(No Model.) 3 Sheets—Sheet 1.

S. J. BURRELL & W. H. MARKLAND.

ELECTRIC SIGNALING DEVICE.

No. 445,538. Patented Feb. 3, 1891.

Fig. 1

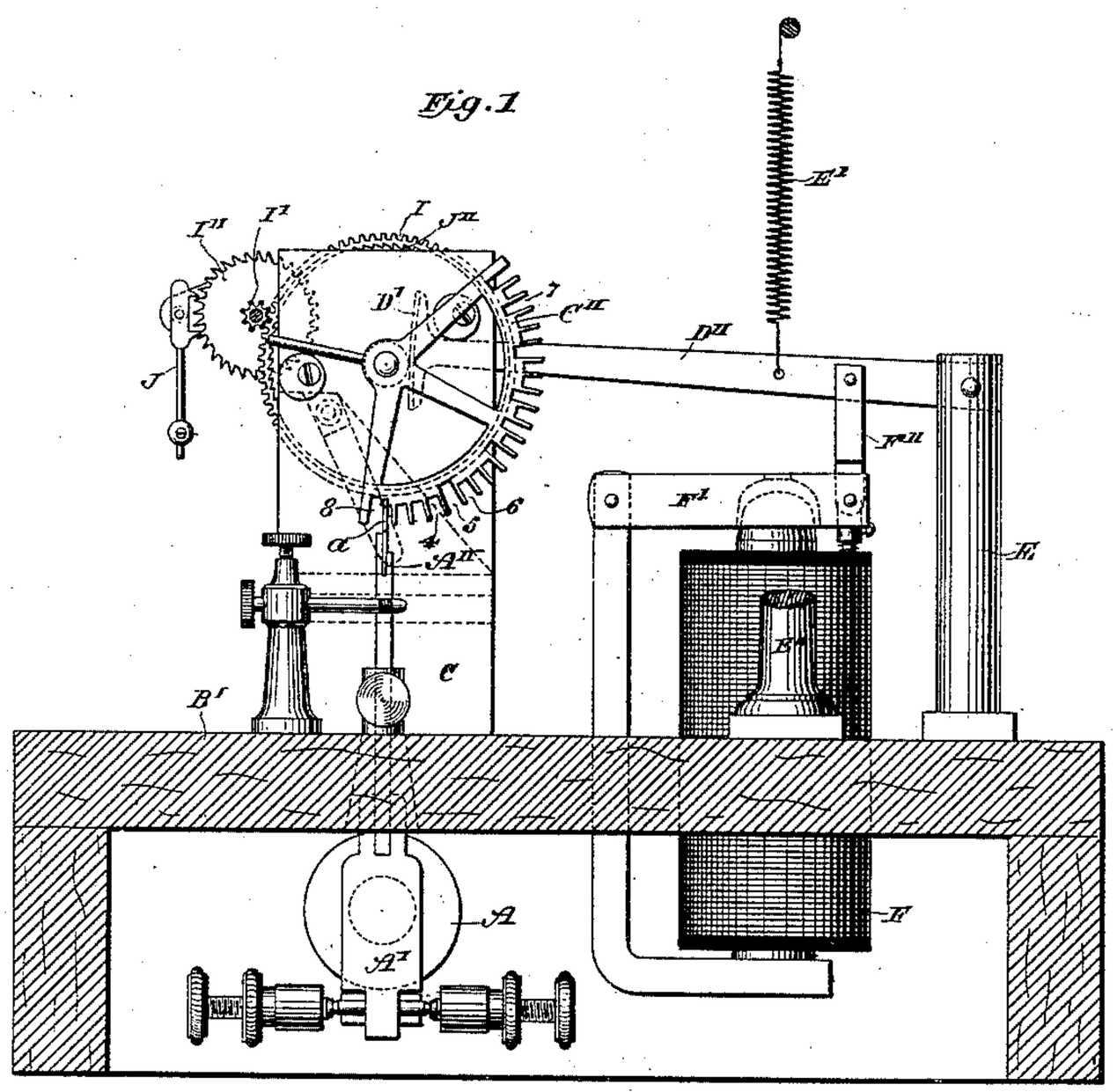
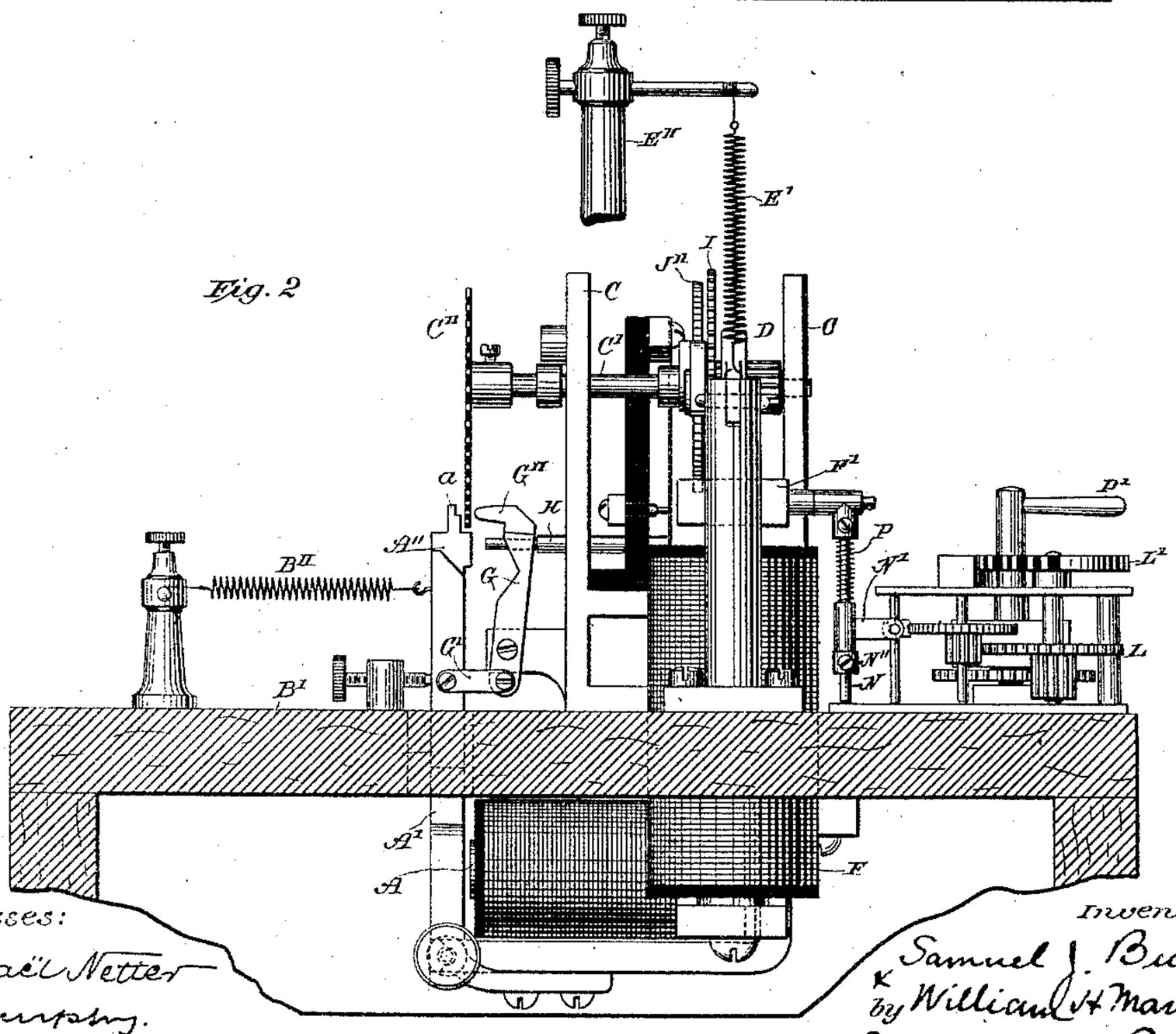


Fig. 2



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No Model.)

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Fig. 3

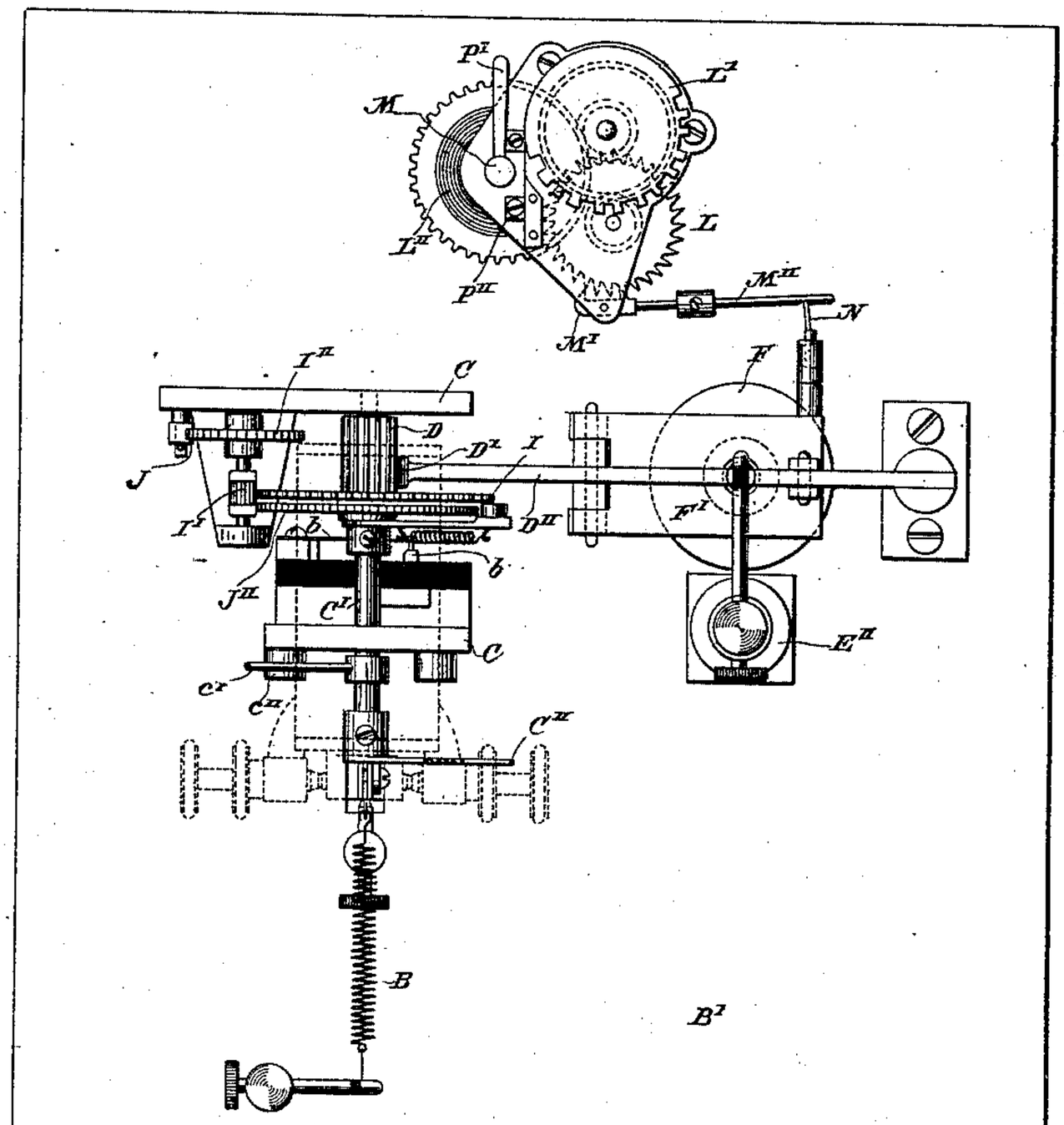

Fig. 4.

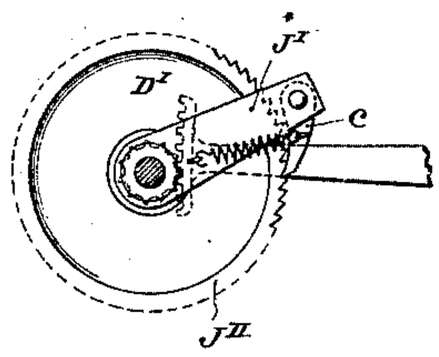

Fig. 5

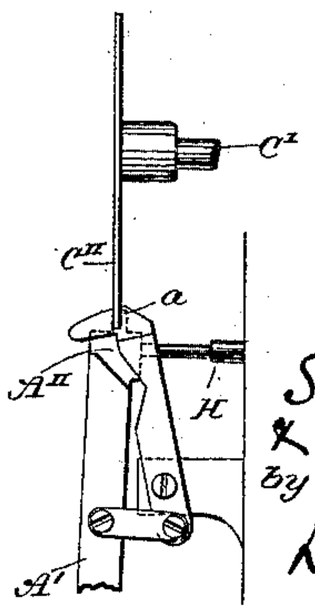

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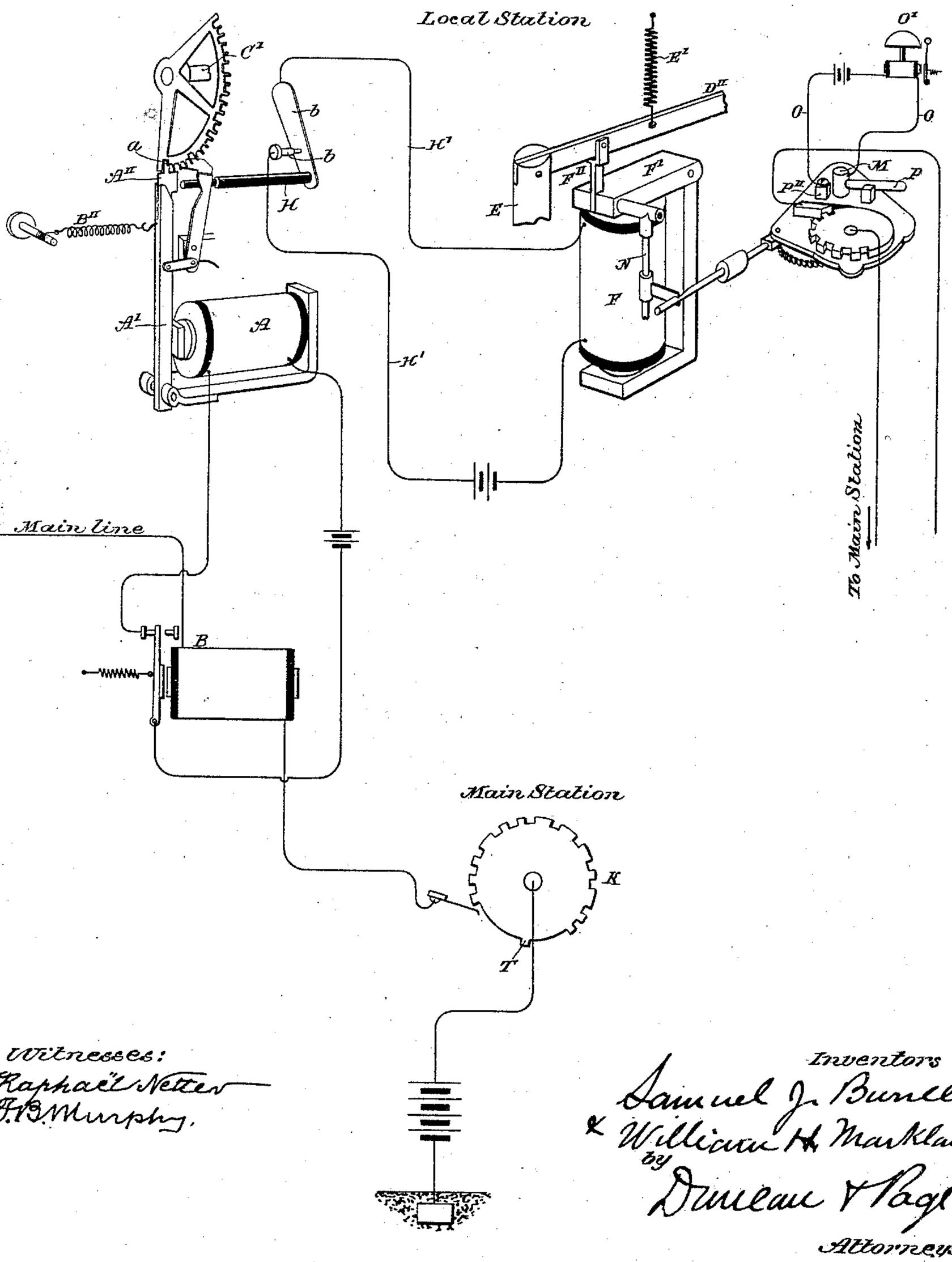
Fig. 6



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UNITED STATES PATENT OFFICE.

SAMUEL J. BURRELL AND WILLIAM H. MARKLAND, OF BROOKLYN, ASSIGNORS TO CHARLES F. BURRELL, OF NEW YORK, N. Y.

ELECTRIC SIGNALING DEVICE.

SPECIFICATION forming part of Letters Patent No. 445,538, dated February 3, 1891.

Application filed June 4, 1890. Serial No. 354,420. (No model.)

To all whom it may concern:

Be it known that we, SAMUEL J. BURRELL and WILLIAM H. MARKLAND, citizens of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Electrical Signaling Devices, of which the following is a specification, reference being had to the drawings accompanying and forming a part of the same.

This invention belongs to that class of electrical devices primarily designed and used for establishing by the manipulation or operation of suitable mechanism at one station electrical communication between such station and any other along the line of a given circuit upon which both are located. Such apparatus is frequently used in telephone systems where a number of subscribers are connected with the same line to call up one subscriber without ringing the bells of the others on that line. It may also be used in signaling systems in connection with railroad business, as for the dispatching of trains or the giving of other orders, and in general to call up any one of a number of stations on a given line without disturbing or operating the instruments at any of the others.

Devices of various kinds for accomplishing this result are known and have been used in various ways; but our object has been to produce a more simple, effective, and economical apparatus, and this we have succeeded in doing.

The following is a general description of the invention or the apparatus in which it is comprised, the features of novelty of which will be more specifically indicated by the claims. At a central or given station on a signaling circuit or line is a main battery and a transmitting-key or a number of automatic transmitters, each adapted to produce a given number of makes and breaks of unequal length. The usual receiving-instruments, relays, bells, and the like though used need no specific description or illustration. At each of a given number of stations along such line is a plate or bar provided with notches of different character to correspond with the contact-surfaces of one of the automatic transmitters at the main station. This plate is capable of being moved past a given point at a predetermined rate, and at such point is a vibrating armature which is moved in response to whichever transmitter may be operating, like the lever of a sounder making dots and dashes.

The essential conditions of operation are that the first impulse of current of a series comprising a call sent over the line will start in motion all the notched plates, and that such impulses follow one another at certain definite intervals of time corresponding to the rate of movement of said plates. The plates are differently notched or formed in an equivalent manner, so that unless the exact signal be transmitted for which a given plate is designed the vibrating armature instead of encountering the plate or some projection thereon will pass through a notch therein and close a local circuit that instantly throws the plate back to its original position. Only that plate, therefore, will complete its movement which corresponds to the signal or call sent, and this complete movement is utilized to sound an alarm, send a return-signal, or to effect any other desired result, as hereinafter explained.

In the drawings hereto annexed, Figure 1 is a side elevation of the local signaling apparatus embodying our invention. Fig. 2 is a similar view from a direction at right angles to the first. Fig. 3 is a plan view of the same. Figs. 4 and 5 are views of details of the mechanism. Fig 6 is a diagram of circuits with the apparatus connected therewith.

Inasmuch as the construction of the apparatus at the stations differs only in respect to the particular form of the parts designed to send and receive signals, according to the special signal to be sent or received, we have shown and shall describe but one of the same in illustration of our invention.

The specific arrangement and manner of associating the operative parts of the apparatus are largely immaterial, and that shown is selected mainly for convenience of illustration.

A is an electro-magnet in the main circuit, over which signals are to be sent, or prefer-

ably, as shown in Fig. 6, in a local circuit controlled by a relay B in the main circuit and normally closed. One leg or pole of this magnet is or may be without a coil, and to it is hinged an armature A′, provided with a non-magnetic extension A″, extending up through a slot in the base B′. The armature is retracted from the wound pole by means of an adjustable spring B″.

In suitable supports C on the base B′ is mounted a horizontal shaft C′, upon which is fixed, so as to turn in the path of the armature-extension A″, a segmental disk or curved plate or bar C″. A pinion D fixed to this shaft is in gear with a curved rack or segmental gear D′, carried at the end of a rigid lever D″, pivoted at its opposite end to a standard E on the base B′. Said lever is acted upon by a spring—as, for example, a coiled adjustable spring E′ connected therewith and to a fixed arm or standard E″, which tends to lift or raise said lever, and through the instrumentality of the rack and pinion to turn the shaft C′ and the plate C″ in the direction which restores it to normal position after a partial or complete movement thereof accompanying the action of the signaling mechanism.

F is a second electro-magnet, the coil of which is in a local circuit. This magnet is preferably constructed like the other, and an armature-lever F′ is pivoted to the extremity of the unwound pole or leg and extends over the end of that containing the coil. It is desirable that this armature should have a comparatively wide range of movement without very marked variation of power, for which purpose many forms may be adopted. In the present instance the pole of the stationary core is conoidal and extends up into a recess or perforation in the armature-bar. By means of a link or other flexible connection F″ this armature is connected with the lever or bar D″, so that if the circuit of magnet F be closed it will operate to draw down the lever D″ and to turn the shaft C′ and the plate C″, carried thereby, through an angle determined by the extent of movement or play of the armature F′.

Loose on the shaft C′ is a gear-wheel I engaging with a pinion I′ on a short shaft carrying an escapement-wheel I″, with which engages an ordinary pendulum-escapement J. Connection between the wheel I and the shaft C′ is maintained by an arm J′, secured to the shaft C′ and carrying a hinged pawl *c*, that engages either with the wheel I or with a second wheel J″ secured to the former. Thus while the movement of the armature F′ toward the magnet F is imparted to the plate C″, and such movement is retarded while the magnet F is energized, the instant said magnet is demagnetized the armature rises freely under the action of the spring and the plate C″ is carried rapidly back to its normal position. The movements of the plate, however, under the impelling power of the magnet F on the one hand and the spring E′ on the other, are controlled by the action of the armature-extension A″ and the devices associated therewith.

G is a lever pivoted to a stationary support back of the plate C″, and is connected to the armature-extension A″ by means of a link G′. The upper and longer arm of this lever carries a thin blade G″, that is designed to be thrown forward by the movement of the lever through the notches or cut-away portions of the plate C″. The edge of the plate C″ is serrated, as shown, or provided with projections and notches of any kind that answer the same purpose. Some of the notches are deeper than others, so that should the armature A′ be drawn forward at a time when a deep notch is presented to it a pin *a* on said armature-extension will pass through said notch, permitting the extension A″ to strike an insulating sliding pin H, that separates two contact-points *b b* in the local circuit H′ of magnet F and demagnetizes said magnet. On the contrary, if an impulse of current attracts the armature A′ at the moment of presentation of a shallow notch the pin *a* strikes the edge of the plate without passing through the notch, while a part of the extension A″ enters the notch and arrests the movement of the plate until the next impulse is sent.

The signals may be sent by hand by means of an ordinary Morse key; but we prefer, in order to secure greater mechanical accuracy, to employ some form of automatic transmitter, such as an ordinary district-telegraph instrument, and to have at the main station one of such instruments for each sub-station or subscriber. The transmitting-disks of these instruments are differently notched or spaced to send a certain number of long and short impulses in different order of succession, and the swinging plates at the several way-stations are conformed accordingly.

One of the automatic transmitters is represented at K in Fig. 6; but as it is an instrument familiar to those skilled in the art it needs no specific description.

Let it be assumed that the station at which is located the apparatus shown in Fig. 1 is to be called and that the appropriate call consists of three dots, dash, two dots, three dashes, dot, dash, two dots, a dot being a short and a dash a long impulse of current. The automatic transmitter or call-box in which the signal-disk has been cut to send the above call is started in operation.

The local instrument is in the condition shown in Fig. 1, with the circuit of magnet A closed. The first short impulse through the relay B interrupts the circuit of magnet A and the armature A′ is retracted. The extension A″ is thereby withdrawn in one direction from engagement with the plate C″, and the blade G″, by the movement of the lever G, is withdrawn in the other direction. The purpose of the blade G″ is to arrest the movement of the plate C″ and not permit it to start until the armature A′ is fully retracted,

and also to enter the next notch upon the first movement of the armature forward to insure the proper action. By this withdrawal of the engaging parts the plate C″ is permitted to move; but the breaking of the main current at the end of the dot causes the armature to come forward into engagement with the next notch in the plate before the movement of the plate has proceeded too far. In the same way the next two short impulses of current over the line bring the extension A″ in engagement with the notch 4. The next impulse of current sent by the automatic transmitter is a long one. Hence the notch 5, which is a deep one, is carried back of the extension A″, and when the impulse terminates the said extension engages with the shallow notch 6. In this way the segmental plate or disk is permitted to complete its movement, the notches therein being so disposed that the extension A″ is arrested each time it is drawn forward, except in response to the last impulse, at which time a deep notch, as 7, is presented. Through this notch the pin *a* passes, and the extension A″, pressing upon the sliding pin H, breaks the circuit of magnet F, whereupon the plate C″ is immediately thrown back to its starting position. The armature F″ and plate C″, however, have completed their normal movements, and this is taken advantage of in the following way: L is an automatic transmitter, the disk L′ of which when turned repeats to the main office the signal or call of the way-station at which it is located. It is turned by the unwinding of a spring L″, secured to a spindle M, provided with a handle, and its movement is retarded and controlled by an escapement M′, having an extended arm M″.

A bar N is secured to the armature F′, and is moved vertically thereby. On this bar is a sliding lug N′, held down against a stop N″ by a spiral spring P. This spring also imparts to the lug a tendency to swing around away from the arm M″; but a notch is cut in this arm and when the instrument is set for use the lug N′ is turned and caused to engage with this notch. This is the normal condition of these parts; but as soon as the armature has completed its full range of movement the lug N′, being pushed down below the arm M″, disengages the latter and permits the local transmitter L to operate and repeat to the main station the call which has just brought it into operation. Thus the operator at the main station will know that he has called up the proper way-station.

Attached to the spindle M is a contact-arm P′, and when the transmitter has completed its signal this arm comes into contact with a stop P″, and thereby completes a local circuit O and rings a bell O′ until the operator again winds up the instrument and resets the lug N′ in engagement with the notched bar M″.

Having now described the operation of the instrument when its own or proper signal is sent, it remains to show what takes place when the signal of any other station is sent over the line. For this purpose it is only necessary to select any given call beginning with four dots. It is clear that the first three dots will permit the plate C″ to move forward three steps; but the fourth dot will cause the pin *a* to pass through the deep notch 5 to break the circuit of magnet F and return the plate C″ to its normal position. Thus unless the right signal is passing over the line the plate C′ will be thrown back two or more times and does not complete its movement.

It will be noted that the return of the plate C″ occurs during the time that the magnet A is energized and when the pin *a* has passed entirely through one of the notches in the plate. The further operation of the instrument requires the pin *a* to be shifted back to the other side of the plate. For this purpose the shaft C′ carries an arm *c*′, that encounters a stop *c*″ on the return of the plate and limits its movement. In this position a deep notch 8 in the plate lies directly back of the pin *a*, and a short impulse is then sent over the line, which, permitting the armature A′ to fall back, brings the pin *a* over to the proper side of the plate. The circuit of magnet F being thus established, the plate C″ is moved, but the termination of the impulse in the main line draws over the extension A″ and causes it to engage with the first tooth or projection ahead of the next notch in the plate. The impulse for this may be sent by a hand-key or by a single tooth, as T, on the disk of the automatic transmitter. The liability of the instruments to improper operation is very greatly reduced by the fact that the plates C″ take a fresh start after each impulse, or, in other words, are synchronized by each impulse, which causes the armature-extension A″ to engage with the projections or teeth between the notches.

A feature to be observed in connection with these instruments is the following: The combinations of long and short impulses and the corresponding conformation of the plates C″ must be such that the final impulse of any signal will cause all the plates to be thrown back, so that the supplemental impulse will bring them all into their normal starting position. In other words, if any one signal or call is made up of thirteen long and short impulses, so that on the completion of the thirteenth impulse the plate corresponding to that signal will be thrown back, all the other plates must be so arranged that this thirteenth impulse will also throw them back. Whether they have been returned once, twice, or more times it matters not. A great many combinations are possible under this requirement.

What we claim is—

1. In a signaling apparatus, the combination of an electro-magnet and armature vibrated by current impulses over a main line, a serrated or notched plate, an electro-mag-

net in a normally-closed local circuit for moving said plate against a retractile force across the path of the vibrating armature, and a retarding device in connection with the said plate for restraining and slowing the movement thereof, a portion of the notches in said plate being of greater depth than the others, whereby the armature will engage with and arrest the plate when entering a shallow notch, but will pass through the plate when encountering a deeper one, as set forth.

2. In a signaling apparatus, the combination of an electro-magnet and armature vibrated by current impulses over a main line, a serrated or notched plate and a retarding device connected therewith, an electro-magnet in a normally-closed local circuit for moving said plate against a retractile force across the path of the vibrating armature, or an extension thereof, and a circuit-breaker in said local circuit, the serrations or notches in the plate being of unequal depth, whereby the vibrating armature will engage with and arrest the plate when entering a shallow notch, but will pass through said plate and engage the local circuit-breaker when encountering a deep notch.

3. In a signaling apparatus, the combination of an electro-magnet and armature vibrated by current impulses over a main line, a serrated or notched plate and a retarding device connected therewith, an electro-magnet in a normally-closed local circuit, an armature therefor connected with and adapted to move the notched plate against a retractile force across the path of the vibrating armature, a circuit-closing or signaling device adapted to be set in operation by the armature when it has reached a given point in its approach to its magnet, and a circuit-breaker in the circuit of said magnet, these parts being arranged as herein described, and the movable plate being provided with notches of unequal depth, whereby the vibrating armature will engage with and arrest the plate by its engagement with the shallow notches, but will pass through said plate when it encounters a deeper notch and operate the local circuit-breaker, as herein set forth.

4. In a signaling system, the combination, with a local signaling-instrument adapted to be operated or started by the movement of an armature to a predetermined point, an electro-magnet in normally-closed local circuit, an armature constituting the means for starting the local signaling mechanism, and an automatically-retracted plate connected with and moved by the armature and serrated or formed with notches of unequal depth disposed in a definite order, of means for starting or operating the local signaling mechanism, consisting, essentially, of an automatic transmitter at the main station adapted to transmit a succession of long and short impulses corresponding to the order of notches in the plate at the local station, a magnet at the local station, and an armature normally locking said plate and adapted when vibrated by the impulses produced by the appropriate transmitter to engage with the short notches only in the plate, as set forth.

5. In a signaling apparatus, the combination, with the shaft C′, carrying the curved and serrated or notched plate or bar, of an escapement and intermediate pawl-and-ratchet connection between the escapement-wheel and shaft C′, whereby the movement of the latter in one direction only is retarded, a rack engaging with a pinion on the shaft, an electro-magnet in a normally-closed local circuit for moving said rack in one direction, and a spring for retracting it.

6. The combination, with the armature-lever and extension thereon vibrated by current impulses over the main line, and a lever pivoted to a fixed support, carrying a blade at one end and connected by a link to the armature-lever at the other, of the curved arc-shaped plate provided with shallow notches with which the armature-lever and the blade engage, and deep notches through which the lever may pass without engaging the plate, the said plate being capable of movement across the path of the armature-lever when disengaged therefrom, as set forth.

7. In combination with a main line or circuit of a main office or station and two or more local or way stations, automatic transmitters at the main office, one for each local station, and each adapted to transmit a definite number of long and short impulses in a certain order, an electro-magnet and armature at each local station included in a normally-closed circuit, a signaling or transmitting instrument adapted to be started in operation by a movement of the armature of predetermined extent, a swinging plate with notches of unequal depth connected with the said armature, a magnet and an armature vibrated by impulses of current in the main line and engaging with the swinging plate, and means, substantially as described, for interrupting the movement of a plate and returning it to its starting position when the signals or impulses transmitted fail to correspond with the combination represented by the order of shallow and deep notches in said plate.

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