(No Model.)

J. W. FROST.

AUTOMATIC REPEATER.

No. 563,586. Patented July 7, 1896.

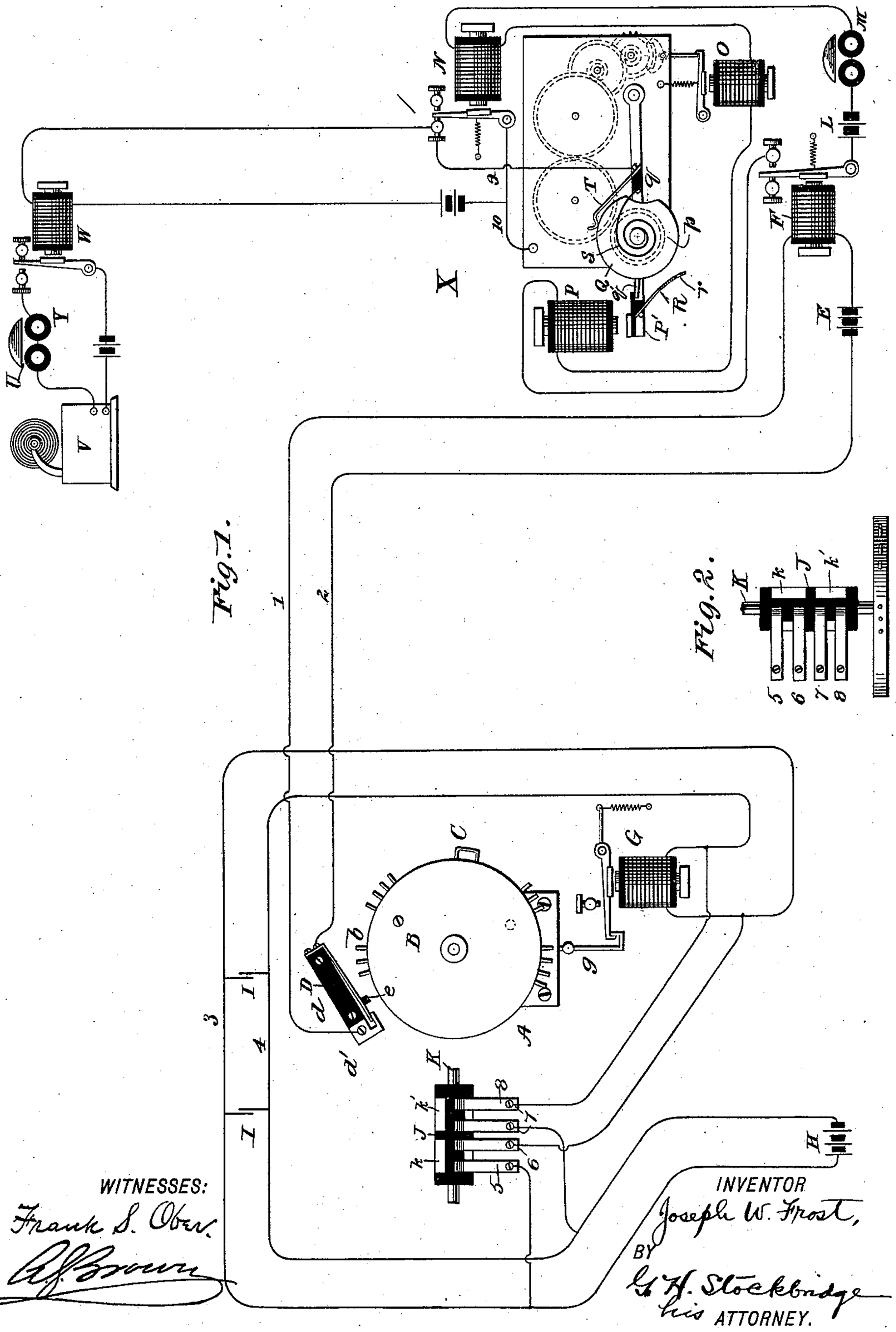

Fig. 1.

Fig. 2.

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AUTOMATIC REPEATER.

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To all whom it may concern:

Be it known that I, JOSEPH W. FROST, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Automatic Repeaters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

In automatic signaling systems it has been customary heretofore to have a central station in charge of the operating company, and to have that station connected with the office of the fire department by means of circuits which could be operated by hand by an attendant in charge of the station. In such cases the attendant has been accustomed to withhold from the fire department all signals indicating trouble, such as artificial grounds or the breaking of a wire, and to transmit to the fire-department office fire-signals alone.

My present invention has to do with an automatic repeater which shall be so combined with devices at the transmitting-station as to accomplish automatically what has heretofore been done by an operator.

The automatic repeater, as will appear hereinafter, is operated intermittently every time the transmitting apparatus located in the building to be protected is actuated. I provide means, however, for rendering such operation of the repeater ineffective for sending an alarm to the fire department unless the operation of the circuit controlled by the transmitter is continued over a considerable period. The means for preventing the effective action of the repeater consists of a short circuit cutting out the same, and the means for prolonging the operation of the transmitter or main circuit is a long tooth on the transmitting apparatus, which holds the said main circuit changed long enough for a piece of clockwork forming a part of the repeater to break the said short circuit, whereupon the signals following will be duly repeated upon the instruments of the fire department.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a diagram of a fire-alarm system including my repeater, and Fig. 2 is a detail view.

Referring to the drawings by letter, A represents the signaling or transmitting apparatus at a local station, which station is a building protected by a thermostatic system of fire-alarm. B is a circuit-controlling wheel forming the chief part of the said signaling apparatus, being provided, in this instance, with pins arranged in suitable order to represent the number "34." For the pins I may substitute teeth or other projections arranged to represent any definite number, and I may also have on the wheel teeth, pins, or projections for indicating different parts or stories of the building. The pins are here designated by the character *b*. There is also on the periphery of the wheel B a long tooth or projection C, designed to change the condition of the circuit and hold it changed for a considerable period. This wheel, with its pins or projections, coöperates with a spring contact-piece *d*, with which is connected a piece of insulating material *e*, lying in the path of the pins *b b* and the tooth C.

Normally the contact-piece *d* is in contact with a corresponding terminal *d'*, the two terminals being both mounted upon an insulating-block D. The said parts *d* and *d'* form the terminals of the main circuit 1 2, leading to the company's central station at X. The said main circuit includes a battery E and an electromagnet or relay F. Now the pins on the wheel D strike the insulating-piece *e* as the wheel rotates under the influence of clockwork, and lift the spring *d* off its coöperating terminal *d'*. By these means the normally-closed main circuit 1 2 is opened intermittently by the successive teeth upon the wheel B.

The signaling or transmitting apparatus at the local station is itself controlled by an electromagnet G in the circuit 3 4 of the local battery H. This circuit is normally closed through the magnet G, the armature of which is consequently attracted to its poles and thus made to interfere with the escapement *g* of the clockwork (not shown) which runs the transmitting apparatus and prevents the said clockwork from moving. Upon the release

of the armature of the magnet G will follow the release of the clockwork, and the consequent transmission of a signal over the main circuit.

At I I are shown thermostats between the branches of the circuit 3 4, these thermostats being exposed in different parts of the protected building, and being intended to serve the purpose of releasing the transmitting apparatus for signaling purposes, as will be readily understood. Now the magnet G can be deënergized for accomplishing the transmission of a signal, not only by the operation of a thermostat, (which would cut out the magnet and release the mechanism,) but also by other causes. In the present instance I have had in mind to show merely an illustrative system, and have therefore taken into account only the effect of a break in the circuit. It is obvious, however, that an artificial ground, or any other source of local trouble, might be caused to deënergize the magnet in a similar way. In any case it is clear that a rupture of the circuit 3 4 would do this and would cause a signal to be sent over the main circuit 1 2. It is the object of the present application simply to illustrate a system in which my repeater will be useful in withholding a trouble-signal arising from a break in the local circuit, and for transmitting to the fire-department office a genuine fire-signal, such as would be caused by the operation of one of the thermostats I I. If there were other sources of trouble in the system, such, for example, as might be caused by cross-circuits, grounds, and the like, my repeater would still be effective in the same way and to the same degree.

Returning now to the details of the transmitting apparatus, it will be seen by reference to Fig. 2 that an insulating-cylinder J is mounted on the shaft K of the wheel B, and that the said cylinder carries conducting-strips *k k'*, lying upon its surface in such positions as to pass under strips 5, 6, 7, and 8 and make contact with them in pairs. The strips referred to are of metal, and the strip 5 is joined to the wire 3 and the strip 6 to the same wire, both on the same side of the magnet G, while the strips 7 and 8 are similarly joined to the wire 4. Now the relation of the parts is such that the conducting-strips *k* and *k'* are brought under the strips 5, 6, 7, and 8 in couples, as aforesaid, after the wheel B has rotated far enough to send in the first number-signal. In this position there will be a complete circuit through the magnet G by way of wire 3, strip 5, conducting-strip *k*, strip 6, wire 3, magnet G, strip 8, conducting-strip *k'*, strip 7, and wire 4.

If it should happen that the circuit inside the protected building should be broken, thereby deënergizing the magnet G and releasing the mechanism, the result would be that the transmitter would be sent in rotation and would send over the main line the box or number signal "35." At the end of this signal the circuit through the magnet G would be restored over the course indicated in the preceding paragraph and the mechanism would cease to rotate and no further signals would be sent. On the other hand, should one of the thermostats I I become closed by heat, the magnet G would be and remain short-circuited in spite of the fact that the circuit above indicated would be formed through the strips, and the clock mechanism would continue to actuate the signaling-wheel, thus bringing the long tooth C into contact with the insulating-piece *e* and holding the main circuit open for a considerable period.

We come now to consider the effects of the foregoing operations of the main circuit upon the sub or local circuits controlled by the relay F. The armature of the said relay is normally upon its front stop, but is drawn back to its back stop whenever the circuit through the relay F is broken. The said armature is in the circuit of a local battery L, which includes an electromagnetic bell M, a relay N, and electromagnets O and P. The circuit of the local battery L is closed whenever the armature of the relay F is on its back stop. The magnet O is a trip-magnet, and the magnet P has upon its armature a pinion *p* and a disk Q, having a notch *q*. Secured to the said armature (marked P') of the magnet P is also a spring R, having a perforation *r*. This spring is in the path of movement of a pin or projection *q'* on the disk Q, and it is so arranged that when the disk is moved far enough the said pin or projection *q'* will enter the perforation *r* and lock the disk in place. A spring S tends to restore the disk Q to the position shown in the drawings, and does so restore it whenever it is released, except when the pin or projection *q'* has locked the disk, as aforesaid.

Bearing on the periphery of the disk Q is a contact-spring T, which is also supported upon the armature P', but insulated therefrom.

The armature of the relay N controls a normally-closed circuit running to the fire-department office Y, as shown. When the armature of the said relay is attracted, it tends to break the said circuit and sound an alarm upon the bell U at the fire-department office and actuate a register V at the same place, through the medium of a relay W, controlling a local circuit. The said armature of the relay L is, however, normally short-circuited by the wires 9 and 10, one of which runs to the insulated spring T, bearing upon the periphery of the disk Q, and the other of which is connected with the said disk through the frame of the clockwork *o*, which operates my repeater. Now the pinion *p* is adapted to engage with the clockwork *o* whenever the armature of the magnet P is drawn up to its poles. Normally, however, it is disengaged therefrom. When engaged,

the clockwork causes it to rotate in the direction of the arrow and carry the disk Q with it.

The trip-magnet O merely releases the clock mechanism of the repeater every time its armature is attracted. Now, whenever the local circuit, including the magnets N, O, and P, is closed, all the said magnets are operated, the clockwork is released, the pinion is drawn into engagement therewith, and the local circuit running to the fire department is opened by the relay N. Such opening of the circuit, however, is not effective for operating the relay W by reason of the short circuit already referred to. It should be stated that the said short circuit is broken whenever the notch *q* in the disk Q comes under the spring T; but it must be noted that the disk Q is moved only so long as the local circuit is closed, and unless the closure last some considerable time it is not carried far enough to bring the notch *q* under the spring T, but is released and carried back by the spring F to its normal position. When, however, the local circuit remains closed for a considerable period, the disk is carried until it brings the notch in its periphery under the spring T, and is locked there by the pin *q'* entering the hole *r*. The short circuit 9 10 is now broken and any further actuation of the relay N will operate the relay W, and, intermediately, the gong and the register controlled thereby.

The ordinary operation of the main circuit 1 2 by the pins on the wheel B effects ruptures of the said circuit, which are too short in duration to cause the repeater to send the signals on to the fire-department office; but the long projection C holds the circuit changed long enough to make the repeater break the short circuit through 9, 10, T, and the disk and frame, and allow the signals to be transmitted through to the fire-gong and the register. Thus, in practice, with an apparatus constructed as shown in the drawings, the first number-signal will be received only at the central office of the local company. This will indicate trouble of some sort, (in the construction illustrated in the drawings it will indicate a break,) and the trouble can be attended to by the authorities of the company without disturbing the fire department. A repetition of the number-signal will indicate fire, and this will be automatically transmitted to the fire-department office, as above made clear.

Of course the long projection described may be preceded or followed, or both, by as many number-groups as may be thought desirable, in which case a single-number signal would indicate trouble of one kind, as a break, and a double-number signal would indicate trouble of another kind, as a ground or a cross connection, and so on.

What I claim is—

1. A signaling system, provided with transmitting apparatus adapted to send a definite signal, a relay responding to the signals thus sent, a local circuit controlled by the said relay and including a second relay which controls, through the medium of its armature, an alarm-circuit, a normally-closed short circuit around the said armature, and means for breaking the said short circuit, as set forth.

2. In an automatic repeater, a local circuit containing a trip-magnet, and a normally-short-circuited armature which controls a subordinate alarm-circuit, circuit-changing devices, a clockwork tending to break the short circuit around the said relay when brought into engagement with the said circuit-changing devices, and a magnet in the said local circuit adapted to effect the said engagement, as and for the purpose set forth.

3. In an automatic repeater, a relay adapted to control a subordinate alarm-circuit, through the medium of its armature, a short circuit around said armature, circuit-breaking devices controlling the said short circuit, a clockwork adapted to be brought into engagement with the said circuit-breaking device for operating the same, a trip-magnet for the said clockwork, and a magnet adapted to effect the said engagement, the relations being such that when the engagement is long continued the said short circuit will be broken, as set forth.

4. In an automatic repeater, a circuit-breaking device, mounted upon the armature of an electromagnet, the said circuit-breaking device consisting of a disk having an insulating portion, and a contact-spring bearing upon the disk, a clockwork adapted to engage with the said circuit-breaking device, and a spring for restoring the disk, as and for the purpose set forth.

5. In an automatic repeater, a circuit-breaking device consisting of a disk having an insulating or cut-away portion and a contact-spring coöperating therewith, a clockwork for operating the said circuit-breaking device when in engagement therewith, a spring for restoring the said disk when released from engagement with the clockwork, and a catch or detent for holding the disk when it has been carried beyond a certain point, as and for the purpose set forth.

6. In a signaling system, a receiving apparatus at a station, such as the fire-department office, a local circuit for operating the said receiving apparatus, the said local circuit being controlled by the armature of a relay, a normal short circuit around the said armature, a means, controlled by signaling apparatus at a distant station, for breaking the said short circuit, as set forth.

In testimony whereof I have signed my name, in the presence of two witnesses, this 4th day of August, A. D. 1892.

JOSEPH W. FROST.

Witnesses:
ELIZA A. FROST,
FREDERICK A. ISHAM.