanisms are connected in series and in the other side of which run parallel to that con-

taining said transmitting mechanism, entering each of said mechanisms, are normally-open taps or branches, in each of which is an electro-magnet whose armature is so arranged as to control by its movement, dependent upon the action of said electro-magnet, the transmission or retention of signals from each of said mechanisms, substantially as described.

5. In a telegraph system for transmitting a predetermined signal, a normally-closed loop-circuit containing a battery and receiving-relay, in one side of which are connected transmitting mechanisms in series and in the other side run parallel to that containing said mechanisms, entering each of said mechanisms, are normally-open taps or branches, each containing an electro-magnet, and means contained in said loop-circuit whereby the same may be opened and short-circuited through said electro-magnet, whose armature is so arranged as to control by its movement the transmission of signals from said mechanisms, and also the means therein contained for the automatic restoration of said branch and loop circuits to their normal condition, substantially as and for the purposes described.

6. In a telegraph system for transmitting a predetermined signal, a normally-closed loop-circuit containing a battery and relay, in one side of which transmitting mechanisms are connected in series and in the other side run parallel to said side containing said mechanisms, entering each of the same, are normally-open branches or taps, in each of which is an electro-magnet, and means in said loop-circuit contained whereby it can be opened and short-circuited through said electro-magnet for the purpose of controlling, by the movement of the armature of the same, the means in said mechanisms contained for automatically restoring said loop and branch circuits to their normal condition after the transmission of a signal, substantially as and for the purposes specified.

7. In a system of telegraph for transmitting a predetermined signal, a normally-closed loop-circuit containing a battery and relay, the two sides of which extend parallel to each other from a central or receiving station and are led back to the same, having at their ends disconnected from said relay means of switching said loop-circuit, the one side having transmitting mechanisms connected in series therein and the other side having normally-open taps or branches entering each of said mechanisms, substantially as and for the purposes described.

8. In a system of telegraph for transmitting a predetermined signal, a normally-closed loop-circuit containing a battery and relay, the two sides of which extend parallel to each other from a central or receiving station and are led back to the same, having at their ends disconnected from the said relay means of switching said loop-circuit, the one side having transmitting mechanisms connected in series therein and the other side having normally-open taps or branches entering each of said mechanisms, and means connected in said loop-circuit for opening and short-circuiting the same through said branches, substantially as and for the purposes described.

9. In a telegraph system for transmitting a predetermined signal, a loop-circuit normally closed, containing a battery and relay, the two sides of which extend parallel to each other from a receiving station and are led back to the same, having at their ends, disconnected from said relay, means of opening and switching said loop-circuit, the one side having therein transmitting mechanisms connected in series and the other side having normally-open taps or branches entering each of said mechanisms, and means contained in said loop-circuit, and mechanisms to open said loop-circuit and short-circuit it through said taps or branches, and after the transmission of a signal restore said loop and branch circuits to their normal condition, substantially as and for the purposes described.

10. In a system of telegraph for transmitting a predetermined signal, a loop-circuit normally closed, containing a battery and a relay adjustable to work on an open or closed circuit, arranged as described, with its two sides extending parallel to each other from a receiving-station, the one having transmitting mechanisms connected therein in series and the other normally-open taps or branches entering each of said mechanisms, both of said sides re-entering said receiving-station, and being provided with means of opening and switching said loop-circuit, and having within said receiving-station normally-open branches connected with the two sides of said loop-circuit, and arranged with means in case either one or both sides of said loop-circuit be broken to connect said sides or either of them at their points of re-entry into said receiving-station with said relay, substantially as and for the purposes described.

11. In a telegraph system for transmitting a predetermined signal, a loop-circuit, *c*, containing a relay, R, battery B, having transmitting mechanisms S S′, connected therein in series, conductor C C, and branches or taps *c′ c′*, substantially as and for the purposes described.

12. In a system of telegraph for transmitting a predetermined signal, a loop-circuit, *c*, containing a battery, B, a relay, R, adjustable to work on an open or closed circuit, switches *a*, *d*, and *f*, plate *e*, branches *h′*, h^2, h^3, and *c′*, galvanometer *g*, and transmitting mechanisms S S′, substantially as and for the purposes described.

13. In a telegraph system for transmitting a predetermined signal, a transmitting mechanism containing a motor, circuit-breaker, an electro-magnet normally not in circuit, with its armature arranged to control the movement of said motor, and means for manually switching said electro-magnet into the main or signal circuit for the purpose of short-circuiting the main current therethrough, and after the transmission of a signal automatically

cut it out of said main or signal circuit, substantially as and for the purposes described.

14. In a system of telegraph for transmitting a predetermined signal, a transmitting mechanism having a motor, circuit-breaker *t*, contact-fingers *w w'*, electro-magnet a^3, with its armature a^2, shunts *s* and *s'*, wheel *q*, and on its shaft arm *q'*, levers L L' and their springs L^2 and L^3, arranged as described, substantially as and for the purposes specified.

15. The combination of shunts *s* and *s'* of the transmitting mechanism herein described, with the releasing apparatus i^3, having a case, *z'*, rod *z*, and guides therefor, z^2 z^{14}, said rod having arm z^3, stops z^7 and z^9 and z^{12}, springs z^{10} and z^{13}, and thumb-latch z^{11}, the whole thereof being fixed to the outer of two casings, the inner of which contains transmitting mechanism arranged substantially as and for the purposes described.

In testimony whereof I have hereunto set my hand this 24th day of November, A. D. 1886.

ALEXANDER M. NEEPER.

Witnesses:
WILLIAM H. ELLIS,
W. B. CORWIN.