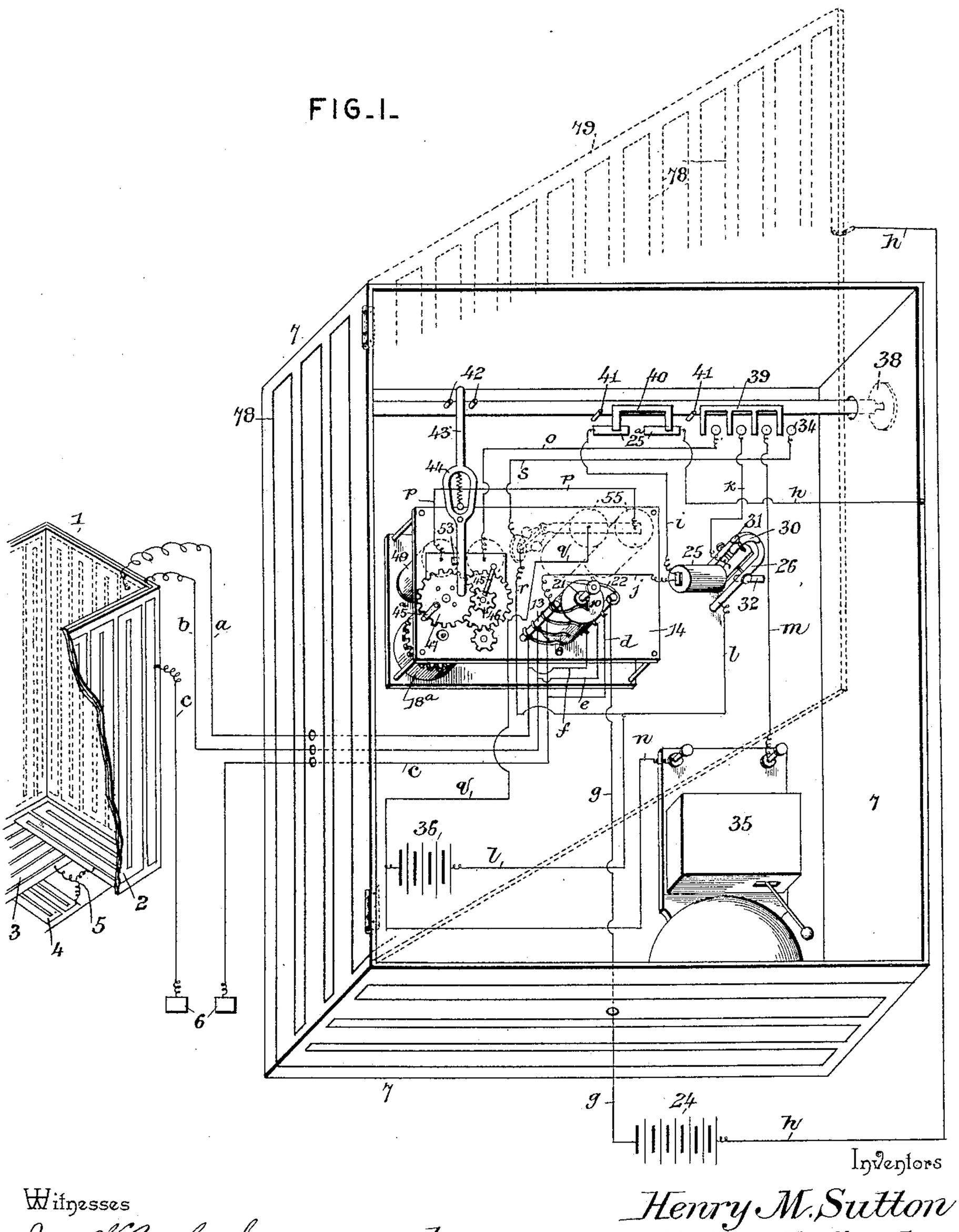
(No Model.) 4 Sheets—Sheet 1.

H. M. SUTTON & W. L. STEELE.

BURGLAR ALARM.

No. 584,798. Patented June 22, 1897.

FIG. 1.



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4 Sheets—Sheet 2.

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BURGLAR ALARM.

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FIG. 2.

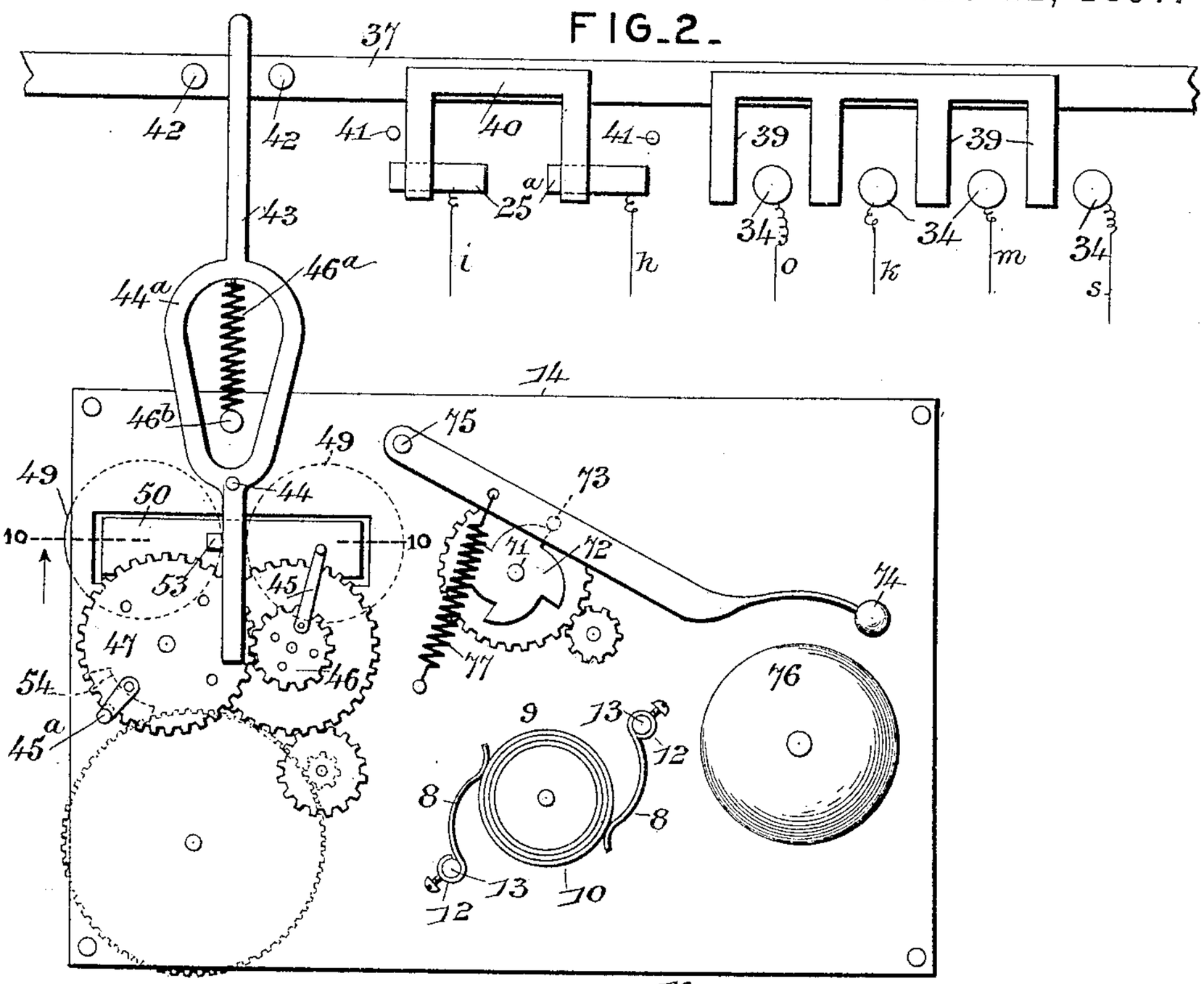


FIG. 3.

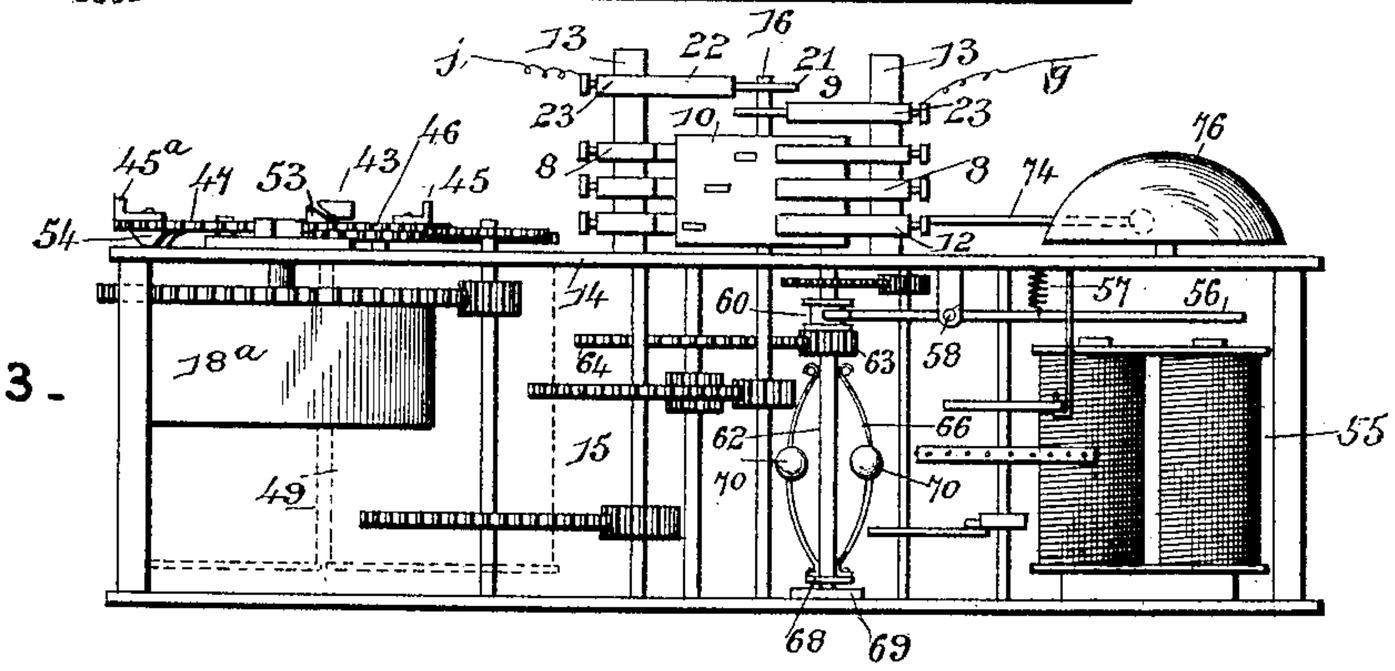
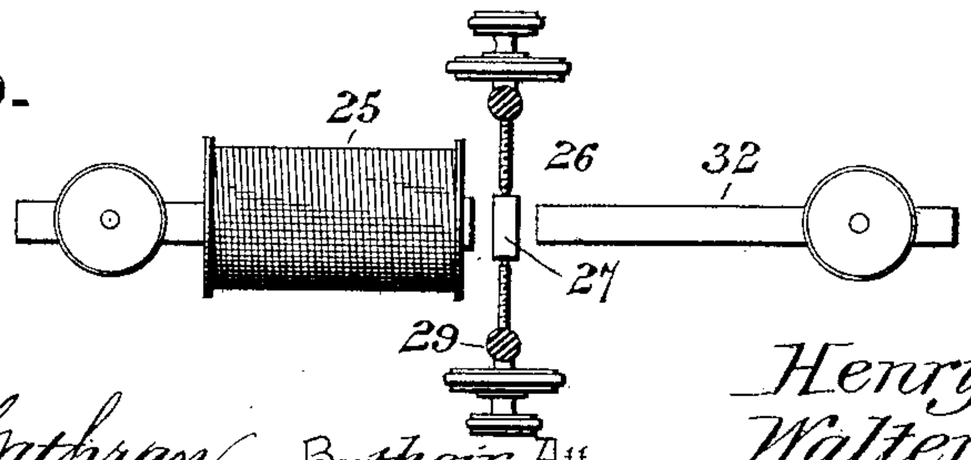


FIG. 9.



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BURGLAR ALARM.

No. 584,798. Patented June 22, 1897.

FIG. 4.

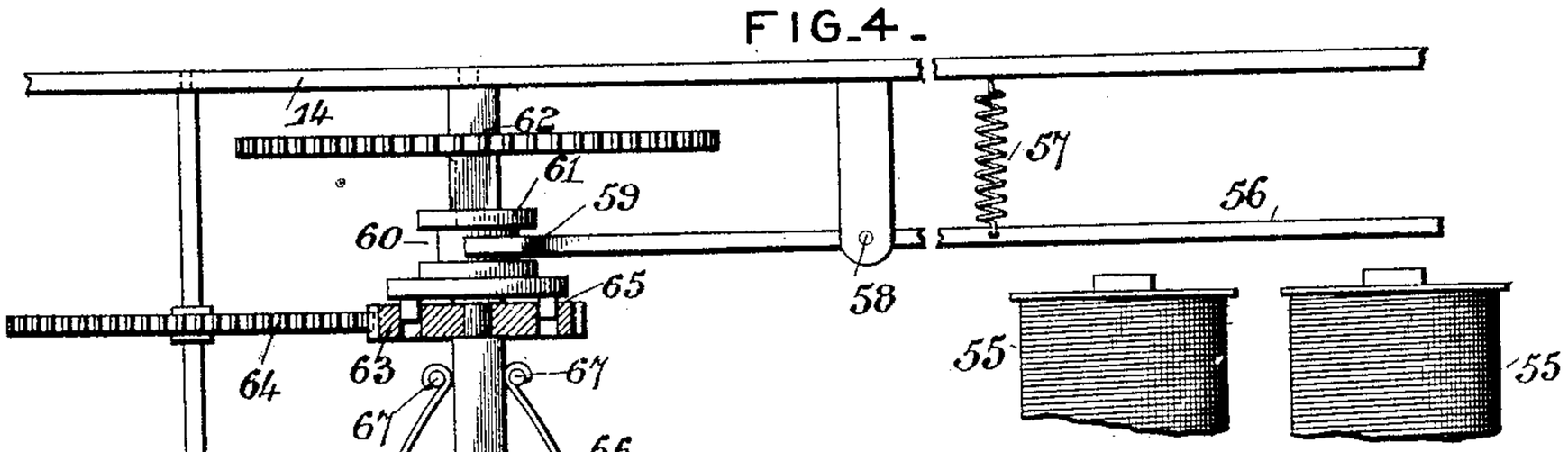


FIG. 10.

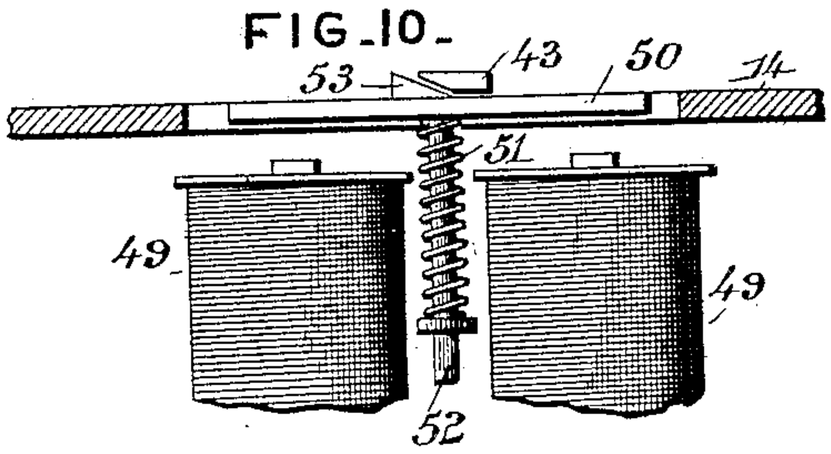


FIG. 5.

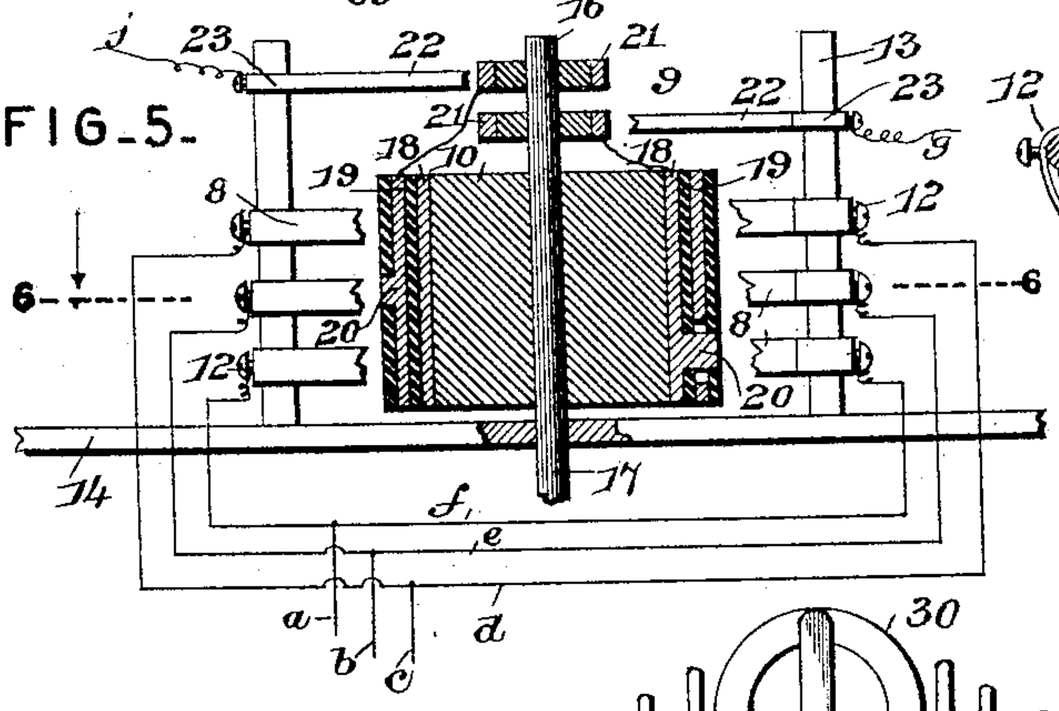


FIG. 6.

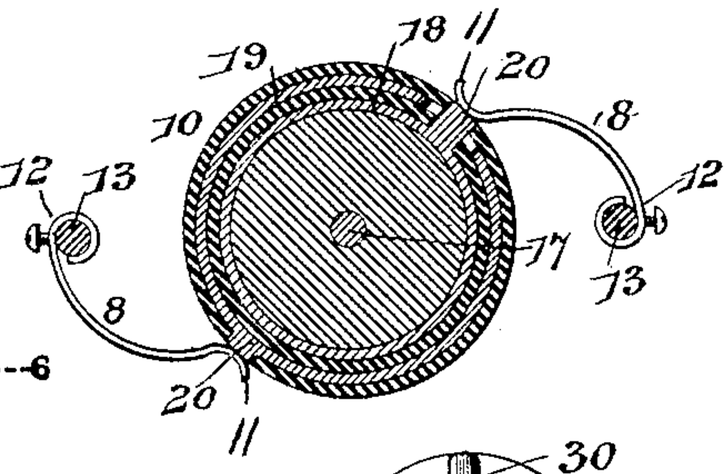


FIG. 8.

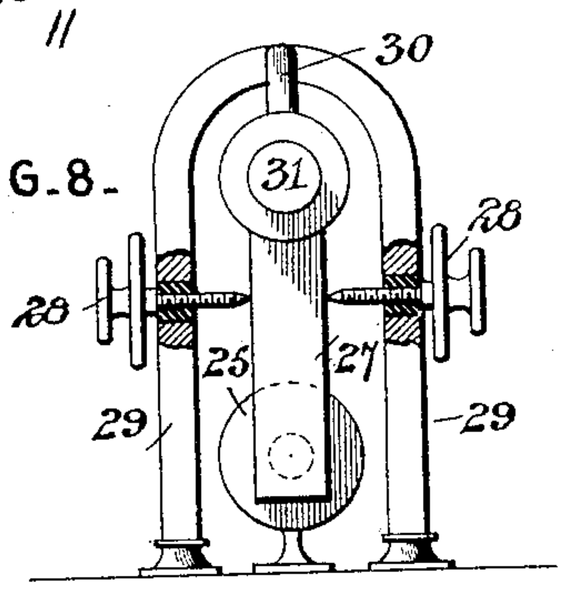
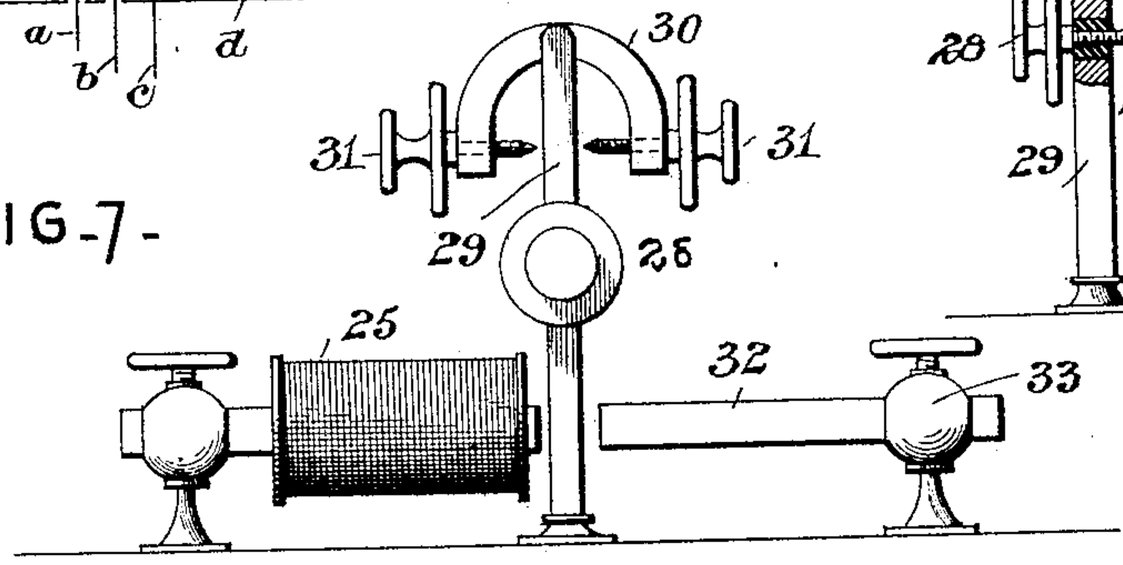


FIG. 7.



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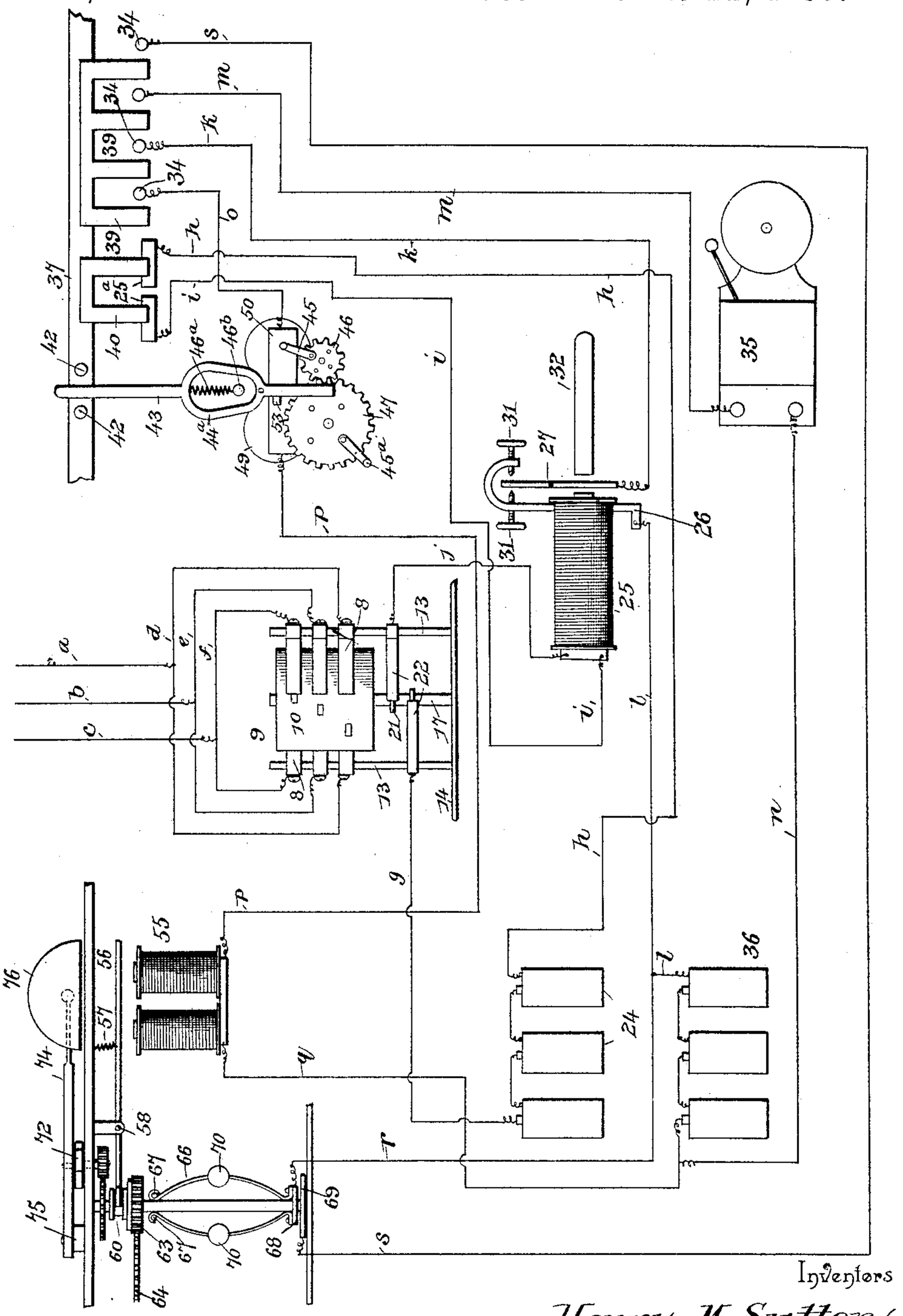
BURGLAR ALARM.

No. 584,798. Patented June 22, 1897.

FIG. II.



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UNITED STATES PATENT OFFICE.

HENRY M. SUTTON AND WALTER L. STEELE, OF DALLAS, TEXAS, ASSIGNORS OF ONE-THIRD TO MICHAEL COERVER, OF SAME PLACE.

BURGLAR-ALARM.

SPECIFICATION forming part of Letters Patent No. 584,798, dated June 22, 1897.

Application filed October 29, 1895. Serial No. 567,295. (No model.)

To all whom it may concern:

Be it known that we, HENRY M. SUTTON and WALTER L. STEELE, citizens of the United States, residing at Dallas, in the county of Dallas and State of Texas, have invented a new and useful Apparatus for Protecting or Guarding Electric Circuits, of which the following is a specification.

This invention relates to apparatus for protecting or guarding electric circuits; and it has for its object to protect or guard electric circuits, such as burglar-alarm circuits, from interference by unauthorized or mischievous agencies.

In carrying out this invention use is partly made of the well-known arrangement of alarm-circuits described in expired United States Letters Patent No. 110,362, dated December 20, 1870, in which patent is illustrated and described a sheet of metal foil surrounding the protected structure, such as a safe, and a strip of foil arranged in convolutions upon the surface of the surrounding sheet of foil, but insulated from the latter, the whole being so arranged that should the foil be broken or the separate layers thereof brought in contact with each other a signal or alarm would be sounded at a distant station.

In apparatus heretofore patented, involving the arrangement of circuits above referred to, it is possible by a suitable galvanometer or other similar apparatus to take complete readings of the signal, determine the electromotive force of the battery employed and also the amount of artificial resistance, providing any such resistance is interposed in the circuit, and then it is simply necessary to introduce on the line a duplicate apparatus and thus disconnect the structure or premises from the alarm-circuit without attracting attention. However, the present invention contemplates means for rendering the line or circuit connections with the protected structure absolutely non-readable, and in the attainment of this result principally provides means for alternating the current at frequent intervals, and at the same time changing or shifting the current automatically from one set of lines to another, thereby leaving one or more lines in circuit with the protected structure dead at a given moment of time. By reason of thus rapidly alternating and changing the current from one set of lines to another readings of the line will be practically impossible, and especially for the reason that the alternation of the current at frequent intervals will have a tendency to produce a counter electromotive force on the line which would naturally make any reading that might possibly be taken somewhat higher than the actual resistance really is, and therefore should an artificial resistance be introduced it would at once overbalance the relay part of the apparatus to be described, and would cause an alarm to sound at the receiving-station.

With the general objects of the invention in mind, and the method involved in connection with the system, the invention consists in the novel construction, combination, and arrangement of parts hereinafter more fully described, illustrated, and claimed.

In the drawings, Figure 1 is a general diagrammatic perspective view of the complete apparatus for protecting or guarding electric circuits. Fig. 2 is an enlarged detail elevation of the clock mechanism, illustrating the construction and operation of the device for automatically throwing the apparatus in and out of service and also the device for giving a continuous signal. Fig. 3 is a plan view of the clock mechanism, illustrating the arrangement of the current-changer and the indicating attachment for the clock mechanism. Fig. 4 is an enlarged detail elevation of the indicating attachment for the clock mechanism. Fig. 5 is an enlarged detail longitudinal sectional view of the current-changer. Fig. 6 is a transverse sectional view on the line 6 6 of Fig. 5. Fig. 7 is a side elevation of the relay. Fig. 8 is an end view thereof. Fig. 9 is a top plan view thereof. Fig. 10 is a detail sectional view on the line 10 10 of Fig. 2, illustrating the magnetically-controlled catch device for the oscillating shifting lever of the sliding contact-bar. Fig. 11 is a diagrammatic plan view of the different parts of the apparatus separated from each other to clearly illustrate the different circuits.

Referring to the accompanying drawings, the numeral 1 designates the covering for the

protected structure, such as a safe, and this protective covering, which may be of any size or character, is illustrated as being constructed on the same general principles as the arrangement of parts illustrated in the expired Letters Patent hereinbefore referred to. In connection with the apparatus contemplated by this invention the covering for the protected structure is illustrated as consisting of three strips of foil 2, 3, and 4, respectively, which are arranged in convolutions around the protected structure, but insulated from each other. The separate strips of foil 2, 3, and 4 are preferably connected or electrically joined by a suitable metallic connection, as at 5, so that a complete circuit will be made around the protected structure, and the parts of the apparatus which are circuited with the separate fragile strips of foil are so constructed and combined that should one of the strips be broken or be brought in contact with another strip it would cause a signal to be given at the receiving-station. The separate strips of foil surrounding the protected structure have respectively connected therewith the main-line wires *a*, *b*, and *c*, the latter wire being illustrated as a ground-wire, having the ground-wire connections 6, and providing for the return-circuit.

The main-line wires *a*, *b*, and *c*, which are in circuit with the protected structure, as described, extend to the police or other station, where the apparatus contemplated by this invention may be conveniently located. This apparatus is preferably arranged inside of a box or cabinet 7, so that all of the parts of the apparatus may be arranged as compactly as possible, and the main-line wires extend into the box or cabinet and have branch connections *d*, *e*, and *f*, with the opposite sets of brushes 8 of the current-changer 9. The opposite sets of brushes 8 are arranged in opposite sets of three, which correspond to the number of main-line wires, and each of the branch connections *d*, *e*, and *f* have a connection with two directly-opposite brushes 8, so that each pair of directly-opposite brushes 8 is directly in circuit with one of the main-line wires, as is clearly illustrated in Fig. 5 of the drawings.

The opposite sets of brushes 8 are arranged at diametrically opposite sides of a rotating contact-drum 10, the free ends of said brushes being curved, as at 11, so as to bear directly on the surface of said drum, while the outer ends of the brushes are adjustably fitted, as at 12, on the opposite insulated supporting-posts 13, projected from one side of the frame 14 of the clock mechanism 15 at opposite sides of the drum 10. The rotating contact-drum 10 is mounted outside of the frame 14 on the shaft extension 16 of one of the shafts 17 of the ordinary clock mechanism 15, which is actuated by the usual spring 18ª, and essentially consists of an ordinary train of gearing. During the operation of the clock mechanism the contact-drum 10 is given a constant rotation, and said contact-drum consists of a pair of concentrically-arranged inner and outer metallic cylinders 18 and 19, which are spaced and insulated from each other, and which are each provided with a series of outwardly-projecting contact-lugs 20, which extend through the insulation between and surrounding the cylinders 18 and 19 and come flush with the periphery or outer surface of the drum 10, so that as the latter revolves the said lugs 20 will be carried under and in contact with the inner ends of the conducting-brushes 8. The contact-lugs 20 of the metal cylinders 18 and 19 are arranged alternately or otherwise so that as the drum 10 revolves the current will be rapidly alternated on the main-line wires and at the same time will be changed or shifted from one set of line-wires to another, thereby leaving the remaining line-wires dead; but at this point it will of course be understood that should more than three line-wires be employed more than one line-wire would necessarily be dead at a given moment of time, it being understood that, in connection with three line-wires, as illustrated, at a given moment of time either *a* and *c* or *b* and *c* will be the active wires.

At one end of the drum 10 are arranged a pair of spaced contact-rings 21, which are mounted on one extremity of the shaft 17, and said contact-rings 21 have separate wire connections respectively with the inner and outer metallic cylinders 18 and 19 of the drum to provide for electrically connecting the said cylinders in the line of the main battery. The contact-rings 21 rotate in contact with the inner ends of the contact-brushes 22, the outer ends of which are adjustably fitted, as at 23, on the outer ends of the insulated supporting-posts 13, and one of said contact-brushes 22 has connected therewith one terminal of the main-line-battery wire *g*, which leads from one pole of the main-line battery 24, from the other pole of which battery leads the other main-line-battery wire *h*. The main-line-battery wire *h* leads to one of a pair of spaced elongated contact-plates 25ª, which are normally connected together in the manner to be hereinafter described, and to the other of which contact-plates is connected one terminal of one relay-wire *i*, the other terminal of which wire connects with the electromagnet 25 of a relay 26. The other relay-wire *j*, which also connects with the magnet 25, has one of its terminals connected with the brush 22, opposite the brush 22, to which the wire *g* is connected.

In connection with the operation of the current-changing device 9, which not only provides for the alternation of the current over each set of main-line wires, but also for intermittently directing the current through such wires, specific mention will be made at this point as to the relation of the contact-lugs 20 to the conducting-brushes 8. It has

already been observed that when the apparatus is employed in connection with three line-wires, as illustrated, either the wires *a* and *c* or *b* and *c* will be the active wires at a given moment of time, it being the purpose of the invention to have the current-changer direct the current intermittently over the wires *a* and *c* or *b* and *c*, and also at intervals to alternate the direction of polarity of the current over said wires *a* and *c* and *b* and *c*. To accomplish this result, which is very important for the purpose of rendering the lines practically non-readable, it will be understood that the brushes 8 belonging to each pair, or, in other words, the diametrically opposite brushes 8, are never in contact with lugs 20 at the same time, but the active brushes 8 at a given moment of time always maintain a diagonally opposite relation. For instance, one of the brushes 8, connected with the branch wire *f* for the main-line wire *a*, will contact with a lug 20 of the inner metallic cylinder 18, while a diagonally opposite brush connected with the branch wires *d* for the line-wire *c* is in contact at the same moment of time with a lug 20 of the outer metallic cylinder 19, thereby completing an electric circuit through the battery 24, wire *g*, one of the brushes 22 and rings 21, inner cylinder 18, lug 20, brush 8, connected with wire *f*, line-wire *a*, protected structure, wire *c*, branch wire *d*, one of the brushes 8, connected thereto, a lug 20 of the cylinder 19, the other of said contact-rings 21 and brushes 22, wire *j*, magnet 25, and wires *i* and *h*. This example shows a completion of the circuit through the line-wires *a* and *c* in one direction, when two diagonally opposite brushes 8, in circuit respectively with the wires *a* and *c*, are active, but when the other diagonally opposite brushes 8 in circuit with the wires *a* and *c* come in contact at the same moment of time with the lugs 20, respectively, of the inner and outer cylinders 18 and 19, it will be obvious that the brush 8 for the line-wire *a* will be in metallic contact with the lug 20 of the outer cylinder 19, while the brush 8 for the wire *c* will be in contact with the lug 20 of the inner cylinder, thereby causing the direction of the current to be reversed over the same circuit-wire connection just referred to. By this arrangement of the brushes 8 with relation to the lugs 20 it will be obvious that the current will be alternated in direction over the line-wires, but it is to be also observed that when the brushes 8 for the line-wire *a* are paired with the brushes for the line-wire *c* the brushes 8 for the line-wire *b* are inactive, and vice versa, thereby providing an arrangement which causes the current to be shifted from one set of line-wires to another, and the current will therefore not only be alternated in direction over each set of line-wires, but will also intermittently pass over such line-wires.

The relay 26 essentially consists of the electromagnet 25, mounted in any suitable position, and the polarized or magnetized armature 27, supported at one end of the magnet. The magnetized armature 27 is pivotally supported intermediate of its ends between a pair of supporting-screws 28, passed through opposite sides of an arched supporting-frame 29, arranged at one end of the magnet 27. At its upper end the arched supporting-frame 29 carries a U-shaped bracket 30, in the opposite extremities of which are mounted the oppositely-disposed contact-screws 31, between the points of which the upper end of the armature 27 is designed to play. Arranged in a line with the core of the magnet 25 and on the opposite side of one end of the armature 27 is a permanent magnet 32, mounted for adjustment in a suitable support 33. The support of the armature 27 is such that one end thereof is arranged to play between the adjacent core ends of the electromagnet 25 and one end of the permanent magnet 32, and at this point it will be noted that the armature 27 is polarized, so that the end thereof between the adjacent ends of the electro and permanent magnets is of the same polarity as such ends of said magnets, and therefore, by the repellent action of both the electro and permanent magnets, the polarized armature 27 will be delicately balanced between the opposite magnets and will thereby be normally held out of contact with either of the contact-screws 31. By reason of this arrangement of parts it must be obvious that should interference on the main line or at the protected structure increase the current strength flowing through the magnet 25 the latter would repel the armature 27 and cause the same to contact with one of the screws 31, while, on the other hand, should an interference with the line or protected structure weaken the current which passes through the magnet 25 the permanent magnet 32 would then come into play and repel the armature 27, so as to cause the same to contact with the other of the screws 31. In either of these events a circuit would be closed over the wires *k* and *l*, respectively connected with the armature 27 and the metal frame 29, which carries the screws 31, uninsulated therefrom.

The wire *k* leads from its connection with the armature 27 to one of a series of spaced contact-buttons 34, suitably arranged within the box or cabinet 7. One of the contact-buttons 34 at one side of the button with which the wire *k* connects has connected therewith one terminal of the bell-wire *m*, the other terminal of which connects with one of the binding-posts of the electric bell or gong 35, mounted within the box or cabinet 7, and the other binding-post of the bell or gong 35 has connected thereto one terminal of the signal-battery wire *n*, the other terminal of which connects with one pole of the signal-battery 36. The other pole of the signal-battery 36 has connected therewith one terminal of the circuit-wire *l*, which connects with the metal frame 29 of the relay.

With the contacts connected to which the wires *k* and *m* lead, by the pins 39 of the bar 37, to be presently described, it will be obvious that when the armature 27 is repelled in either direction by reason of an increase or decrease in the strength of the current which passes through the magnet 25, a signal-circuit will be completed over the wires *k*, *m*, *n*, and *l*, which will cause the bell 35 to at once sound an alarm that will indicate at the receiving-station that the main line or protected structure has been interfered with, as will be readily understood by those skilled in the art, it being noted at this point that either a short-circuiting of the main line or the breaking of the circuit by breaking the strips 2, 3, or 4, for instance, would produce the results referred to.

Arranged to work at one side of the series of contact-buttons 34 and the contact-plates 25^a is a sliding contact-bar 37, one end of which works through one side of the box or cabinet 7 and is provided with a finger-button 38, which is grasped at any time it may be necessary to manipulate the bar 37 by hand. The bar 37 is provided at one side with a series of offstanding contact-pins 39, which may form either an integral or separate part of the said bar. The pins 39 are metallically joined together and project in the spaces between and at one side of the buttons 34, so that when the bar 37 is moved in one direction each of the buttons 34 will have a contact with a separate one of the pins 39, whereby the circuit will be closed over the wires which have a connection with said buttons. The bar 37 is also provided at a point intermediate of its ends with an arched bridge-plate 40, the metallic ends of which have a permanent sliding contact with the spaced elongated contact-plates 25^a, so that normally the circuit will be closed over the wires *h* and *i*, connected with the said plates 25^a. Beyond each end of the arched bridge-plate 40 are located stop-pins 41, which limit the movement of the said plate 40, and in connection with the said bridge-plate it will be noted at this point that the contact-plates 25^a are in series with the main line and batteries to prevent the contact-bar 37 from being forcibly pulled out or shoved in, in either of which cases the circuit would be broken and an alarm would be sounded by the bell by reason of the closing of the alarm-circuit by the action of the permanent magnet 32 of the relay.

The sliding contact-bar 37 is provided at a point near its inner end with a pair of offstanding spaced shifting-pins 42, between which plays one end of an oscillating shifting-lever 43. The oscillating shifting-lever 43 is pivotally mounted at 44 at one side of the clock-mechanism frame 14, and at one side of its pivot 44 the said lever 43 is provided with an open yoke 44^a, within which is arranged the retractile spring 46^a. The spring 46^a is connected at one end to the lever 43 at one end of the yoke 44^a, and at its other end the spring 46^a is connected to a fixed point of attachment, as at 46^b, located at one side of the pivot 44. The end of the lever 43, opposite the end which plays between the pins 42, is disposed between and in the path of movement of the strike-arms 45 45^a, attached, respectively, to the outer sides of the gear-wheels 46 and 47.

The gear-wheels 46 and 47 intermesh and are mounted on the extremities of two adjacent shafts of the clock mechanism 15, and the wheel 46 is sized and given a rotation so as to make one complete revolution every twelve hours, while the wheel 47 is sized relatively to the wheel 46, so as to make one complete revolution every twenty-four hours. The strike-arms 45 and 45^a are suitably mounted on the gear-wheels, so as to be capable of adjustment to any set position, and the strike-arm 45, carried by the wheel 46, which rotates once in twelve hours, is intended to strike against one side of the lever 43, so as to move the same in a direction against one of the pins 42, whereby the bar 37 will be moved outward and carry the contact-pins 39 in contact with the buttons 34 and thereby close all of the different circuits and set the apparatus for use. In this connection it will be noted that the contact-plates 25^a are sufficiently long, so that the bridge-plate 40 will always maintain a contact therewith.

The strike-arm 45^a is carried by the wheel 47 against the side of the lever 43, opposite the side engaged by the arm 45, so as to move the lever in a direction which will slide the bar 37 inward and carry the contact-pins 39 out of contact with the buttons 34, thereby opening the different circuits of the apparatus and throwing the latter out of service. For instance, the arm 45 may be set so as to cause the pins 39 to be thrown in contact with the buttons 34 at six o'clock p. m., while the strike-arm 45^a will not come into play to throw the apparatus out of service until, say, for instance, nine o'clock a. m. This part of the apparatus is very useful, inasmuch as it throws the apparatus automatically in and out of service at any predetermined time. In conjunction with the operation of the strike-arms 45 and 45^a the spring 46^a greatly assists in the throw of the lever 43, it being noted that when the said lever has been moved to a position which carries the swinging end of the spring 46^a to a certain point, the said spring will sharply draw the lever 43 in either direction, so as to insure the proper throw of the bar 37 to cover and uncover the contacts 34, as will be readily understood by those skilled in the art.

At one side of the lever 43, and within the clock-mechanism frame 14, is arranged a pair of electromagnets 49, having a spring-pressed armature 50, supported to work directly at one side of the lever 43. The armature 50 is normally held outward against the lever 43 by means of the push-spring 51, coiled on the supporting-rod 52 and bearing against the

inner side of the armature 50. The said spring-pressed armature 50 is provided on its outer side with a beveled catch-lug 53, which normally engages at one side of the lever 43 and serves to lock the lever, which holds the bar 37, firmly in the position when the pins 39 contact with the buttons 34, so that the said pins cannot be moved off of the said contact-buttons.

The gear-wheel 47, which carries the strike-arm 45^a, is provided on its inner side with a cam lug or projection 54, which is adapted to ride on the outer side of the armature 50 and depress the same, so as to disengage the lug 53 from the lever 43 in time to allow the strike-arm 45^a to move the lever 43 in a direction which will cause the bar 37 to carry the pins 39 out of contact with the buttons 34, and this same result may be secured by the operation of the electromagnets 49, which are designed to control the movement of the armature 50 under certain conditions. One terminal of the magnets 49 has connected therewith the magnet-wire *o*, which leads to one of the contact-buttons 34 at one side of the button with which the wire *k* connects, and the other terminal of the magnet 49 has connected therewith the magnet-wire *p*, which leads to one terminal of a pair of electromagnets 55, the other terminal of which electromagnets 55 has connected therewith the wire *q*, which leads to the same pole of the signal-battery 36 as the wire *n*. By reason of the circuit connections just described, should there be an interference with the main line or protected structure the magnets 49 will be energized by the operation of the batteries through the relay-contacts, and the armature 50 will be attracted by the said magnets 49, thereby disengaging the lug 53 from the lever 43, and this automatic operation of the armature 50 allows the operator at the receiving-station to grasp the finger-button 38 and push the bar 37 inward to break the circuit connections at the buttons 34. The alarm or bell of course continues to sound until the operator has broken the circuit connections in the manner just referred to, and when the line or protected structure has been put in working order again the circuits are again closed by simply pulling outward on the button 38, and the spring 51 will throw the armature 50 out in engagement again with the lever 43 to lock the bar 37 in its readjusted position.

The electromagnets 55 are suitably arranged within the clock-mechanism frame 14 and are designed to control the movement of the armature-lever 56. One end of the armature-lever 56 plays opposite the core ends of the magnets 55 and is normally held out of contact therewith by means of the spring 57, attached to the armature 56 and to the frame 14. The said armature 56 is pivotally mounted intermediate of its ends, as at 58, within the frame 14 and is provided at its end opposite the magnet 55 with a yoke 59, which loosely engages in the annular groove 60 of the sliding clutch-collar 61, feathered on one of the shafts 62 of the clock mechanism 15. Loosely mounted on the shaft 62, adjacent to the collar 61, is a pinion 63, which engages with one of the gear-wheels 64 of the clock mechanism, and said pinion 63 is provided with a clutch-face 65, adapted to interlock or engage with the corresponding face of the clutch-collar 61, feathered on the shaft 62, which is preferably square throughout its entire length.

A pair of reversely-bowed springs 66 are fastened at one end, as at 67, to the shaft 62 directly at one side of the loose pinion 63, and the opposite ends of said springs, which are disposed at opposite sides of the shaft 62, are suitably connected with a sliding contact-plate 68, mounted to slide on the shaft 62 in opposition to the fixed contact or contact-plate 69, which may be an integral or separate part of the frame 14 of the clock mechanism. The sliding contact-plate 68 has connected therewith one terminal of the wire *r*, which has a connection through the medium of the wire *l* with one pole of the signal-battery 36, and the fixed contact-plate 69 has connected therewith one terminal of the circuit-wire *s*, the other terminal of which is connected with a contact-button 34 at one side of the button to which the signal-battery wire *m* leads.

The opposite reversely-bowed springs 66 carry centrally between their ends the governor-balls 70, which operate by centrifugal force during the rotation of the shaft 62. In operation the shaft 62 rotates and throws the balls 70 outward by centrifugal force, thereby causing the contact-plate 68 to slide inward and out of contact with the fixed contact-plate 69. Should the clock mechanism stop or the shaft 62 otherwise cease to rotate, the springs 66 will draw inward and move the contact-plate 68 against the plate 69, causing an alarm-circuit to be completed over the wires *r l*, battery 36, wire *m*, bell 35, wire *m*, connected contacts 34, and wire *s*. This alarm would at once indicate that the clock mechanism has ceased to operate for some cause, and should the main line or protected structure be tampered with the magnets 55, being in series with the magnets 49, would attract the armature-lever 56. This attraction of the armature-lever 56 by the magnets 55 would throw the clutch-collar 61 out of engagement with the pinion 63, and the said pinion 63 would then freely rotate without revolving the shaft 62, the stoppage of which shaft would cause the contacts 68 and 69 to be brought together and close the alarm-circuit referred to, so that it will be obvious that should the shaft cease to rotate from any cause whatever the alarm would be sounded, and it will also be noted that the construction just described, involving the use of the magnets 55, provides an indicating device that does not interfere at all with the continual working of the clock mechanism.

One of the shafts 71 of the clock mechanism

15 has mounted on one extremity a ratchet-disk 72, the teeth or projections of which rotate in contact with a pin or stud 73, projected from the inner side of a bell-hammer 74. The bell-hammer 74 is pivoted at one extremity, as at 75, to one side of the frame 14, and the other end of said hammer is designed to play against a bell 76, suitably secured within the clock-mechanism frame. The hammer 74 is normally retracted against the bell 76 by means of a retractile spring 77, connected at one end to the hammer and at its other end to the clock-mechanism frame. It will readily be seen that during the operation of the clock mechanism the ratchet-disk 72, combined with the spring 77, will cause the hammer 74 to strike the bell 76, and thereby provide for giving continuous signals while the apparatus is in service.

The entire apparatus herein described is not only intended to be conveniently and compactly arranged within a box or cabinet 7; but, as illustrated in diagrammatic Fig. 1, the said box or cabinet is preferably surrounded by convoluted strips of metal foil 78, which are connected in series with the main batteries and the protected structure, and should the box or cabinet be broken or opened the circuit would at once be broken and thereby cause an alarm to be sounded. The strips of foil surrounding the box or cabinet 7 are illustrated in Fig. 1 as being connected in the main-line circuit by means of the main-line battery-wire *h*, and the door 79 of the box or cabinet is provided with a suitable contact connection with the box or cabinet for normally closing the circuit over the wire *h* when the door 79 is closed, as will be readily understood by those skilled in the art.

From the foregoing it will be understood that while the entire apparatus described positively insures an alarm should the main line or protected structure be interfered with at the same time the line is rendered practically non-readable, owing to the alternation and shifting of the current transmitted over the main line. By reason of thus distributing the current any readings which might be taken would be somewhat higher than the real resistance of the line really is, so that should similar resistance be attempted to be introduced on the main line the relay would be at once overbalanced and cause an alarm to be sounded at the receiving-station in the manner referred to. This operation involves the salient feature of this invention; but it will of course be understood that various changes in the form, proportion, and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of this invention.

Having thus described the invention, what is claimed, and desired to be secured by Letters Patent, is—

1. The method of guarding or protecting electric alarm-circuits extending between a receiving-station and a protected structure, which consists in rapidly and continuously alternating the polarity of a current of constant strength and alternately shifting this current from one set of main-line wires to another set of line-wires, thereby leaving one set of main-line wires momentarily electrically dead at a given moment of time, while another set is momentarily charged with the current, and causing an alarm-signal to operate at the receiving-station upon a variation in the current strength when induced solely by extraneous interference with the circuits, substantially as set forth.

2. In an apparatus for protecting electric circuits, the combination of a plurality of main-line wires paired into sets, a main-line battery, a signal-circuit, a relay included in said signal-circuit and having a circuit-closer with a normally-balanced movable contact, and a continuously-operating current-changing device having means for rapidly alternating the polarity of the current and for shifting the same from one set of main-line wires to another set, said current-changing device being included in a circuit with all of the main-line wires, the main-line battery, and said relay, substantially as set forth.

3. In an apparatus for protecting electric circuits, the combination with the main-line wires and the main-line battery; a relay having separate electro and permanent magnets controlling a circuit-closer, a signal or alarm circuit including therein the circuit-closer of the relay, and an automatically-operating current-changing device included in a circuit with the main-line wires and electromagnet of the relay, substantially as set forth.

4. In an apparatus for protecting electric circuits, the combination with the main-line wires, and the main-line battery; of an automatic current-changer consisting of a rotary contact-drum having independent sets of contact-lugs, a series of contact-brushes arranged in opposite sets at opposite sides of the drum and adapted to contact with said lugs, each pair of directly opposite contact-brushes having a circuit connection with one of the main-line wires, and a contact device rotated with the drum and having wire connections with the opposite poles of the main-line battery, and respectively with the independent sets of contact-lugs, substantially as set forth.

5. In an apparatus for protecting electric circuits, the combination with the main-line wires, and the main-line battery; of an automatic current-changer consisting of a motor-rotated shaft, a contact-drum mounted on said shaft and having a pair of concentrically-arranged inner and outer metallic cylinders spaced and insulated from each other and provided with a series of separate contact-lugs, the outer ends of which are disposed flush with the periphery or outer surface of the drum, a pair of spaced contact-rings mounted on the shaft adjacent to one end of the drum, separate brushes contacting with said rings

and having circuit connections with the main-line battery, and a series of contact-brushes suitably supported in sets at opposite sides of the contact-drum and adapted to contact with said lugs, each pair of two directly opposite contact-brushes having a circuit connection with one of the main-line wires, substantially as set forth.

6. In an apparatus for protecting electric circuits, the combination with the main line in circuit with a protected structure, and the main-line battery; of a relay having a suitably-supported electromagnet in circuit with the main line and main-line battery, a permanent magnet supported in a line with and opposite the electromagnet, an armature pivotally supported to play at one end between the adjacent ends of the two magnets, a pair of contacts supported for one end of the armature to play therebetween, and a signal or alarm circuit including therein the armature and the pair of contacts of the relay, substantially as set forth.

7. In an apparatus for protecting electric circuits, the combination with the main line in circuit with the protected structure and the main-line battery; of a relay having a suitably-supported electromagnet in circuit with the main line and main-line battery, a permanent magnet supported in a line with and opposite the electromagnet, a magnetized armature pivotally supported to play at one end between the adjacent ends of the two magnets, the end of the armature between the two magnets being of the same polarity as the adjacent ends of the latter, a pair of contacts supported in a position to allow one end of the armature to play therebetween, and a signal or alarm circuit including therein the armature and the pair of contacts of the relay, substantially as set forth.

8. In an apparatus for protecting electric circuits the combination with the main-line wires, and the main-line battery; of a signal or alarm circuit, devices for closing said signal or alarm circuit upon interference with the main-line circuit, a series of spaced contact-buttons having wire connections with the different circuits, and means for automatically closing and breaking the circuit at said buttons at predetermined intervals, substantially as set forth.

9. In an apparatus for protecting electric circuits, the combination with the main-line wires and the main-line battery; of a signal or alarm circuit, a circuit-closing relay included in the signal or alarm circuit, a pair of spaced elongated contact-plates included in the circuit with the relay and the main-line battery, a series of spaced contact-buttons having circuit-wire connections therewith, a sliding contact-bar provided with an arched bridge-plate having a permanent sliding contact with the spaced elongated contact-plates, and a series of metallically-connected contact-pins adapted to separately contact with said contact-buttons, and means for automatically adjusting said contact-bar in either direction, substantially as described.

10. In an apparatus for protecting electric circuits, the combination with the main-line wires, and the main-line battery; of a signal or alarm circuit, devices for closing said signal or alarm circuit, a series of spaced contact-buttons having wire connections with the different circuits, a sliding contact-bar having a series of metallically-connected contact-pins adapted to contact with said buttons, and a pair of spaced shifting pins, a suitably-supported oscillating shifting lever having one end thereof playing between said shifting pins, a suitably-arranged clock mechanism having a pair of intermeshing gear-wheels carrying adjustable strike-arms adapted to engage against opposite sides of one end of the shifting lever at predetermined intervals, and an automatic catch device arranged to automatically engage and disengage the shifting lever, substantially as set forth.

11. In an apparatus of the class described, the combination with a series of spaced contact-buttons and the different circuit-wires connected with said buttons; of a sliding contact-bar having a series of contact-pins to contact with said buttons, and a pair of spaced shifting pins, an oscillating shifting lever pivotally supported intermediate of its ends and provided above its point of pivot with an open yoke, one end of said shifting lever being arranged to play between said shifting pins, a spring arranged in the yoke of the lever and connected at one end to one end of said yoke and at its other end to a fixed point of attachment located at one side of the pivot of the lever, a suitably-arranged clock mechanism having a pair of intermeshed gear-wheels carrying adjustable strike-arms adapted to engage against opposite sides of one end of the shifting lever at predetermined intervals, one of said gear-wheels being provided on its inner side with a cam lug or projection, and electromagnets arranged in a suitable circuit and provided with a spring-pressed armature having on its outer side a beveled catch-lug adapted to engage at one side of the shifting lever, said armature being adapted to be depressed by the cam lug or projection of one of said gear-wheels, substantially as set forth.

12. In an apparatus of the class described, the combination with the main-line wires, and the main-line battery; of a suitably-arranged clock mechanism, a current-changing device operated by said clock mechanism and included in a circuit with the main-line wires and the main-line battery, a loose pinion mounted on one of the shafts of the clock mechanism and controlled by the train of gearing thereof, said pinion being provided with a clutch-face, a clutch-collar feathered on the pinion-shaft and adapted to engage with the clutch-face of the pinion, electromagnets arranged in a suitable circuit, a spring-

retracted armature-lever pivotally supported intermediate of its ends, one end of said armature-lever being disposed adjacent to the core ends of the magnets and the other end of the lever having a loose connection with said clutch-collar, a pair of reversely-bowed springs fastened at one end to the shaft carrying the pinion and provided centrally between their ends with balls or weights, a fixed contact, a sliding contact working opposite the fixed contact and fastened to one end of said springs, and a signal or alarm circuit including therein said fixed and sliding contacts, substantially as set forth.

In testimony that we claim the foregoing as our own we have hereto affixed our signatures in the presence of two witnesses.

HENRY M. SUTTON.
WALTER L. STEELE.

Witnesses:
W. D. SAMPSON,
W. T. CHAPPELL.