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W. UNGER & H. E. TOWLE.

Telegraph Apparatus for Automatic Signalling.

No. 144,643. Patented Nov. 18, 1873.

Fig. 1

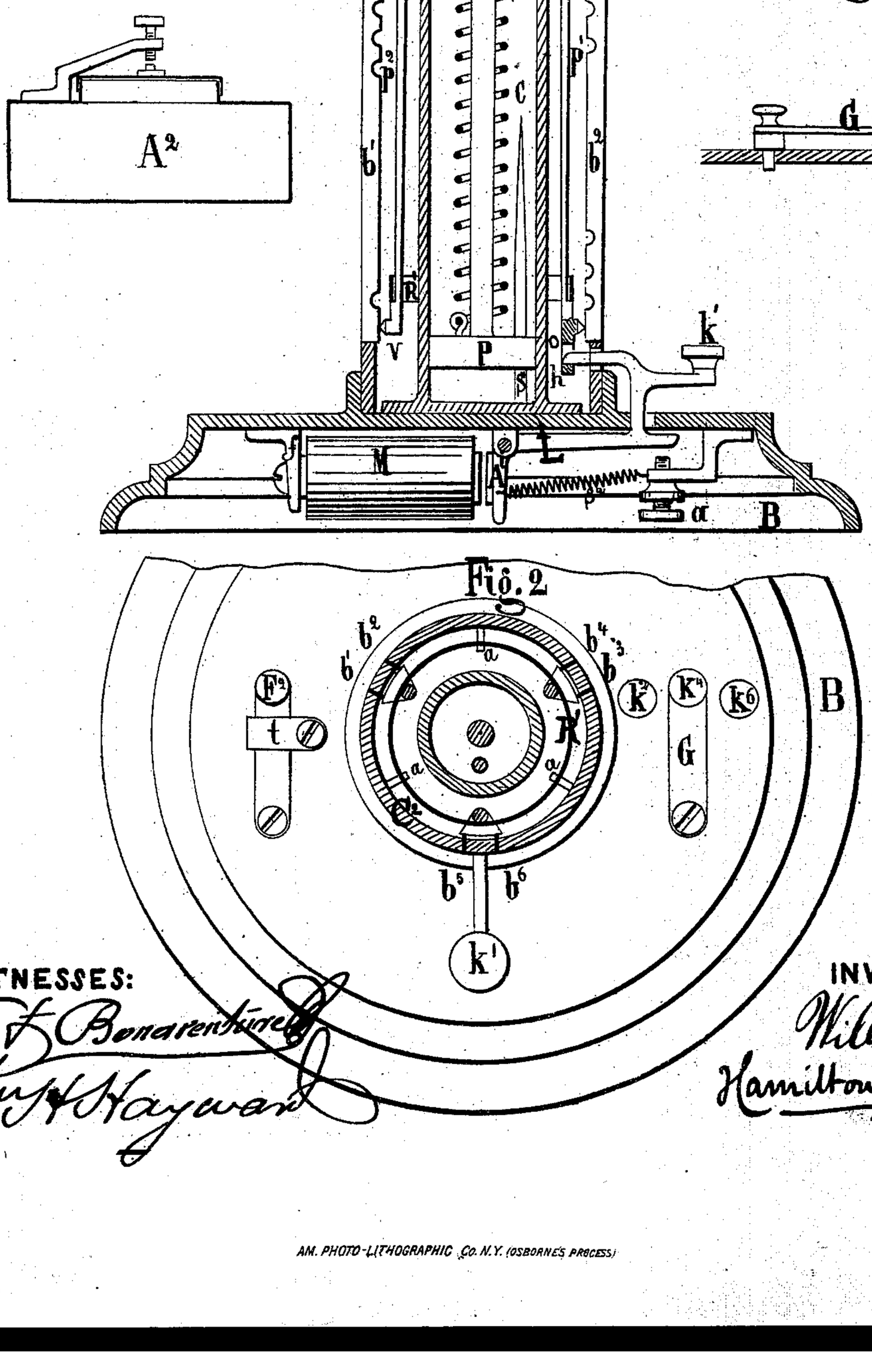

Fig. 3

Fig. 2

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Fig. 4

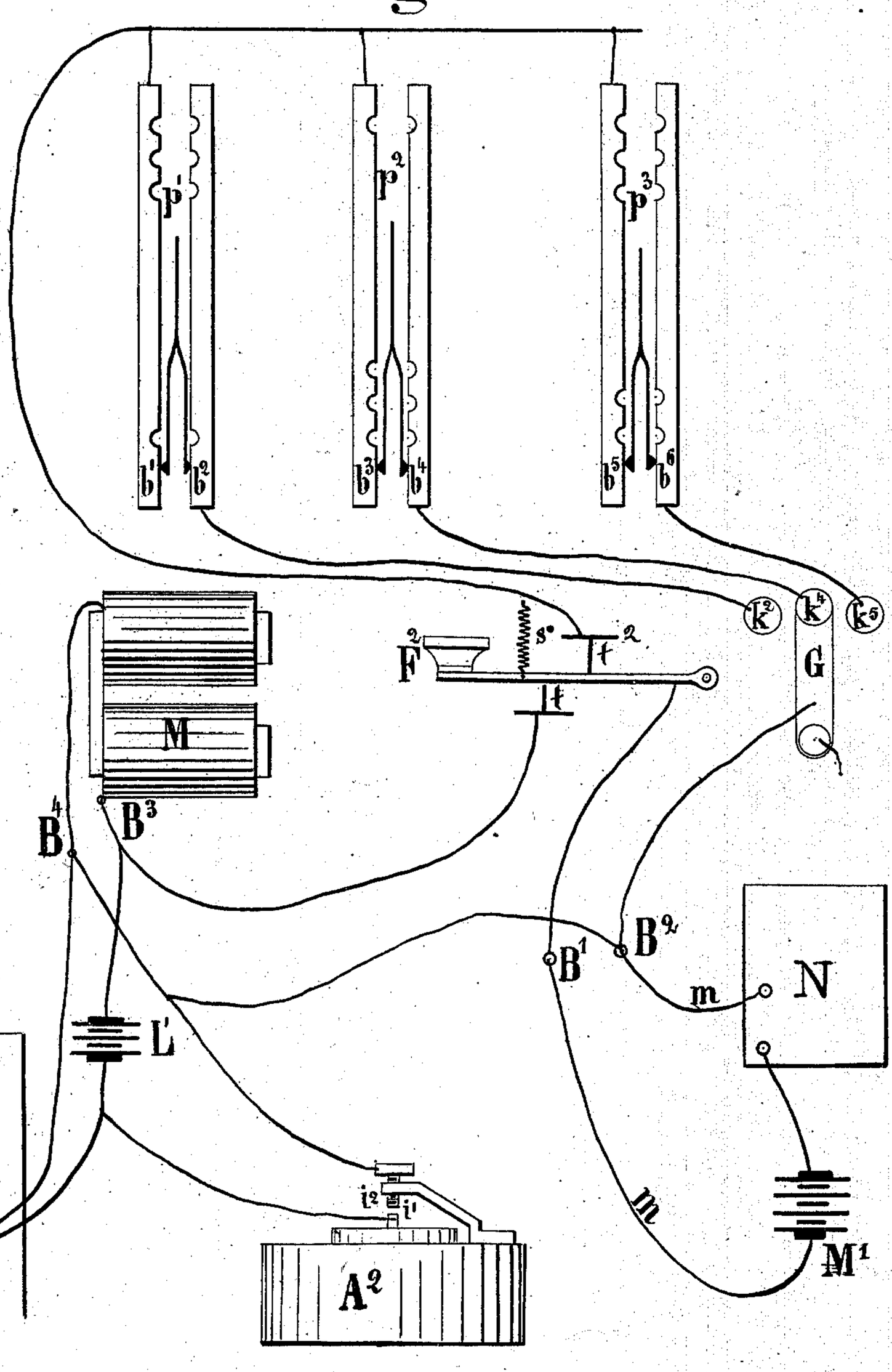

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Fig. 7

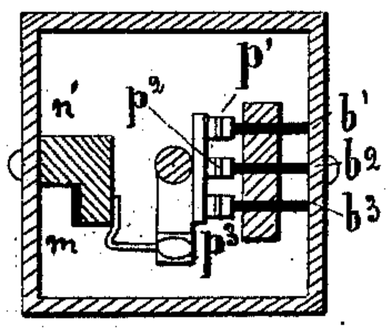

Fig. 5

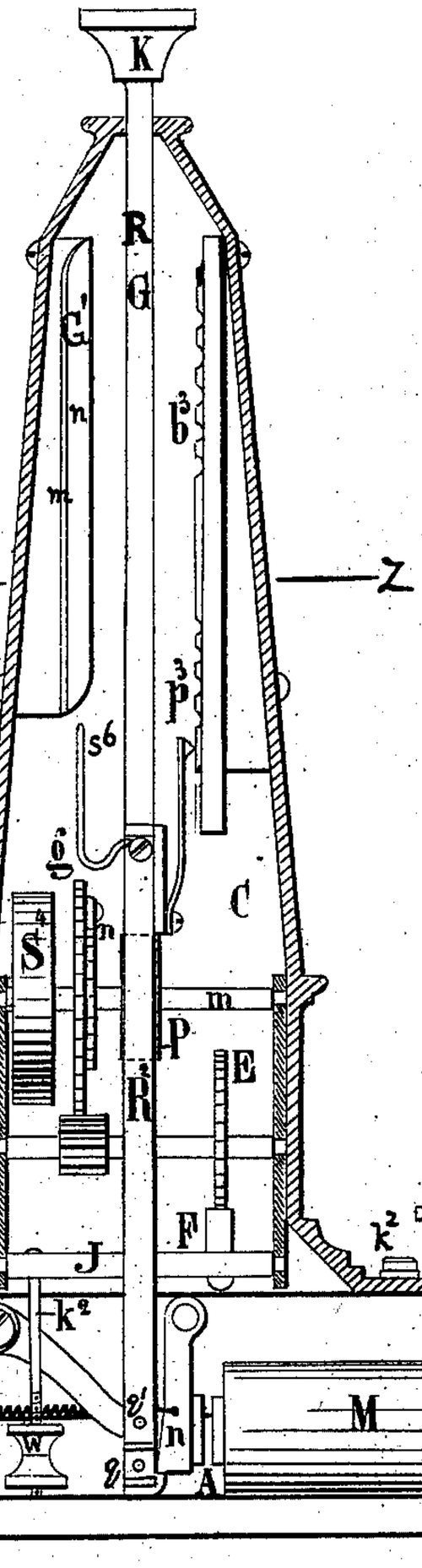

Fig. 6

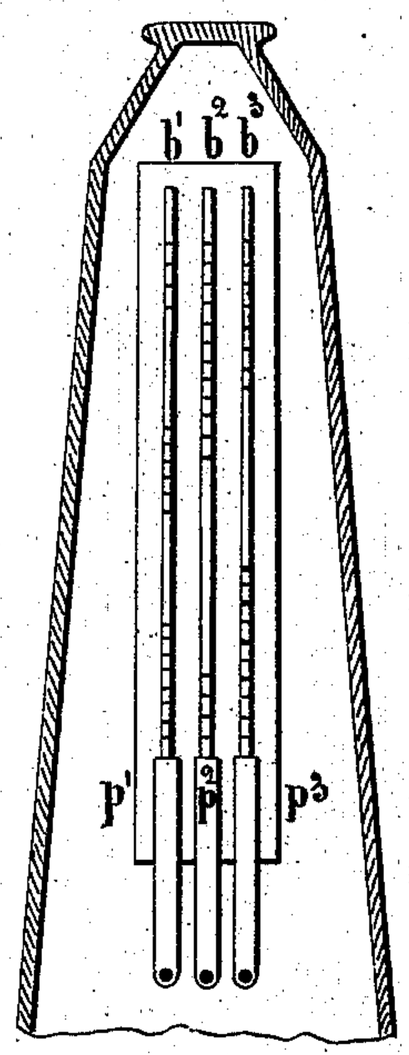

Fig. 8

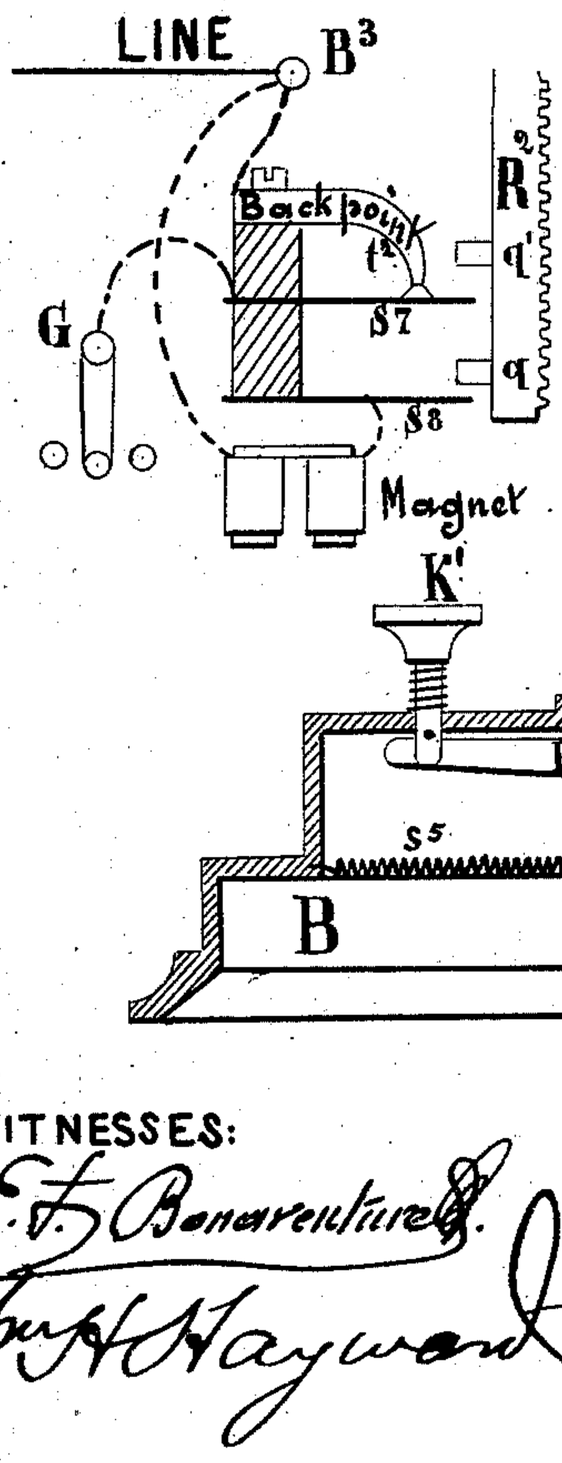

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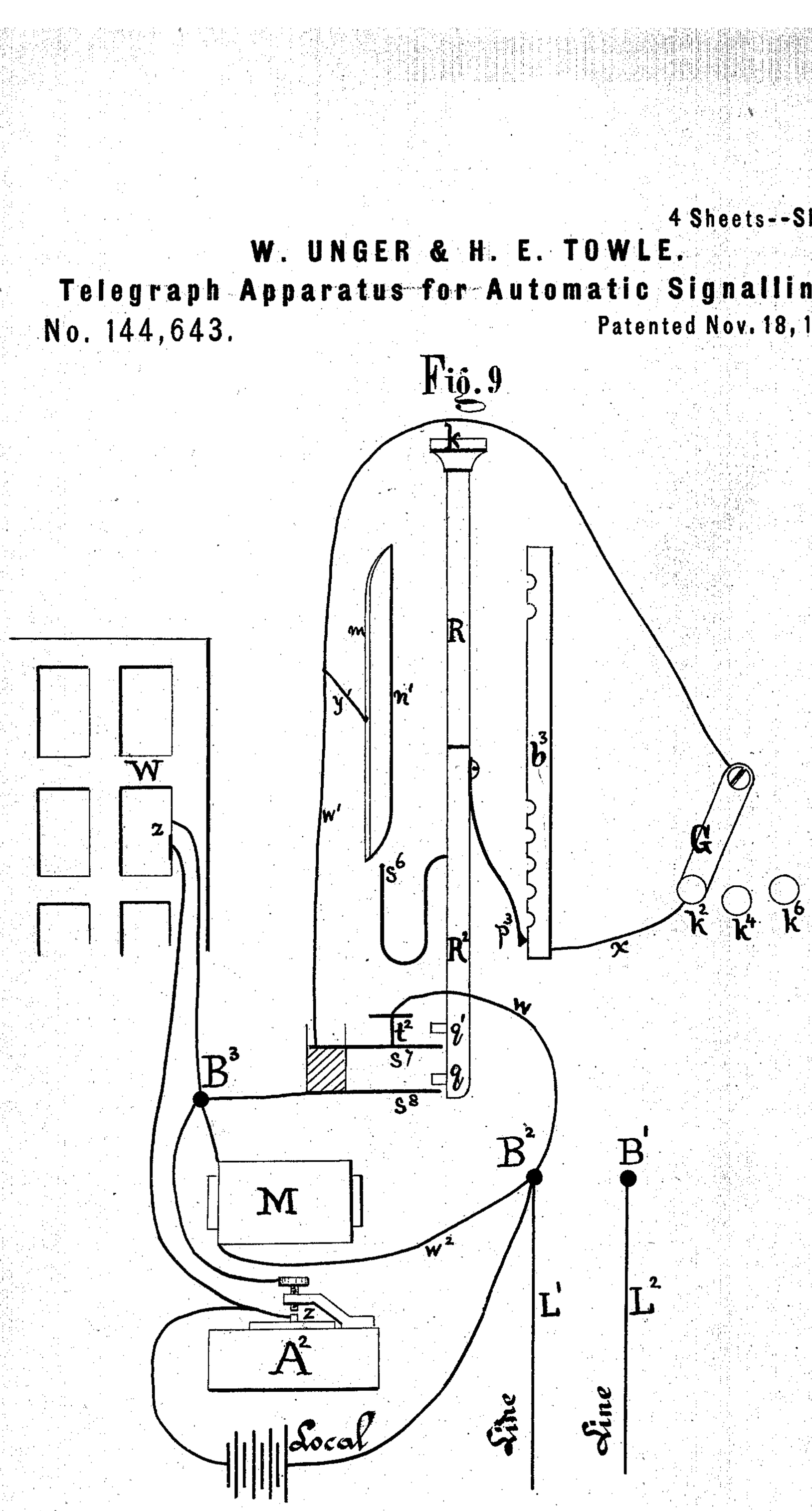
Fig. 9



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WILLIAM UNGER, OF NEWARK, NEW JERSEY, AND HAMILTON E. TOWLE, OF NEW YORK, N. Y.

IMPROVEMENT IN TELEGRAPH APPARATUS FOR AUTOMATIC SIGNALING.

Specification forming part of Letters Patent No. **144,643**, dated November 18, 1873; application filed August 15, 1873.

To all whom it may concern:

Be it known that we, WILLIAM UNGER, of Newark, New Jersey, and HAMILTON E. TOWLE, of the city of New York, have invented certain new and useful Improvements in Automatic Telegraphic Apparatus, of which the following is a correct description:

Our invention relates to that kind of apparatus which is intended to automatically make and break electric circuits, for the purpose of transmitting over wires signals, arranged in the machine itself, the operator having nothing to do but to set and start the machine. The machine, when set, may be started also by the action of heat in case of an accidental fire, or by the opening of doors or windows in case of an attempt at burglary.

The motive power of the automatic apparatus consists of a weight or spring, which is to be wound up or contracted whenever the machine is set for use, by merely moving a knob or handle through a convenient space; or it may be wound up like a clock, so as to serve for several transmissions of signals.

We prefer the construction which provides for compressing the spring each time previous to using the apparatus with the arrangement of the knob or handle, so that by merely inspecting the position of the same it will be seen if the apparatus is set ready for use or not.

The signals are produced at the station or stations by an ordinary Morse register, sounder, or other suitable instrument. The signals are given automatically, and the same apparatus will, for example, give signals for calling a messenger, police, or to indicate fire, or for any other similar purpose.

One peculiarity of the machine is the reciprocating circuit-breaker, which is moved in one direction by hand to set it for action, and in the opposite direction by a spring or weight when it is making signals, thus distinguishing it from rotary circuit-breakers, which repeat without reciprocating. This circuit-breaker consists of a sliding bar, connected with one pole of the battery, armed with projections, which conduct the electric current when in contact with the opposite pole of the battery, and alternated with spaces, which, either from the absence of metal in them or the presence of a non-conductor, prevent the current from passing, and a point, which is the opposite pole of the battery, so placed that it will be drawn against and into contact with the conducting projections on the bar. These two parts may both be moved in opposite direction, or one may stand still and the other be moved; but in either case the moving part must be returned to the starting-point after each transmission before it can repeat the signals. The movable part of this circuit-breaker is provided with a notch, into which a detent enters to hold it in position when it is set, and a spring or weight for driving it when the detent is withdrawn, and when it is moving to make and break the circuit. These parts form a new combination, which gives great advantages to our automatic telegraph, used for conveying a few simple signals, over any other combination known to us, among which simplicity and cheapness of construction, certainty of action, durability in use, and facility for operation by unskilled persons, are conspicuous.

Several circuit-breakers may be employed in the same apparatus, whenever more than one set of signals are required.

A simple and convenient form of application of the device herein suggested is shown in Figure 1 of the accompanying drawings, which is a vertical section through an upright cylinder, C, fixed upon a base, B, which also carries an inclosing-cylinder, C^2, upon which are secured the various bars b^1 b^2 b^3 b^4 b^5 b^6, &c., which are constructed or notched to produce the desired arbitrary signals. The inner cylinder C may conveniently contain the spring giving the moving power, as shown in a state of tension at *s*, in which it tends to lift the piston P up through the cylinder C, and carry with it the piston-rod R, surmounted by the yoke *y* and the knob *k*. To provide against the unequal force of the spring, a corresponding resistance is provided, to cause the piston and attached parts to move uniformly. Some fluid or liquid is placed in the cylinder, and a hole or passage-way is made in the piston, through which the liquid must pass as the piston is moved by the force of the spring.

This hole is provided with a tapering spindle, s^1, secured at the bottom of the cylinder, and passing through it, leaving an annular space around it, and so contracts the passage-way when the force of the spring is greatest, and enlarges it when the spring loses its force, as to cause the piston to move quite uniformly during its entire stroke. From the yoke y depend spring-pieces p^1 p^2 p^3, connected with one pole of the battery, carrying at their lower ends the points v in contact with the bars b^1 b^2 b^3, &c., ready to automatically make and break the circuit whenever the piston is moved upward by the spring s. The spring s may be released at will by pressing upon the key k^1, which is fixed upon the bent lever L, centered at the pin i, and which carries the detent h, engaging in an opening, o, in one of the spring-pieces p^1. The spring s^2 serves to keep the key raised, and at the same time holds the detent h in proper position to engage in the opening o whenever the piston P is pressed down to the bottom, as shown in its present position. The bent lever L also carries the armature A. The magnet M is fixed in working position upon the stud f, opposite the armature A. An adjustable screw, a, acts upon the lever L, and regulates the motion of the armature A. The spring-pieces p^1 p^2, &c., are each made forked, as shown in Fig. 4, and each end of the fork carries a pole or point for contact, and they operate as hereinafter explained. A switch, G, Fig. 3, serves to throw the current through whichever circuit-breaker is to produce the required signal, one circuit-breaker only being in the circuit at once. A ring, R^1, inclosing all the springs p^1 p^2, &c., serves to keep the points away from the bars during the downward motion of the piston, by dropping over the enlarged ends of the springs when they reach the upper limit of their motion, at which point they become compressed by the cam-pieces c^1 c^2 c^3 enough to permit the ring to inclose them. The springs now remain compressed, away from the bars, during the descent of the piston, till they reach nearly to the bottom of the cylinder, when the ring comes in contact with studs, which prevent it from further descent, and as a consequence, the springs being still further depressed, the enlarged ends pass below the ring, and their elasticity renews the contact of their points with the bars, and the ring remains passive till carried up by shoulders on the springs to the upper end of the cylinder, when it again clasps the spring, as before.

For giving more certainty to the breaking and making the circuit, the combination-bars may be arranged in pairs, as shown in Fig. 4, by which the combination of signals is duplicated; or one bar only in any circuit may have the combination of signals, while the remaining bar in the same circuit may be plain, and only used for preserving continuous contact of a point moving against it. In the case where the circuit-breaking point remains at rest, one combination-bar in the circuit is made to pass along against the point, thus producing the same effect as in the case above stated, where two points connected by a fork pass over two similar bars.

To facilitate understanding the action of the apparatus in practical operation in a line or telegraph circuit, the diagram, Fig. 4, is made, which fully shows the system as a whole, including an explanation of the use of the key F^2, &c.

The main line m m is kept charged from the main battery M′, and the system is worked with what is termed a closed circuit.

N represents an electric bell, sounder, or Morse register at the office where signals are to be received.

The binding-posts B^1 B^2 serve to connect the main line to the apparatus, which is described as follows: From B^2 connection is made to the switch G, which may be placed at will upon either of the buttons or knobs k^2 k^4 k^6, which are, respectively, connected with the combination-bars b^2, b^4, and b^6. (Shown independent of the other parts of the instrument in Fig. 4.) Starting from binding-post B^1, the connection leads to the finger-key F^2, which, from the force of the spring s°, is in contact with the back point t^2, connecting with one of each pair or set of the combination-bars employed in the system.

In the present example three sets of combinations are employed, and the back point t^2 is connected with all the combination-bars, of which, however, in the present position of the switch G, the bars b^3 b^4 only are in circuit. The current is, therefore, free to flow uninterruptedly through the entire line, connection being preserved at the combination-bars by the spring-piece p^2, carrying the points for contact at its lower ends.

If, now, it is desired to produce at N the particular signals in combination on the bars b^3 b^4, (one of which may be entirely plain, if desired,) the key k^1, Fig. 1, is pressed, and the spring-piece p^2 ascends, and the points of the spring-pieces are drawn over the notches in the bars, whereby corresponding interruptions of the current take place, and the desired signals are produced at N.

By altering the switch G to the button or knob connecting with any other set of bars, corresponding signals will be produced at N.

In order that one operator may not start his instrument while the line is being operated by another, provision is made for testing the line as follows: A small magnet, M, serving as a sounder, is, at pleasure, thrown into the circuit by pressing the finger-key F^2 to the anvil t^1, which, at the same time, cuts out of circuit all the circuit-breakers beyond the back point t^2, at which the break occurs. If M is found not to be working, it is then known that the line is free, and that the key k^1 may be pressed and the instrument thereby be started.

While making the above test in this form of instrument, the knob k should be held down

to prevent the piston from rising, as it would do in consequence of the bolt *h* being withdrawn by the action of the magnet M upon its armature and the bent lever to which it is attached.

For starting the apparatus in case of fire, a small local battery, L^1, is erected convenient to the instrument, containing the combination-bars, and this local battery is connected to the magnet M, and, also, to a small air apparatus, A^2, which is placed in the circuit of the local battery and magnet M. This circuit is kept open by the break at the air-chamber till sufficient heat occurs to expand the internal air, and thereby bring together the points i^1 i^2, when the force of the magnet will withdraw the detent *h* and start the instrument.

The air-chamber A may be made of glass or other suitable material, in the form of a small jar, with an opening provided with a rubber or other elastic air-tight cover, upon which a metallic point, i^1, is secured opposite to a corresponding adjustable point, i^2. These points must be insulated in respect to each other.

For burglar-alarm purposes the local battery and magnet M are connected with the doors or windows at which the burglar is supposed to make his attack, so that, upon his moving them sufficiently, the local circuit is closed and the instrument started and made to give the desired signals.

The arrangement of the local circuit connecting the battery L^1, magnet M, and window W is also shown in Fig. 4.

Another form of the instrument in which our circuit-breaker is employed to make the arbitrary breaks of the circuit is shown in Figs. 5, 6, 7, and 8. In this form of the apparatus an ornamental column and base inclose nearly all the working parts, while the outside may be made to support a thermometer or serve for some similar purpose.

Fig. 5 is a vertical section through the instrument, showing a side view of the three circuit-breakers b^1 b^2 b^3 and p^1 p^2 p^3; and Fig. 6 shows the same in front view. Fig. 7 is a horizontal section taken on the line *x z*.

A train of clock-work actuates a rod, R, which projects through the top of the case, and is surmounted by the knob *k*, as shown in Fig. 5. This rod is attached to a rack, R^2, which engages in a pinion, P, upon the shaft *m*, which carries the driving-spring s^4, the ratchet and pawl *r*, and the gear-wheel *g*, engaging the pinion below upon the same shaft as the escapement-wheel E, which is acted upon by the pallet F, fixed upon the rock-shaft J, which also carries a pendulum, k^2, with adjustable weight *w* screwed upon it. These parts comprise the clock-work movement, which serves to move the rack R^2 and the attached points p^1 p^2 p^3 upward when the instrument is required to give the arbitrary signals arranged on the combination-bars. The spring s^4 in Fig. 5 is in a state of tension, with the knob *k* and attached rod R, and the rack R^2 held down by the detent *n*, entering a notch in the foot of the rack. The detent *n* carries the armature A of the magnet M, and the spring s^5 serves to throw the detent into a notch in the lower end of the rack, and also to draw the armature away from the magnet. The points p^1 p^2 p^3 are attached to spring-blades, which are secured to the rack R^2; and the spring-blades serve to bring their points into contact with the conducting-points of the combination-bars whenever they are made to pass over them. A bent lever, L, centered at the pin *o*, and provided with the finger-key k^1, supported by a spring, (directly beneath k^1,) with the other end of the bent lever in contact with the detent *n* or the armature A, serves to withdraw the detent and release the rack whenever it is desired to make use of the apparatus.

When the instrument is employed as fire-detecter, the magnet M is made to attract the armature, and thus withdraw the detent and start the instrument. The switch G can be set to correspond to the messenger, police, or fire alarm, or other combinations on the circuit-breaker, either combination being thrown into the line, at the pleasure of the operator, by merely moving the switch to connect with the proper button.

When the instrument is at rest, the line-current is free to pass through the switch G, thence to one of the combination-bars, through its corresponding point and spring-blade to the rack-piece and base, and from the latter, through a convenient binding-post, the line is continued to the next instrument in the circuit.

In order to prevent the whole, or any part, of either combination of signals from being made during the process of setting the circuit-breaker, we have so arranged a metallic spring-piece, s^6, and attached it to the rack R^2, that, while the points are passing along in reverse order over the bars during the act of setting the circuit-breaker, full connection is made with the line through s^6 and the metallic plate *m*, which is insulated from the base, but connected with the line, so that no breaks occur in the circuit during the setting; but as soon as the setting has been finished, then the detent *n* holds the clock-work wound up till it is released; at the same time the spring s^6 flies away from contact with the plate *m*, against which it presses at all times during the setting. The contact of s^6 with *m* during the descent of the rack R^2, which corresponds to the setting, is caused by the cam-shaped upper end of the plate *m*, directly over which the horizontal bent end of s^6 stands when the rack is in its highest position. When the rack is pressed down, the cam-shaped end of the plate *m* causes the spring-piece s^6 to move to the left, in constant contact with it, till s^6 escapes from one end or the other of the plate *m*. When, however, the spring-piece s^6 has been pressed so as to escape from the lower end of the plate *m*, it cannot resume connection

with plate m again till it arrives at the upper part of its stroke, after having passed along the non-conducting surface n', which guards the right side of the plate m. This non-conductor, at the lower end, has the form of a cam, reversed in direction from that at the upper end of the metallic plate m, so that, in fact, s^6 passes downward upon one side, and upward upon the other side of the plate m and the insulator n'.

It is of the first importance to provide a simple and practical way for this operator to test the line before starting any instrument to work upon it. This may be effected by any device which will throw the line-current through a magnet or sounder attached to the instrument. For this purpose, in Fig. 5, we make special use of the same knob or handle by which the instrument is set, and we may so arrange the connections that either an end, rotary, or sidewise movement to the knob or handle will throw the line-circuit into the magnet through which the test is made. In the form of our invention shown in Fig. 5, the endwise motion of the handle or knob is preferred; so that, after the instrument is wound up and set, the operator has only to press upon the knob k and cause the rack to descend a short distance, which will free the detent n, and at the same time, by means of two pins, q q', projecting from the rack R^2, throw the magnet M into the line-circuit, as hereafter explained, and allow the armature A to vibrate, and thus indicate if the line is being used or not. As soon as it is found that the line is clear, the operator may remove the pressure from knob k and press upon key k^1, which will push the detent n from and release the rack R^2, whereupon the clock-work will immediately carry the points over the combination-bars, and produce the desired breaks in the circuit. The connection may be so made that the test can be applied before or after the apparatus is wound and set ready for use. We prefer the latter method, so that the testing immediately precedes the starting of the instrument.

We secure great advantage from making the test of the line by the same knob or handle by which the instrument is set, inasmuch as full control is thereby held over the action of the instrument by the same hand that makes the test.

The object of the escapement and adjustable pendulum is to so modify the motion of the main shaft as to cause the rack to ascend with the proper speed to produce the desired breaks in the circuit. Fig. 5 represents the spring s^4 in a state of tension, with the rack held down by the detent n, engaged in a notch in the foot of the rack-piece. The knob k^1, acting upon the bent lever L centered upon the pin o, serves to disengage the detent and release the rack whenever it is desired to start the instrument. Whenever it is desired to test the line, the handle k is pressed upon. The detent is then free to be moved by the magnet M acting upon its armature A secured to the detent, the electric current being thrown through the magnet by the descent of the handle k, which, in addition to setting the detent free, also throws the magnet M into the line-circuit in the following manner: The line is connected with the insulated binding-post B^3, Fig. 8, and this post is connected to a back point, t^2, which is ordinarily in contact with the spring s^7, which is in turn connected with the switch G. The binding-post B^3 is also connected with the magnet M, and through it to the spring s^8. The lower end of the rack R^2, which is in contact with the base, carries the two pins q q'.

Now, when the rack is pressed to the extreme bottom, the pin q makes contact with s^8, throwing the line-current through the magnet M, while at the same time the circuit through the back point t^2 is opened, in consequence of the pin q' coming into contact with the spring s^7 and moving it away from the back point t^2. Thus the magnet M is thrown into the line, and the test required is completed; and if the magnet remains quiet, the line will thus be known to be free, and the operator can start his instrument.

Fig. 9 represents an analytic view of the connections by which the electric current is affected by the operations of the machine shown in Fig. 5.

L^1 L^2 represent the main line as it enters and leaves the instrument. B^1 is the binding-post to the base of the instrument. B^2 is the insulated binding-post, through which the insulated connections are made. B^3 is the binding-post for passing the current through the magnet M, for the purpose of testing the instrument or for the fire or burglar alarm. G is the switch, and k^2 k^4 k^6 are the buttons to the same. R^2 is the reciprocating rod, carrying the point p^3 of the circuit-breaker. The combination-bar is lettered b^2; and m and n' compose the switch G', upon which the spring s^6 operates, in the manner already described. The pins q and q' are on the reciprocating rod or rack R^2, and s^7 and s^8 are the springs which come into contact with the pins q and q'. The back point, through which the current passes when the wire w touches it, is t^2. These different parts are intended to represent corresponding parts in Fig. 5.

As the instrument is shown in the drawing, it is set ready for action. Commencing at the binding-post B^2, the current passes through the wire w to the back point t^2, and through the spring s^7 and the wire w^1 to the switch G, and through the button k^2 and the wire x to the combination-bar b^3, which, being in communication with the rack-bar R^2 through the point p^3, completes the circuit with the base, so that the current passes through the machine, and out through the base, at the binding-post B^1, without interruption.

For the purpose of testing the line, the bar R^2 is pressed down by the knob k, in consequence of which the pin q comes into contact

with the spring s^8, and the pin q' immediately afterward into contact with the spring s^7, which, being depressed by the pressure upon the knob k, breaks the circuit at the back point t^2. In this condition the current can no longer pass through the wire w; but communication being formed through the spring s^8 and pin q, the current passes through the wire w^2, through the helix of the magnet M, through the binding-post B^3 into the base, through the spring s^8 and pin q, and rod R^2, which is in communication with the base. If, under these circumstances, signals are passing through the main line, the armature of the magnet M is vibrated, and the line is known to be occupied. If the armature is still, the line is not otherwise occupied, and the circuit-breaker may be liberated and set to work. As the bar R^2 rises, the spring s^6 comes into contact with the insulated side n' of the switch G', and consequently no current passes through that switch. When the circuit-breaker has completed its movement, the spring s^6 will be above the switch, with its point over the upper curve, in the same relative position as it occupies in the drawing below its lower curve. The upper curve and one side of the switch G' are covered with a metallic plate, m, in connection with the wire w^1 by means of the wire y'. When the knob k is pressed downward to set the instrument, the bent point of the spring s^6 (see Fig. 7) comes into contact with the metallic plate m before the point p^3 has broken the connection by passing over a blank or insulated space on the bar b^3, and, as a consequence, the bar R^2 is in circuit with the main line through the wire y'; and while the bar R^2 is being depressed to the bottom, that connection is maintained without interruption through the metallic plate m. When the bar R^2 has been depressed far enough to put the point p^3 below the breaks on the combination-bar, the spring s^6 flies off from the end of the plate m, thereby breaking the connection through s^6, which cannot again be restored until the instrument has transmitted its signals and is about to be reset.

When the fire-alarm or burglar-alarm acts, the local circuit is closed at one of the points $z\ z$, whereby the current from the local battery passes through the magnet M, causing the armature of that magnet to withdraw the detent which holds down the rod R^2, and thus to set the circuit-breaker into action, as already described.

We claim—

1. In telegraph apparatus for automatic signaling, the combination of a reciprocating circuit-breaker with a detent to hold and release the movable reciprocating part of the breaker, and a spring or weight to move the same, for the purpose of giving signals, substantially as described.

2. In telegraph-machines for automatic signaling, the combination of two or more reciprocating circuit-breakers with a switch-key, by which any one of the circuit-breakers may be brought into action independently of the others, substantially as described.

3. The stem or key, for the double purpose of setting the circuit-breaking apparatus, and of testing the line-current which operates the automatic telegraphic machine, substantially in the manner described.

4. The electro-magnet, arranged substantially as described, for the double purpose of testing the current which operates the machine, and for unlocking the detent which holds the circuit-breaker whenever the circuit of a local battery is affected by the opening of a window or door or by heat.

5. The switch or conductor, connected to one end of the main circuit, upon which a point connected and moving with the circuit-breaker slides while the circuit-breaker is being restored to its starting-point, and which is insulated from contact with the circuit-breaker while the instrument is making signals, for the purpose of maintaining continuity through the main line while the movable part of the circuit-breaker is being restored to its starting-point, substantially as described.

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H. MILLER.