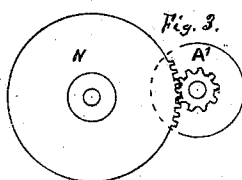
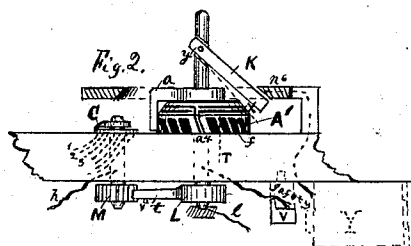
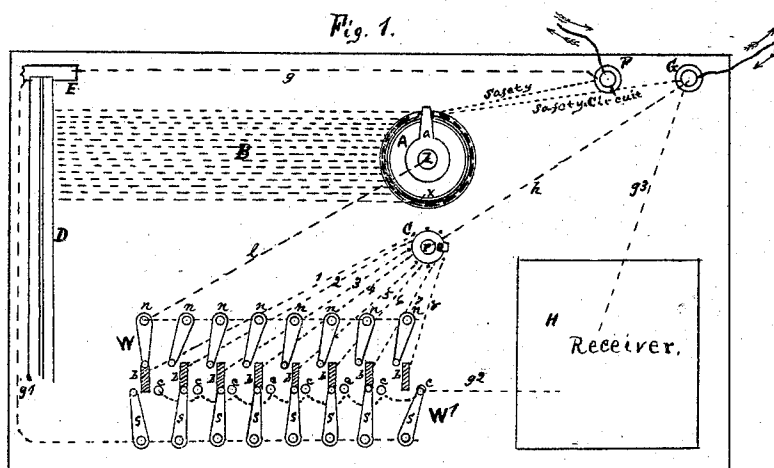


M. GALLY.
Circuit-Closers and Circuits for Multiplex or
Interval Telegraphs.
 No. 143,340. Patented September 30, 1873.



WITNESSES.

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IMPROVEMENT IN CIRCUIT-CLOSERS AND CIRCUITS FOR MULTIPLEX OR INTERVAL TELEGRAPHS.

Specification forming part of Letters Patent No. **143,340**, dated September 30, 1873; application filed September 22, 1873.

To all whom it may concern:

Be it known that I, MERRITT GALLY, of Rochester, in Monroe county and State of New York, have invented certain new and useful Improvements in Telegraphic Apparatus; and do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings and to the letters of reference marked thereon.

In the drawings, Figure 1 is a plan of circuit-closer, circuits, and switch-board. Fig. 2 is a front view of circuit-closer, safety-connector, and gear; and Fig. 3 is a plan of modified gear.

My invention is especially adapted to instruments intended for "multiplex transmission" upon a single wire; but some parts thereof are equally adaptable to instruments based upon any system in which automatic circuit-closers are used.

Plan Fig. 1 shows the automatic circuit-closer with instrument-circuits for a multiplex instrument, in which I use a manipulator similar to that described in my application filed September 11, 1873, the key-bars D making connection with different combinations of the metallic lines B, each of these fifteen metallic lines connecting with one of the conductors of the circuit-closer. In my application of September 11, 1873, the circuit-closer is described as being divided into segments, equaling in number the instruments intended to be used at any one time transmitting different messages upon a single wire, each segment being allotted its portion of divided time, and each instrument using one of the segments. It was also shown how each instrument could be adjusted to any segment not in use, and how other instruments could be brought in on any interval not being occupied without interfering with any operating instrument on the line.

It will be readily seen that a circuit-closer constructed with different segments allotted to different instruments cannot be made to accommodate a large number of instruments unless the circuit-closer be very large and the circuit-closing conductors are of great number. If the circuit-closer is very large it is not only cumbersome, but requires proportionately more power to operate it; and if the number of con-

ductors is increased the liability of disarrangement is proportionately increased.

I have therefore constructed an automatic circuit-closer for a multiplex instrument, as shown in Fig. 1, which has only one group of transmitting-conductors, and this group only sufficient in number to form the longest letter of a proposed alphabet. The "dot and dash" alphabet in common use requires the space of fifteen dots to represent its longest character; therefore I have given the small automatic circuit-closer A fifteen conductors, corresponding to the fifteen metallic lines B. This would be sufficient, with a common circuit, for single transmission; and my object in this invention is to make it suffice for the instrument when arranged for multiplex transmission.

I accomplish this in either of two ways, the devices for one being shown, in connection with the circuit-closer, in Fig. 2, and the modified devices being shown in Fig. 3. Both of these methods are based upon my own peculiar plan for multiplex telegraphy, which does not consist, as others, in constructing a transmitter or receiver to operate upon a particular interval allotted to it, and no other, but in methods and means for adjusting a transmitter or receiver, or both combined, to any unemployed interval desired.

Although the conductors of the automatic circuit-closer are only sufficient in number for single transmission, all that is necessary for me to do to accomplish the first object of my invention is to limit the action of this circuit-closer to the particular interval to which it is set; and, although the number of operating intervals may be fifty or more, the circuit-closer will not be increased in size.

In the plan of the instrument shown in Fig. 1, W represents a group of eight switches, representing eight transmitting-intervals, and W' represents a group of eight switches, which are for the purpose of changing the transmitting to receiving-intervals for the instruments when desired. Each pair of switches acts independently of all the others, and affects the instrument only as respects one interval, the switch *n* setting the instrument to transmit on its interval, or the switch *s* setting the instrument to receive on its interval, or connect-

ing the main line for such interval when not used either for transmitting or receiving. Any number of these pairs of switches may be employed in constructing the instrument, and each pair will represent an interval, upon which the instrument may be set to transmit or receive, and, as each pair acts independently, the instrument may be set to transmit on any one interval and to receive on another, or a number of others, if a number of registers are employed.

The manner in which these results are secured, and the means for securing them, I will further explain, as follows: The circuit-closer A passes its transmitting impulses through the metallic line *l* to the group of transmitting-switches *n n*, &c. Any one of these switches may be turned onto one of the group of conducting-bars *b*. Each of these bars is attached to a metallic line, as 1, 2, 3, &c., the entire number of lines terminating near the pivot of a small connector, *r e*, at C, at each revolution of the shaft of the circuit-closer A. The small connector connects with the termination of one of the wires 1, 2, 3, &c., and if this wire be connected by means of its switch with the line *l* the transmitting impulses will pass at that interval onto the main line through the line *h*. If, however, the switch is not on its conductor *b*, the transmitting circuit-closer A will be cut out for that interval. Connection from line *h* is made successively with the entire number of lines 1, 2, 3, &c., by means of the pinion M and spur *t* on shaft L, Fig. 2, and each wire of the group 1, 2, 3, &c., preserves its connection with the circuit-closer A during an entire revolution of the circuit-closer, if the wire is connected with its switch. It will be seen, therefore, that any one or all of the intervals represented by the lines 1, 2, 3, &c., may be set for transmitting, and that they may be interchanged at pleasure. The transmitting circuit-closer A is represented in the drawing full size for a working instrument, and may be used, in the manner described, with any number of intervals for multiplex transmission. Any of the lines 1, 2, 3, &c., representing intervals not being used by the instrument for transmission, are connected by means of the switches *s* through the conductors *b* through the line *g*¹ *g*, to the main line at F, and on such intervals the main line is connected through from F to G without affecting or being affected by the instrument. Such intervals can then be used by other instruments on the line. I use also a group of conductors, *c c*, &c., connecting through *g*² with the receivers H, or connect each separately with a separate receiver, as I desire. The switch *s* of any interval not being employed by the instrument for transmitting may be turned from its line-conductor *b* onto its receiving-conductor *c*, and any message passing on the main line during that interval will be passed through the receiver, thence through the line *g*³ onto the main line

at G, or in the opposite direction, as the case may be. As any receiver is not necessarily connected with the ground at its station, the message it is recording is again passed onto the main line or branch lines to be received by other receivers set upon the same interval. The instrument of Fig. 1 is set to receive on one interval and to transmit on another, as shown, and both operations being independent it will be seen that they cannot conflict. It will be seen also from the previous description that the intervals not employed by this instrument may be used by others on the line, and that different instruments may interchange intervals, as desired.

The motors of all the instruments on the line are supposed to be running synchronously, or controlled by a line-pulsator.

In the modification of gear shown in Fig. 3 I reverse the order of movement of the shafts *z* and *r* of Fig. 1, and drive the circuit-closer A¹ by the partial gear N and pinion on the shaft of the circuit-closer, as shown in Fig. 3.

With this construction the circuit-closer makes a revolution only on the transmitting-interval, to which it is set. The transmitting-switches *n n*, &c., are now omitted, as also the metallic line *l*, which is replaced by another connecting directly from the circuit-closer with the main line. The circuit-closer is set to any desired interval for transmitting, by setting the gear N to a corresponding position in relation to the motor.

Other modifications of gear may be used; or the motor may, by means of a local circuit, slip the gear at a proper time, which local circuit may be set in a similar manner to the main-line circuit to any interval desired.

Any number of instruments at any station (such instruments not exceeding the number of intervals to be employed) may be operated through a single circuit-closer, A, and each instrument be set by its operator to use any interval he may find unemployed. This I accomplish by extending the metallic lines B to all the manipulators, together with the wire *l*, and then make connection of all the instruments with a common switch-board, W W¹, or furnish each manipulator with a distinct switch-board to be used exclusively for its own manipulator. When a number of instruments are used in connection with a single circuit-closer at any station, it will be necessary to give the circuit-closer the continuous movement, as first described.

If the circuit-closer be used in connection with a single transmitter, which transmitter is intended to be set at different times to different intervals, as the case may demand, the switch-board of such instrument may be modified as to its transmitting portion, the metallic line *l* connecting with a single switch, which may be turned onto any one of the conducting-bars *b* by arranging the bars on a curved line.

To secure unison to telegraphic instruments

it is a common practice to detain each instrument at a complete revolution by means of a catch-pin or equivalent until the last one has made its circuit, when, by a common impulse, all are again set free. Such detention is a waste of time and is unnecessary.

To secure unison to the instruments I proceed upon an entirely opposite plan. It is an easy matter to secure to instruments perfect synchronism by good clock-work, making the correction of time only at comparatively remote intervals. My circuit-closer, Fig. 2, makes an entire revolution for a single letter, and gives one letter and a single revolution to each succeeding interval. If I now set one of the interval switches on the line connection, that interval alone may be used for unison correction; or, if I have one interval-switch always set for calls I may interrupt this interval at stated periods for a correcting-line pulsation, without interfering with the messages passing the line. My plan is as follows: Either to set one interval on the line-connection for the line-pulsation or use at distant periods a single revolution of the circuit-closer or the space of a single interval of the call-circuit for a magnetic detent, holding the circuit-closer for a single revolution without necessarily interfering with the motor, although the motor may be stopped for such purpose if desired. To accomplish my object, I pass through the line at certain periods, sufficiently frequent to correct the instruments, a pulsation from a line-pulsator confined to the interval mentioned, and of duration equal, at least, to the entire interval, affecting the magnet Y, Fig. 2, for a period at least equal to an entire interval or an entire revolution of the circuit-closer. This will both stop and release all the circuit-closers of the line and make the correction positive. By tripping the circuit-closer, as shown in my application of September 11, 1873, the motor will not be detained.

The magnetic detent is shown at *v v*, Fig. 2, with the magnet Y, which is connected with the main line and safety-circuit.

II. The second part of my invention has reference to the construction and arrangement of the conductors of a circuit-closer. In order to join two separate short conductors to produce a long impulse it is common to place a third one above or below the space between them, and connect with the three. Instead of such an arrangement I place the short conductors of any number desired in a single line arranged on a diagonal as to the position of each with the line, as shown in Fig. 2, at *A*¹. The face of the connector *a* produces contact on a vertical line. This line, as T, cannot be moved entirely over one conductor without first coming in contact with the next; therefore, the contact will be unbroken unless one of the conductors be "cut out," in which case a space will be produced. The same result will follow

if the conductors are vertical and the connector *a* be made to connect on a diagonal to the line of conductors.

III. The third part of my invention has reference to a safety device for instruments used in multiplex telegraphy. Its object is to avoid the breaking of the main line by the stoppage of any instrument occasioned by accident, carelessness, or otherwise, which would interrupt the working of the other instruments of the line.

In any set of instruments working upon an interval plan the line must be broken for each transmitter on its interval, if transmitting by positive impulses, or for the receiver, if transmitting by negative impulses. If, therefore, one of the instruments of the line be accidentally or otherwise stopped on such a break of the main circuit, or at any other point of break, all the other instruments of the line will instantly become inoperative.

To avoid this I place upon the circuit-closer A, or in connection with some other appropriate part of the instrument, a conductor or conductors, *x*, with a connector, which will make connection of the main line whenever the instrument ceases to move with proper rapidity. As a convenient connector for this purpose, I use the centrifugal drop-connector K pivoted to the shaft of the circuit-closing connector. This connector K is made sufficiently heavy, or to be retarded by sufficient resistance to remain in contact with the conductors *x* until the circuit-closer has attained the required speed for correct transmission, when it rises by the effect of centrifugal force.

As soon as the motor of the instrument ceases to move or falls below its proper speed the connector K connects the main line, through the safety-circuit shown in the plan, and the instrument is cut out of the line.

If, for any reason, the instrument is deranged and runs too fast, the connector K touches the counter conducting-ring *n*^o, Fig. 2, which connects the safety-circuit, and the instrument is cut out of line.

Thus perfect safety is attained for all the messages being transmitted by the instruments which are in proper order. Another advantage of this part of my invention is that any instrument on the line can be stopped or started at pleasure, or may be regulated as to any of its parts without interfering with the other instruments of the line.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. An automatic circuit-closer, having conductors for a single transmitter, in combination with a device for adjusting the same to the different intervals of a multiplex instrument, without necessarily increasing the size of the circuit-closer, or changing the size or number of its segments, spaces, or conductors, substantially as specified.

2. The combination of a group of conductors and a circuit-connector, having a diagonal position in their relation one to the other, for producing lengthened unbroken pulsations by combinations of conductors of the group, substantially as specified.

3. The combination, with a multiplex transmitter or receiver, or both combined, of an

automatic safety device, which preserves, in case of stoppage or derangement of the instrument, the proper connection of the main line for the use of other instruments.

MERRITT GALLY.

Witnesses:

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N. K. ELLSWORTH.