(Model.) 2 Sheets—Sheet 1.

J. B. CURRIER.

ELECTRIC SIGNALING APPARATUS.

No. 246,374. Patented Aug. 30, 1881.

FIG. 1.

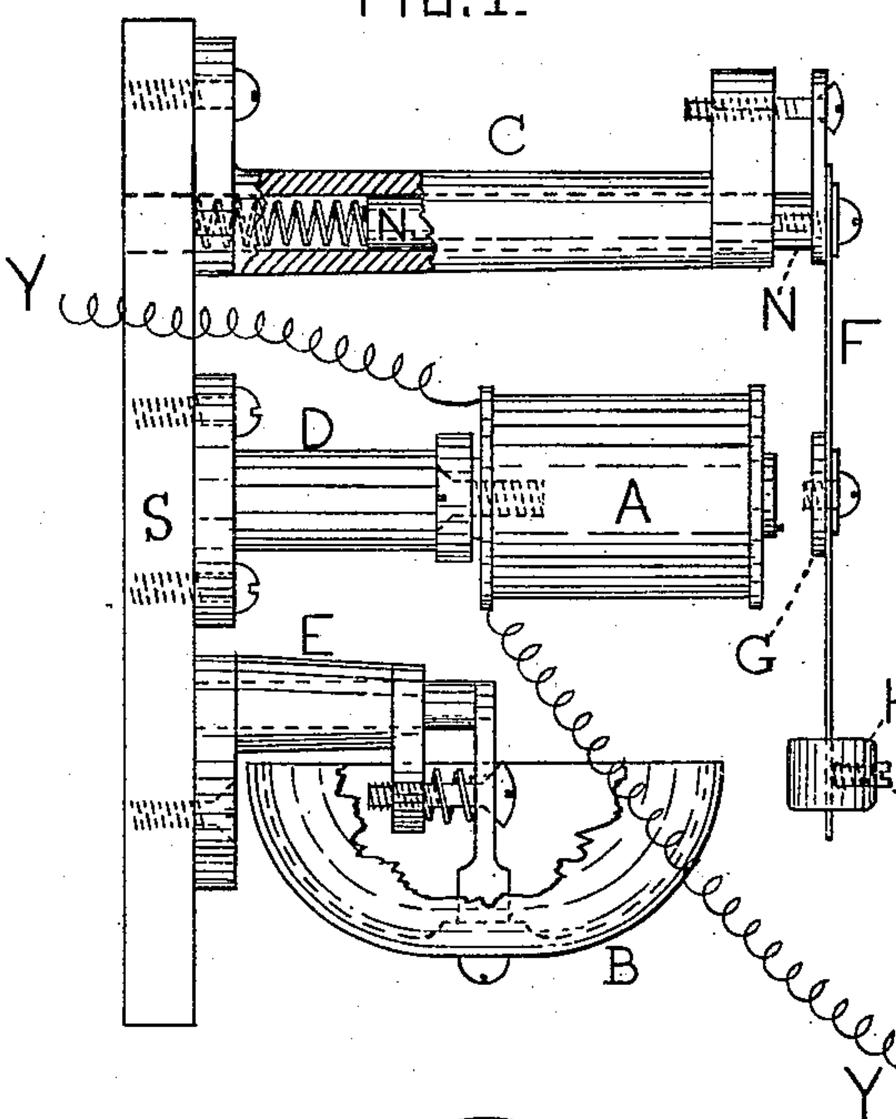


FIG. 2.

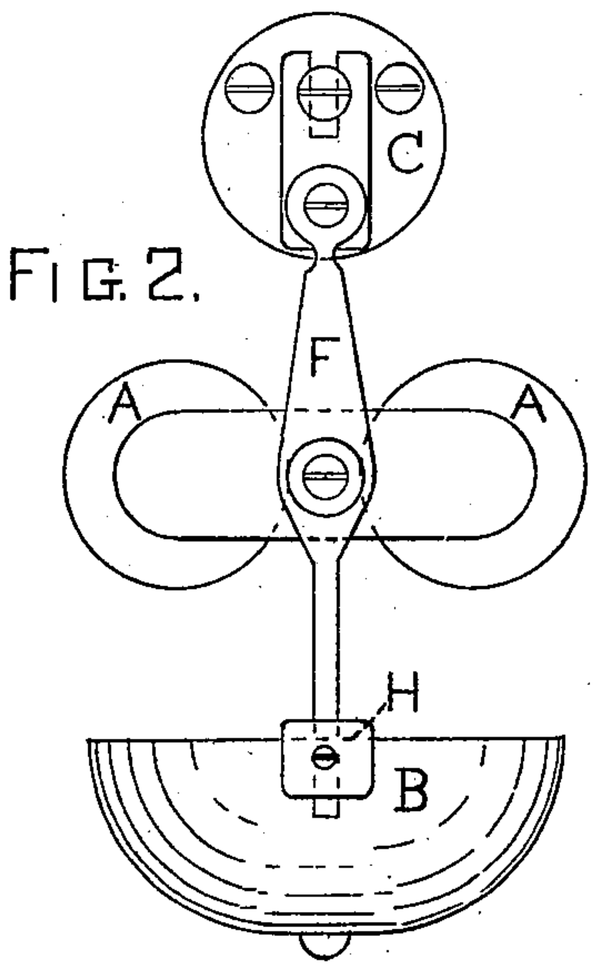
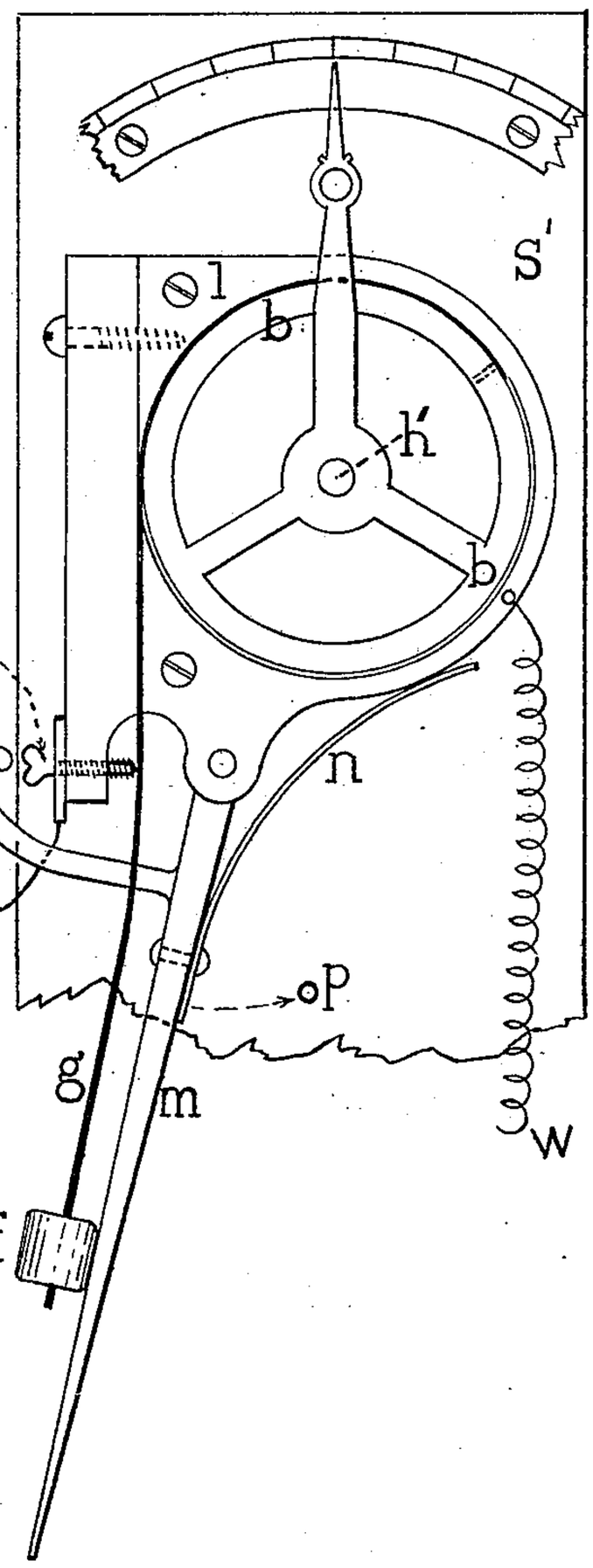


FIG. 3.



WITNESSES.

A. P. Ockington.

George A. Wilber.

INVENTOR.

J. B. Currier.

by Lepine & Rice

Attorney

(Model.) 2 Sheets—Sheet 2.

J. B. CURRIER.

ELECTRIC SIGNALING APPARATUS.

No. 246,374. Patented Aug. 30, 1881.

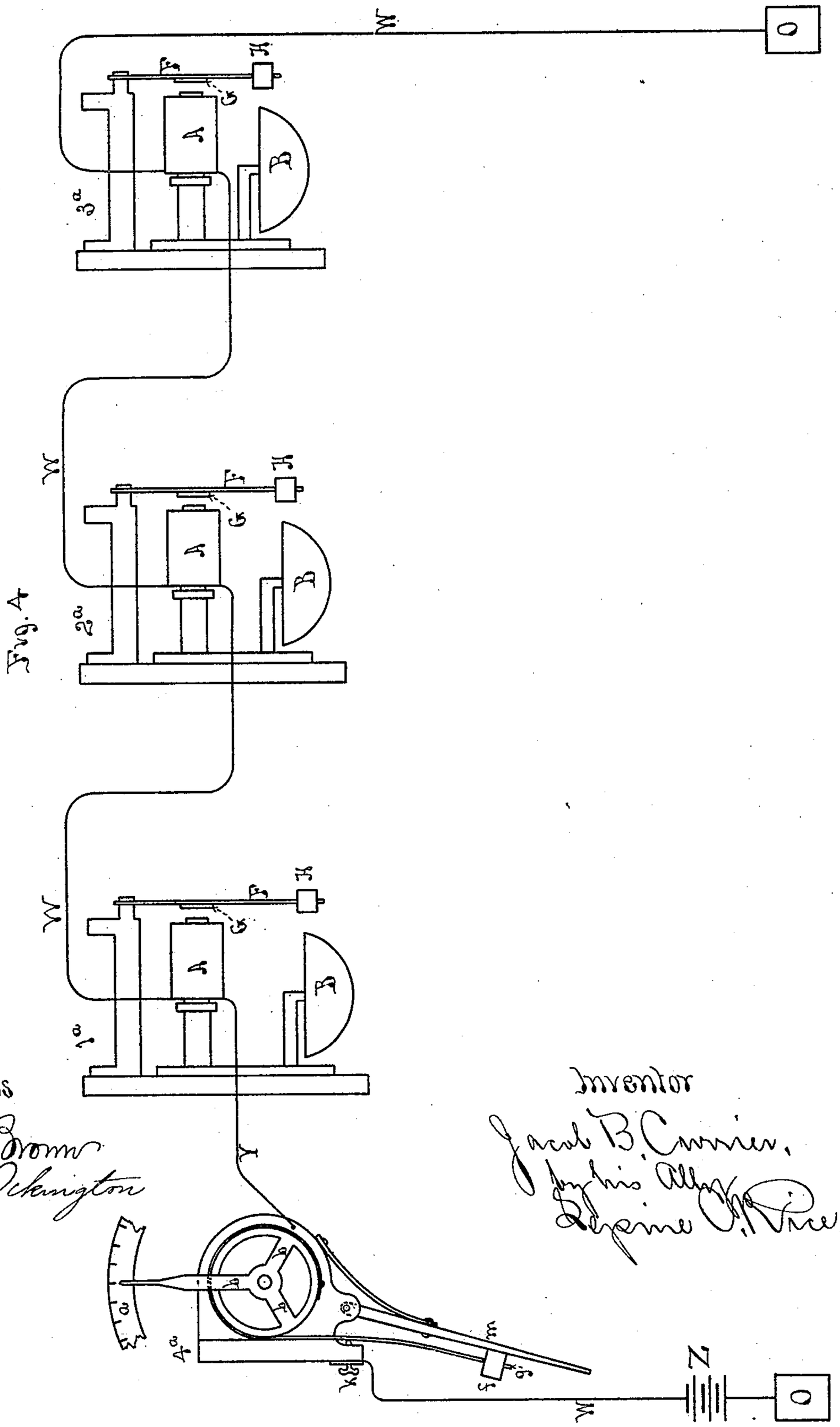


Fig. 4.

Witnesses
Wm. S. Brown
N. P. Ockington

Inventor
Jacob B. Currier,
by his Attys
Lepine & Rice.

UNITED STATES PATENT OFFICE.

JACOB B. CURRIER, OF LOWELL, MASSACHUSETTS.

ELECTRIC SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 246,374, dated August 30, 1881.

Application filed October 8, 1880. (Model.)

To all whom it may concern:

Be it known that I, JACOB B. CURRIER, of the city of Lowell, county of Middlesex, and State of Massachusetts, have invented a new and useful Device for Transmitting and Receiving Electric Calls, of which the following is a specification.

My invention relates to improvements in calls and alarms placed upon electric circuits to call and sound an alarm at any one of a number of stations on such circuit without calling and alarming any other.

The objects of my invention are to provide a mechanism which shall give a satisfactory alarm at any desired station on an electric circuit without sounding an alarm at any other station, to provide such a mechanism as shall permit of the greatest number of alarms being upon one circuit without danger of sounding any of the alarms except the one desired, and one by which such increased number will not increase the difficulty and labor of the operator in managing the circuit, and to provide an automatic stop mechanism which shall hold and operate the caller mechanism with precision. I accomplish these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is an elevation of the alarm device. Fig. 2 is a plan of the same. Fig. 3 is a front elevation of the caller. Fig. 4 is an ordinary electric circuit with its ground-connection and battery, having different stations thereon at which are placed a series of alarm mechanisms and a central or calling station, at which is placed a calling device constructed according to my invention.

In Fig. 4, W Y W is the electrical circuit. O O are its ground-connections. L is the battery. 1^a, 2^a, and 3^a are the stations at which the different alarm mechanisms are placed, and 4^a is the central or calling station, at which the calling device is placed. These stations may be at any convenient distance apart upon the circuit. The details of the alarm and calling devices are shown in the other figures.

It has long been known that when elastic steel tongues are fixed in proper position with relation to electro-magnets in a circuit they may be set in vibration, if magnetized, by currents of electricity to which an undulatory or intermittent motion over the circuit was given, provided such undulations corresponded in number in a given time with the normal rate of vibration of such tongue or tongues to be affected. It has further been demonstrated by Helmholtz and others that when two or more steel tongues, differing in their normal rate of vibration in a given time with their magnets, are introduced in the same electric circuit, the intermittent or undulatory electric current which will set one of such magnetized tongues in vibration will leave the other practically unaffected, and vice versa, provided the difference in their normal rate of vibration is considerable, because the steel tongues are of considerable rigidity, and sufficient to resist undulations in the electric current not in or approximating closely to their normal vibration, respectively.

This invention consists in employing a modification of such vibrating tongues by making them somewhat more slender than those employed as mentioned, and providing them with a ball or hammer at the end and placing a bell in proper position to be struck thereby; and it further consists in placing such tongues in relation to their magnets which vibrate them, and to the strength of the electric current which develops the attractive power of the magnets, so that no single electric impulse will draw the tongue up to the magnet, and thereby cause currents not in the normal time of vibration of a tongue to make it strike the bell; and it further consists in attaching to the steel tongue opposite to the magnet a soft-iron armature, where intermittent currents of the same polarity are to be used to vibrate it; and it further consists in placing one of these alarm mechanisms at each of separate or different stations on the electric circuit which are to be called, the alarm mechanism of each station being so constructed as to require a different time of undulation or vibration of the electric current to operate it from that of other stations on the line; and it further consists of an improved adjusting mechanism for setting the vibrating tongue in proper position, as above described, with relation to its magnet and bell.

Another branch of this invention consists of improvements in the mechanism for making

and breaking the electric circuit to adapt it to put in operation in the most efficient manner the above-described alarm mechanism.

Practically the above alarm mechanism invented by me differs from a steel tongue without a hammer attachment in its capacity of striking a louder and better alarm at the station desired, and it differs from a bell-hammer which is operated by a magnet and swings freely upon an axis or pivot to and from the bell in preserving its normal rate of vibration while continuing to strike the bell at each oscillation. It has been found that this is not the case with a bell-hammer swinging freely, because one or two strokes upon the bell by the latter tend to throw it out of its normal rate of vibration, and so cause its strokes upon the bell to grow weaker or cease entirely from the interruption of its synchronous action with the electric current. As I have stated, this is not the case with my spring-striker above mentioned, which I attribute to the resilient power of the spring, which immediately overcomes the tendency of the blow upon the bell to interrupt its synchronous action. Another advantage of the spring-striker is the extreme rapidity with which it can be set in action and the rapidity with which it delivers its blows upon the bell. This not only produces a better alarm, but enables the placing of a greater number of such alarm mechanisms, operating in different time upon the same circuit.

S′ is the base-board, upon which is attached the cylinder *b*, which has a dial-pointer and dial, upon which are placed figures indicating the different stations upon the circuit. Attached to the cylinder by one of its ends is a spring strip of metal, *g*, considerably longer than the circumference of the cylinder, and upon the pendent end of the strip is placed a bob or weight, *f*, of such weight that the resiliency of the metal strip, acting as a vibrating tongue, will be able to quickly overcome any momentum which can be given it, so that when it is started swinging back and forth like a pendulum, instead of swinging with the slowness of a true pendulum, or nearly so, it will, by its spring-like action, make many more vibrations in a given period of time. The addition of the bob *f* to the spring *g* enables me to alter the time of vibration of the spring by merely shortening or lengthening the same, without necessarily varying its resiliency, as might be required if the bob were not attached.

W is a wire connecting the battery with the insulated plate *l*, into which the stud *h*, upon which the cylinder *b* is rotated, is inserted.

Y is the line passing from the insulated screw *k* out to the different stations and alarm mechanisms upon the circuit.

m is an arm swinging in the path of the weight *f*, and having attached to it a spring, *n*, sufficiently strong to overcome the gravity of the weight *f* and resilience of the suspending-spring *g*. The spring *g* will, therefore, be constantly held in a state of tension against the screw *k* by the arm *m*, and the electric current will be free to pass through the plate *l*, stud *h*, cylinder *b*, spring-strip *g*, and screw *k* to the line Y. When, however, the arm *m* is swung out of the way of the weight *f* by bearing quickly upon the thumb-piece *x*, swinging the arm over to the pin *p*, the gravity of the weight *f* and resilience of the spring-strip *g* will cause the weight to follow after the arm. The bob or weight being small in proportion to the power of the spring, it will, as it swings beyond the perpendicular, have its momentum quickly overcome by the strength of the spring and begin its backward movement, and will thus commence a series of rapid vibrations, which, with a proper proportioning of the spring-strip and weight, may be made to reach several hundred per minute, and as the circuit is broken each time the spring-strip leaves the screw *k*, each time the weight vibrates the circuit will be made and broken. I thus can greatly increase the number of electric impulses upon a circuit in a given time, and consequently a larger number of alarm devices can be placed upon a circuit and still have the difference between any two of the mechanisms marked by the same or a greater number of separate movements per second than before. This results from the fact that a certain difference in the number of their vibrations in a given time must exist between the strikers of different stations, in order that the caller, when sending a number of electric or magnetic impulses over the line in a given time, corresponding with the vibrations of one striker, shall not operate the other strikers on the line which are nearer in times of vibration to the one actuated. This difference in the number of vibrations of the several strikers is as effectual to accomplish this whether the vibrations themselves are comparatively slow or fast within certain limits.

When it is desired to increase or diminish the number of times the circuit is made and broken in a given period, the vibrating spring-pendulum is either shortened or lengthened, as the case may be, by rotating the cylinder, which winds or unwinds the spring upon itself.

In Fig. 1, S is the base-board, which is attached to the wall or to some convenient object.

C, D, and E are supports for the vibrating striker, electro-magnet, and bell, respectively. These are made adjustable, as shown, or in any other convenient manner. Extending down from the adjustable rod N, held by the support C, is the vibrating spring-tongue F, which has attached to it opposite the poles of the electro-magnet A an armature, G, and opposite the bell B the bob or hammer H, held in place upon the tongue by the set-screw *h*. The vibrating tongue F is of such a stiffness and is placed at such a distance from the electro-magnet that its attached armature will be far enough from the magnet so that no single impulse of any current which is ever allowed to pass over the line will bring them together, or cause the ham-

mer to strike the bell, either when continued for a long or a short period of time; but it is at such a distance that the armature will be drawn while the circuit is complete a considerable distance toward the magnet, moving the spring vibrating tongue from its point of rest until the resistance of the spring and the force of the magnet are in equipoise. This adjustment is made either by changing the distance between the point of attachment of the vibrating tongue and the base-board or by placing the mechanism in such position that the action of gravitation will bring the armature nearer to the magnet when at rest. This construction and relation of the armature and the vibrating striker F H is important to the operation of the invention, because it enables the oscillations of strikers which are not vibrating in unison with the magnetic or electric impulses to attain a return movement when first attracted, which operates against the electric impulses instead of in unison with them, and thus to prevent their alarm being sounded at the same time it enables the oscillating striker which is vibrating in unison with the electric or magnetic impulses over the line to re-enforce the attractions created in the magnet by such impulses, and thus actuate its alarm with certainty and effect.

The spring-striker F is secured to the sliding bolt N by the screw L. The bolt N slides in a hole through the brace C, which forms a sleeve, and the lower end of the bolt N bears upon a spiral spring, which tends to press it out of the sleeve. The spring-striker F, with its sliding bolt N, is adjusted and secured in position by a screw, K, passing through a lug or projection of the sleeve C, as shown. The hammer H is made to slip upon the spring F, and is secured in position with reference to the bell B by means of the set-screw *h*. The bell B is attached to a plunger, T, which slides in a bore in the stud E. The set-screw V, passing through a lug upon the stud E, serves to adjust the bell to and from the spring-hammer with relation to the latter and the magnet A. These several parts enable me to set or adjust the hammer, the bell, and the magnet in the proper relations to accomplish the best result, which I consider quite important.

Having arranged a number of alarm devices at different stations upon a circuit, all adjusted so that no two have vibrating tongues of the same stiffness, length, and weight of hammer, or an aggregate of these elements which shall be the same, the operation of the device may be thus described. By a sudden release from being held by the stop at the extreme of its arc of movement, the pendulum-weight and spring-tongue of the caller makes and breaks the circuit, moving, on account of the accelerating action of its spring suspending-strip, with great celerity for a limited length of time, the bob being set at such a length that it will vibrate in the period of the vibration of some one of the alarm movements upon the circuit. The circuit being made and broken and a number of alarms being upon it, they will, after being attracted, (each with its first breaking,) fall back, with their vibrating tongues and hammers, toward their normal position of rest, being acted upon by the resilience of their spring vibrating tongues. By the momentum gained, as the hammers or bobs move toward such normal position, they will be carried beyond and then will return. Now, if the circuit be again made and broken at the time one of the vibrating tongues begins to swing back toward the magnet, that one will, by the acceleration which it receives by the attraction of the magnet upon its armature, swing nearer to the magnet than at first, because of the momentum its hammer has gained, when, if the circuit be continued to be broken and made at proper intervals of time corresponding to the vibration of the bob or hammer, its motion will continue to be increased until the armature finally comes in contact, or nearly so, (dependent on adjustment,) with the poles of the electro-magnet at each vibration, when the bob or hammer will repeatedly strike the bell with considerable force, because the power of the electro-magnet upon the armature is much greater when the armature comes close to it. If, however, the circuit be not made and broken in the proper and regular intervals corresponding to the vibration of the spring-tongue carrying the hammer or bob, its motion will be adverse to the attraction of the magnet and it will not strike its bell, because the attraction of the magnet will so frequently be exerted while the armature and hammer are swinging away from, and in opposition to, the magnet, and the vibratory movement will be constantly checked instead of accelerated.

Now, as the different alarms placed upon the circuit have their spring-tongues of such a length and stiffness and are provided with hammers so adjusted that no two of them will make a complete vibration in the same period of time, it is evident that but one alarm will be struck by any regular making and breaking of the circuit, and that by making and breaking the circuit a number of times in the period of vibration of any one of the alarm spring-tongues such alarm will be struck. To insure the striking of but one alarm it is desirable that a number of impulses be requisite before the hammer will reach the bell, and the adjustment of the vibrating tongue, magnet, armature, and bell is made so that such will be the case.

It will be seen that the striking of the bob upon the alarm-bell is not a necessary part of the invention, as the vibration of the tongue may be made to sound an alarm in a great variety of ways by intermediate mechanism—such as clock-work, auxiliary batteries and circuits, &c.

The spring alarm device herein described can be used with the spring-hammer in any convenient position—as, for instance, project-

ing horizontally or at any angle to the perpendicular, and this will be found very convenient in many cases.

It is also obvious that instead of using a closed circuit an open one may be employed, and it is also obvious that the device may be made to operate on a circuit with a very strong electric or magnetic force, even if the circuit be not entirely broken. If it be very largely increased and diminished, it can be made to operate substantially as would a weaker current, made and broken, if the alarm mechanism be adjusted for the purpose.

What I claim as new and of my invention is—

1. The combination, in an electric circuit, of a vibrating spring-tongue actuating an alarm device with a circuit-breaker which makes and breaks the circuit in the time required to vibrate the tongue and actuate the alarm, substantially as described.

2. The combination, with their electro-magnets in an electric circuit, of two or more vibrating spring-strikers placed at different stations in the circuit, each of whose periods of vibration differs from that of the others, and operates an alarm by a suitable intermittent or vibrating electric current passing over the circuit synchronously with the striker, operated substantially as described.

3. The combination, on an electric circuit, of a number of vibrating alarm spring-tongues placed at different stations therein, and adapted to vibrate in different periods of time, with a vibrating circuit-breaker capable of being adjusted and operated to make and break the circuit with sufficient rapidity and in the time of vibration of any desired one of the alarm spring-tongues, substantially as described.

4. The electric-alarm device consisting of the magnet A, spring F, hammer H, and bell B, constructed, combined, and adjusted with relation to the electric current substantially as described—that is to say, so that the hammer vibrates in a given time and is not brought up to strike the bell by any single impulse of the electric current and consequent attraction of the magnet, all for the purpose substantially as set forth.

5. The combination, on an electric circuit provided with suitable mechanism for transmitting electrical impulses thereover, of two alarm mechanisms placed at different stations, each composed of the magnet A, spring F, hammer H, and bell B, said springs and hammers being constructed to vibrate in substantially different times, and all being constructed and combined substantially as described.

6. In combination with the vibrating spring-caller, the pivoted stop *m* and its spring *n*, substantially as described.

7. In combination, the bell B, electro-magnet A, armature G, and spring-bob striker F H, the said bell and striker being adjusted relatively to the maguet as set forth, whereby the bell will not be sounded until the intermittent attraction of the magnet is re-enforced by several synchronous vibrations of the striker, substantially as described.

8. In combination with the spring-bob striker F H, adapted to vibrate synchronously with an intermittent electric current and its magnet A and bell B, the adjusting-screw K and sliding bolt N, substantially as described.

9. In combination with bell B, magnet A, and synchronously-operating spring-hammer H, the set-screw V, adapted to adjust the bell, substantially as described.

10. In combination with the electric circuit, the spring circuit-breaker, with its attached weight *f*, and the synchronously-operating spring-striker F H, with its magnet A, substantially as described.

JACOB B. CURRIER.

Witnesses:
LE ROY J. CHERRINGTON,
FRED. A. LOVEJOY.