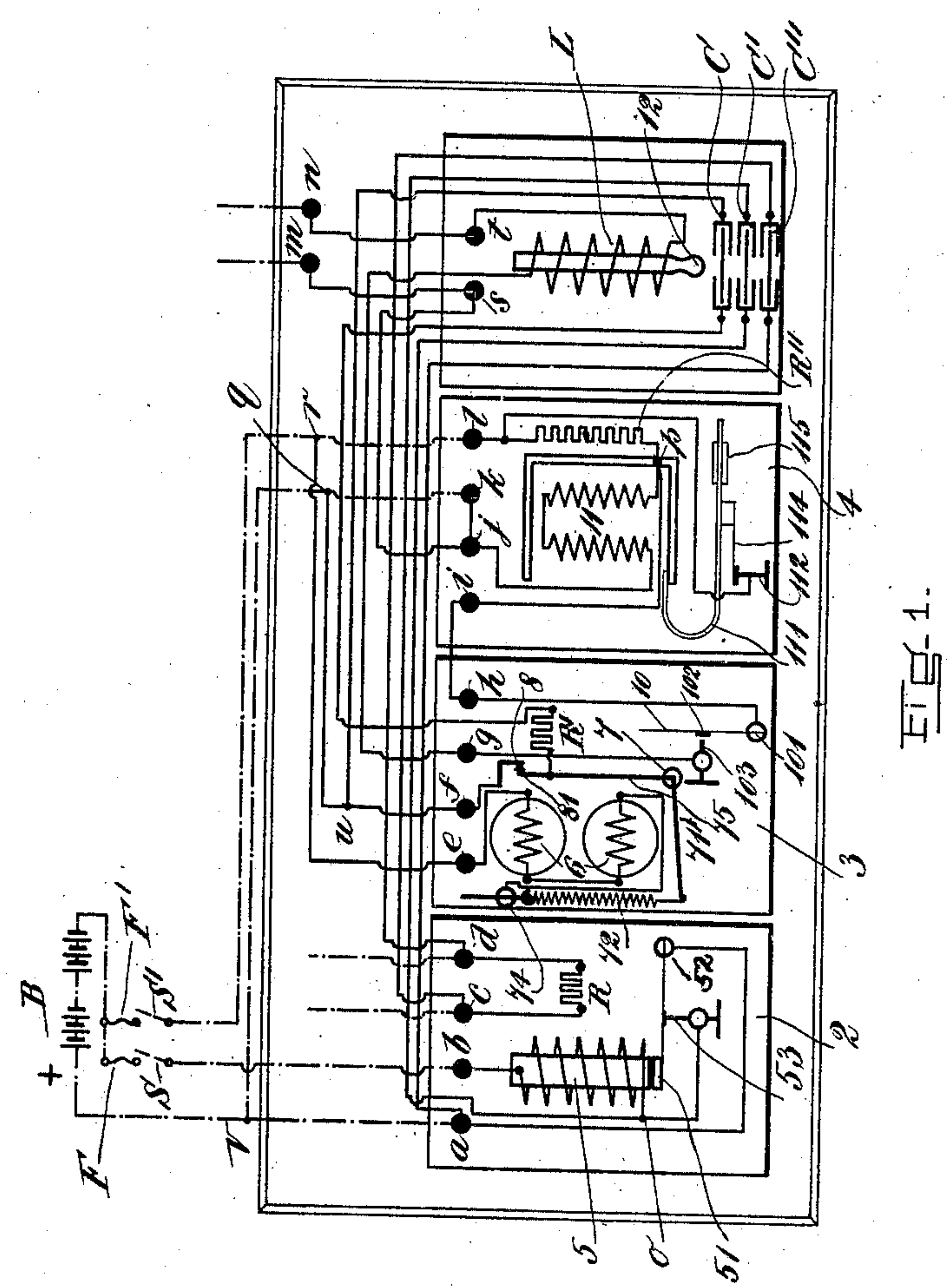


990,685.

E. M. TORMIN.
TELEPHONE SIGNALING SYSTEM.
APPLICATION FILED MAR. 29, 1910.

Patented Apr. 25, 1911.
4 SHEETS—SHEET 1.



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4 SHEETS—SHEET 2.

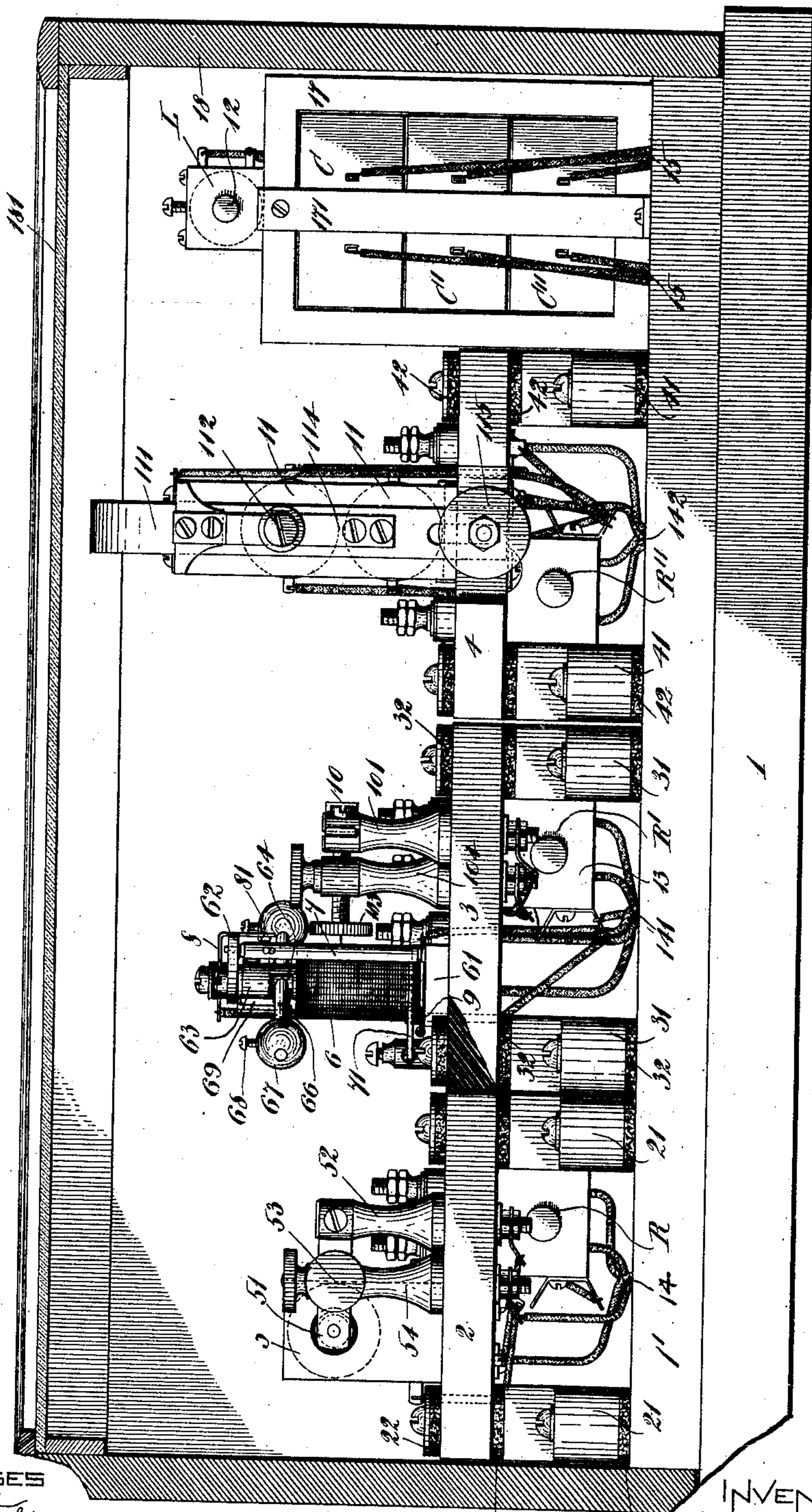


FIG. 2.

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4 SHEETS—SHEET 3.

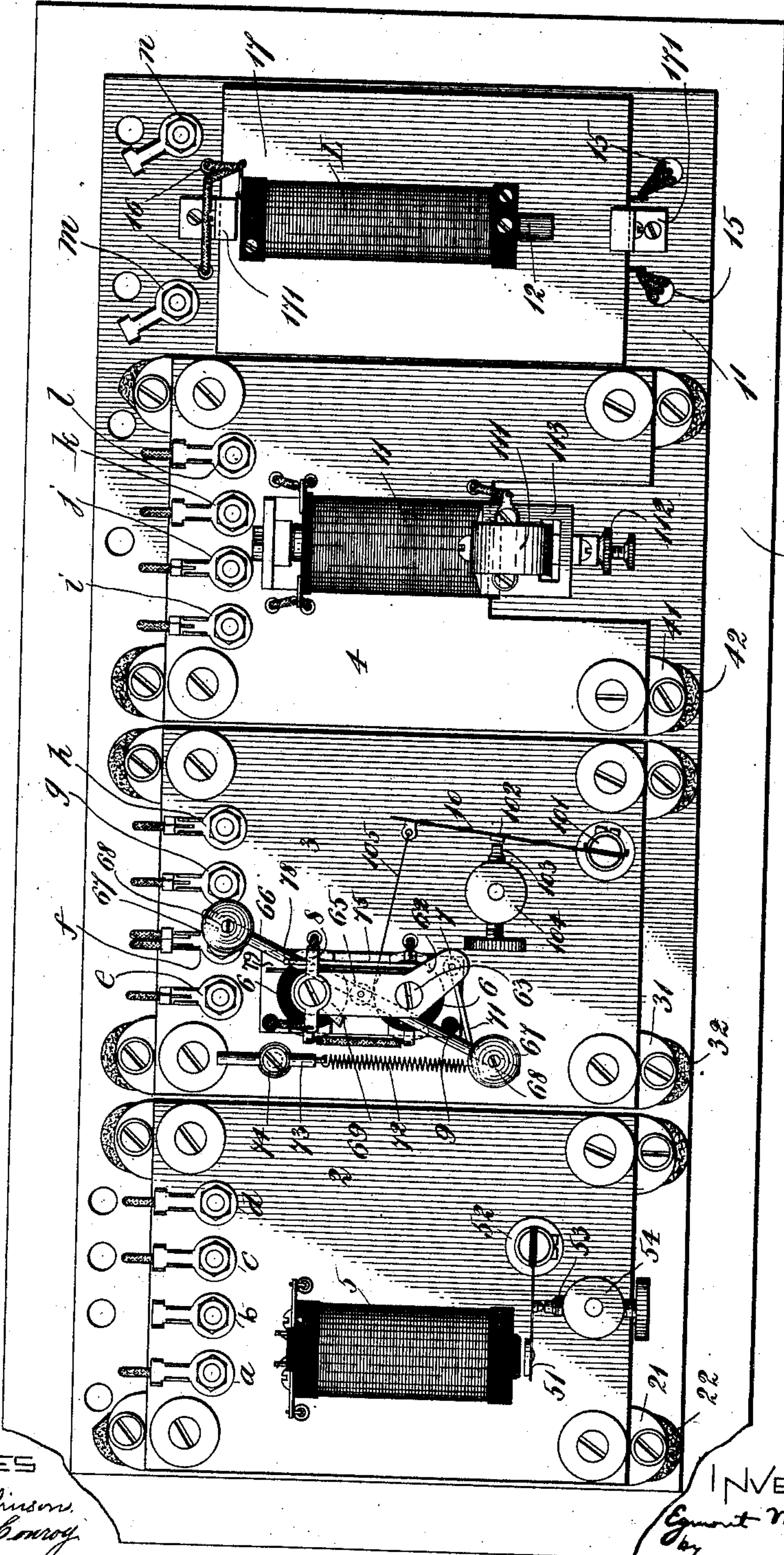


FIG. 3.

WITNESSES
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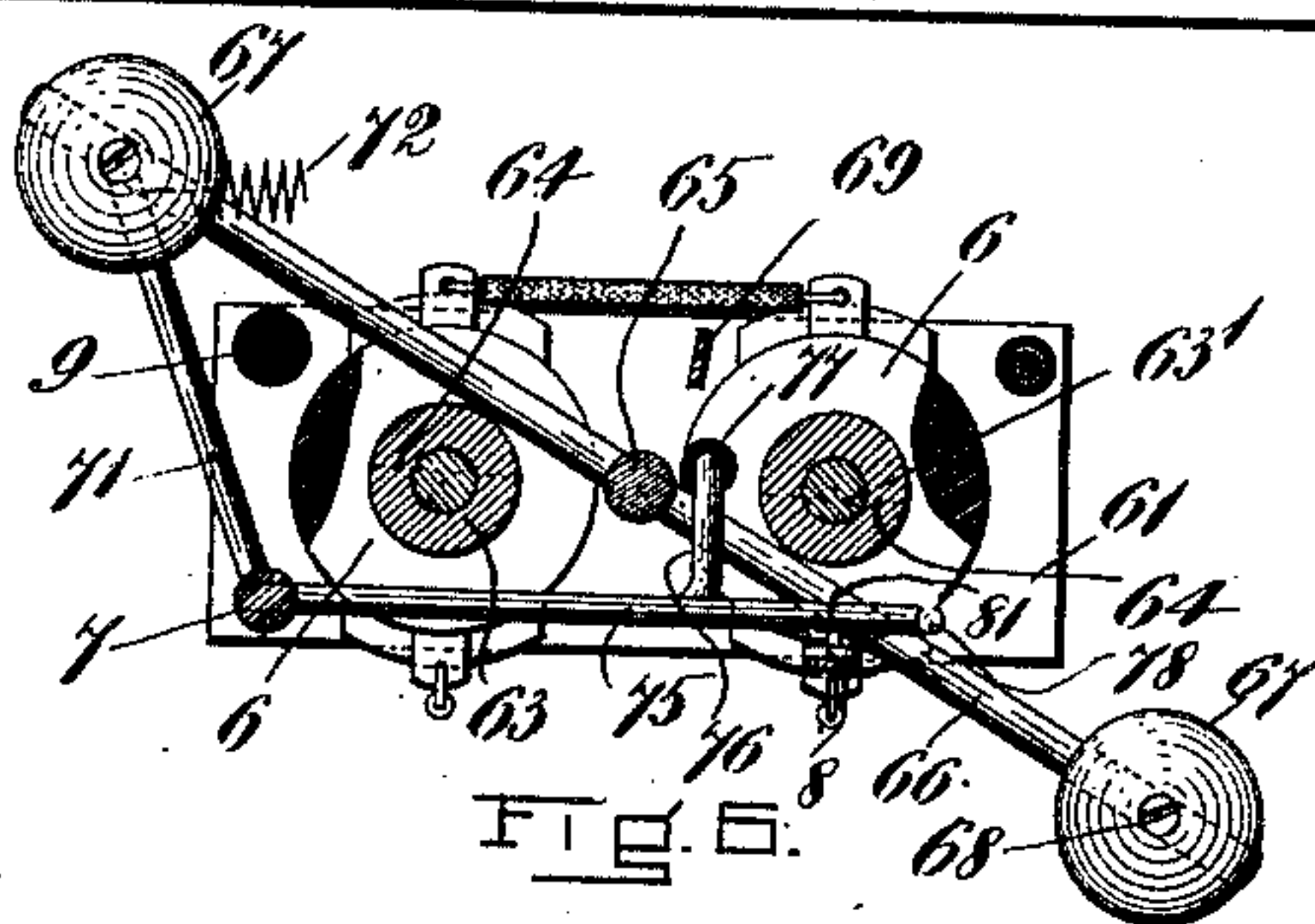
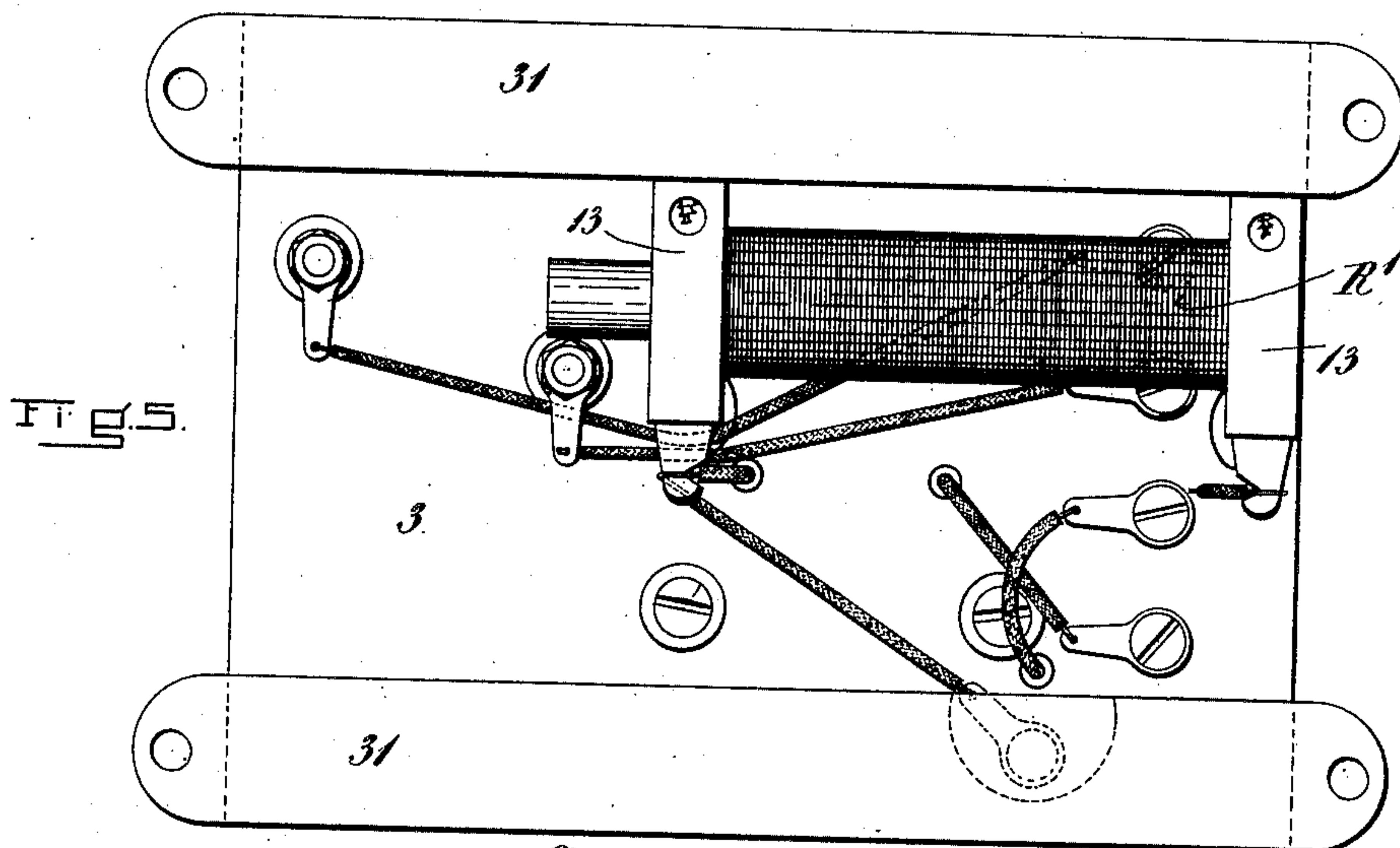
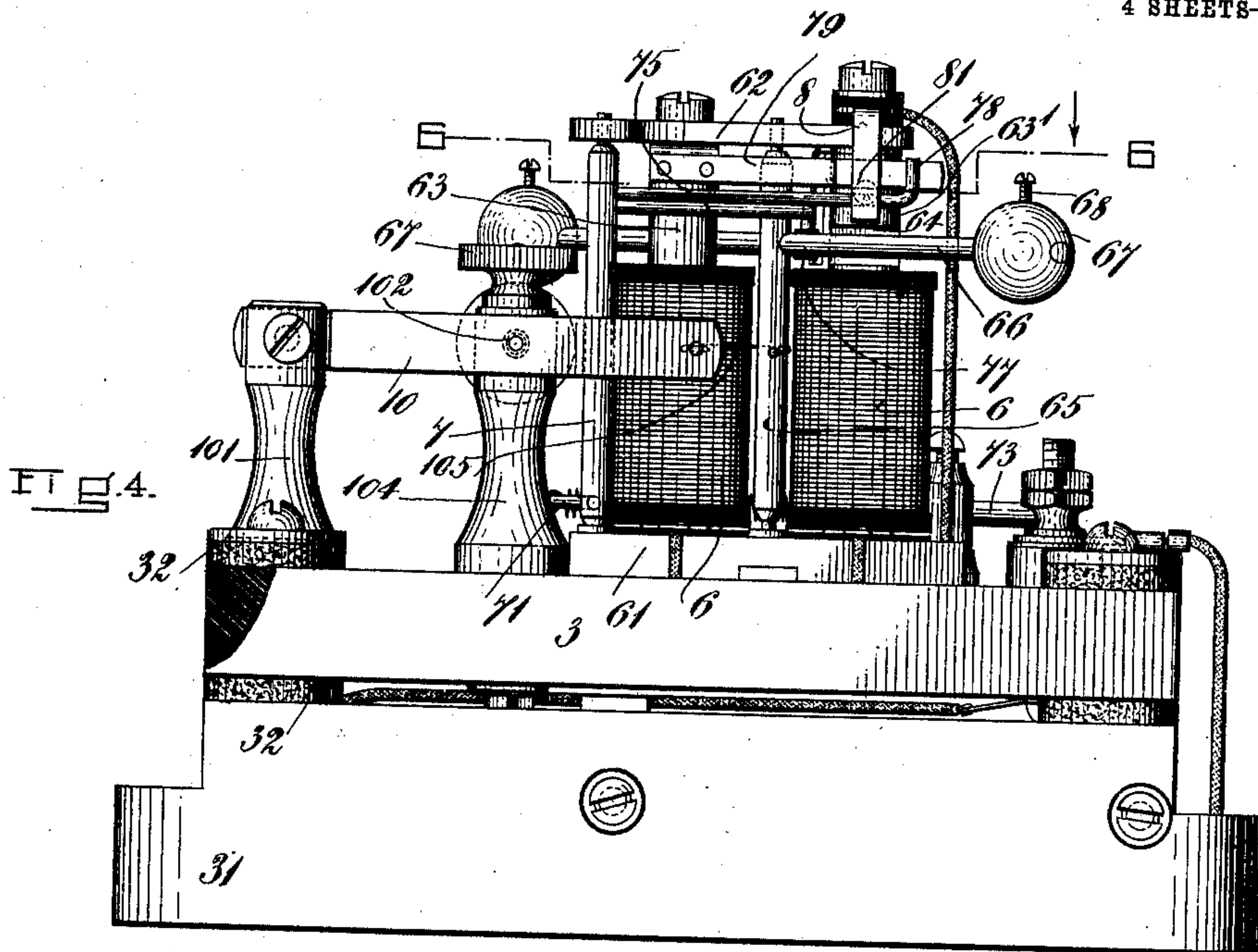
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4 SHEETS—SHEET 4.



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TELEPHONE SIGNALING SYSTEM.

990,685.

Specification of Letters Patent.

Patented Apr. 25, 1911.

Application filed March 29, 1910. Serial No. 552,125.

To all whom it may concern:

Be it known that I, EGMONT M. TORMIN, a subject of the Emperor of Germany, and a resident of Newton Center, in the county of Middlesex and State of Massachusetts, have invented a new and useful Improvement in Telephone Signaling Systems, of which the following is a specification.

My invention relates to telephone signaling systems and its object is to provide a simple and compact apparatus for use at a telephone exchange whereby a subscriber may be notified that the line called by him is busy or that he has left his receiver off the switch-hook thereby opening the ringing circuit.

Other special objects of my invention are to provide a busy-back timer for regulating the cadence of the signals produced by the busy-back vibrator or other suitable source of varying current; to provide means for regulating the strength of the current employed for the busy signal; to provide a compactly arranged means for preventing sparking at the various sets of circuit-controlling contacts; and to so arrange the several instrumentalities upon a single support as to be readily accessible and to require a minimum amount of wiring.

The drawings which accompany and form a part of this specification illustrate one embodiment of my invention whereby the foregoing objects have been realized in practice.

In the drawings—Figure 1 is a diagram showing one mode of connecting the several sets of apparatus illustrated in the other figures. Fig. 2 is a front elevation of one form of apparatus constituting my invention, the cover being shown in section. Fig. 3 is a plan view with the cover removed. Fig. 4 is a side view of the busy-back timer and Fig. 5 is an inverted plan view of the same. Fig. 6 is a section taken on the line 6 6 of Fig. 4.

In that particular embodiment of my invention illustrated in the drawings, 1 represents a base of hard wood or other suitable material carrying the slabs 2, 3 and 4, which may be of slate mounted respectively on the brackets 21, 31 and 41, which may be secured to the base by screws or other suitable means. Felt washers 22, 32 and 42 may

be interposed between the brackets and the base and between the slabs and the brackets as well as between the slabs and the heads of the screws which hold the slabs on the brackets.

Mounted on the slab 2 is a vibrator commonly known as a "howler" consisting of the electromagnet 5 having a spring-armature 51 mounted on the post 52 and normally making contact with the screw 53 mounted on the post 54. The function of the howler, as is well known, is to enable the operator to produce rapidly varying currents of large amplitude in the subscriber's set to notify the subscriber that he has left his receiver off the switch-hook and thereby has opened his ringing circuit.

On the slab 4 I mount the busy-back vibrator consisting of the electromagnets 11, spring-armature 111 which carries the spring-contact member 114 and the screw-contact 112 which is secured to the bracket 113 and which is arranged to contact with the spring 114. For regulating the frequency of vibration of the armature, I may provide the weight 115 adjustable longitudinally with respect thereto. The function of the busy-back vibrator, as is well known, is to enable the operator to produce in the subscriber's set varying currents of relatively small amplitude for the purpose of notifying him that the line which he has called is busy.

It is often desirable for many reasons to vary the cadence of the busy signals as distinguished from varying the frequency thereof by adjusting the weight 115 and the contact 112 or otherwise. For example, if the frequency of the current produced by the vibrator is three hundred per second, it is desirable in certain systems that one exchange be provided with apparatus for interrupting the circuit of the vibrator say thirty times per minute so that the subscriber will receive a busy signal produced by a plurality of groups, each of 300 pulsations of current having a frequency of three hundred per second, each group being repeated thirty times per minute—in other words, a varying current signal having a cadence of thirty per minute; and that other exchanges be provided with similar appara-

tus for giving different cadences to their busy signals produced by vibrators having a frequency which may or may not be the same as that of the first exchange. It is also sometimes desirable that a single exchange be provided with a plurality of devices for interrupting the varying current produced by a vibrator at different rates or for impressing on such current different cadences in order to enable the operator to transmit various information to a subscriber, such for instance as the information that the party called does not answer, etc.

In order to regulate the cadence of the signals produced by the busy-back vibrator 11, I provide a timer and have shown the same in the present instance mounted on the slab 3 between the howler and the busy-back vibrator; but it will be understood that this timer is not limited in its use to the signaling system which constitutes the subject matter of the present invention, and that it is independent of the vibrator and may be used with any suitable source of varying current. The electromagnets 6 for energizing the timer are mounted on the base 61 of iron and are provided with the cores 63, 63' which extend above the magnets and support the cross-piece 62 of brass or other suitable material. The cores are provided with oppositely arranged grooves 64 which serve as pole pieces for the oscillating armature 66, which in the present case consists of a governor mounted on the vertical rod 65 of hardened steel journaled in the base 61 and cross-piece 62. The governor may be provided with means such as the balls 67 adjustably secured thereto by the screws 68 for assisting in timing the period thereof. A back-stop 69 secured between the core 63' and the cross-piece 62 may be employed to limit the movement of the governor.

A vertical rod 7 of steel also journaled between the base 61 and the cross-piece 62 carries at or near its lower end a pin 71 to which the spring 72 is connected, and the tension of said spring may be adjusted by the pin 73 which is adjustably secured in the post 74 and which is attached to said spring. Secured near the upper end of the rod 7 is the arm 75 carrying the lateral extension 76 which extends over the governor and is provided with a downwardly extending insulated finger 77 normally contacting said governor. The arm 75 at its outer extremity is provided with an upwardly extending finger 78 arranged to strike against the leaf spring 79 which is attached to the core 63. The stationary contact 8 carried by and insulated from the core 63' normally is in contact with the point 81 on the arm 75. A stop 9 mounted on the base 61 may be employed to limit the inward movement of the pin 71.

A leaf spring 10 mounted on the post 101

carries the contact 102 arranged to cooperate with the adjustable contact 103 which is carried by the post 104. The outer end of the spring 10 is connected to the rod 65 by a flexible connection 105 which in the present instance consists of a silk thread making a half turn around said rod and secured in a hole therein, preferably by knotting the end of the thread, and passing the same through the hole which may be tapering. When the magnets 6 are energized by the direct current, the governor-armature 66 of soft iron is attracted to the cores 63, 63' into the grooves 64 which constitute the pole-pieces for said armature, and thereby the normally maintained contact between the points 8 and 81 is broken by the armature striking the finger 77 and drawing the arm 75 which carries the contact 81 away from the contact 8. The circuit of the magnets 6 as more fully explained by reference to the diagram shown in Fig. 1, is now opened between the points 8 and 81 and the magnets thereby deenergized, whereupon by the combined action of the leaf spring 79, which acts against the upturned finger 78 of the arm 75, and the spring 72, which through the pin 71 acts on the pivoted upright rod 7, the arm 75 is forced back to its normal position so that the circuit of the magnets is again closed at the points 8 and 81; and at the same time the finger 77, which is rigid with the pivoted rod 7, acts on the governor-armature and throws the same outward away from its pole-pieces with considerable force so that said armature is carried outside the magnetic attraction of the magnets. The partial rotation of the pivoted rod 65 causes the thread 105 to pull on the spring 10 until the contact is closed at the points 102 and 103, and the centrifugal action of the governor causes said spring to be slightly bent so that it operates as a lever with the contact point 103 as a fulcrum. The spring 10 thus serves to limit the motion of the governor, to bring it to rest and to cause it to move back toward its original position within the magnetic attraction of the magnets whereupon, the magnets being energized (the magnet-circuit having been closed at the points 8 and 81) again attract the governor armature and the cycle is repeated.

It will be obvious that by suitably varying the adjustable contact screw 103, the tension of the spring 72 and the position of the balls on the governor, the period of oscillation of the latter may be varied throughout a wide range so that a circuit connected in series with the contacts 102, 103 may be opened and closed as many times per minute as desired.

Any suitable source of varying current produced in any suitable manner, as for example, by the vibrator 11, may be connected in series with the contacts 102, 103. In

order to regulate the strength of the varying currents which produce the busy signal, I provide the inductance L connected in the circuit carrying said current and provided
5 with the adjustable core 12.

It is desirable that means be provided for preventing sparking at the contacts 51 and 53, 8 and 81, and 112 and 114, and in the present case I prefer to use for this purpose the
10 non-inductive resistances R R' R'' secured respectively to the under sides of the slabs 2, 3 and 4 by brackets such as shown at 13, 13, together with the condensers C C' C'' . In order to secure a compact construction
15 and to minimize and simplify the circuit-connections, I prefer to house said condensers in a casing 17 secured as shown to the base by the strips 171, and to mount the inductance coil L on said casing. The various
20 sets of conductors are brought through the holes 14, 141 and 142 of the block 1' which is secured to the base 1 and the condenser and inductance connections respectively are brought through said block as shown at 15
25 and 16, so that the various circuits may be joined in the space left between the base and the block 1'.

The apparatus may be inclosed in a dust-proof casing 18 which rests upon the base
30 and is provided with a top 181 of glass or other transparent material.

Referring to the diagram shown in Fig. 1, which shows schematically the various devices above described, and in which the
35 timer mechanism is omitted for clearness, B represents a battery or other suitable source of current, F F' are fuses which may be employed, and S S' are switches. Upon the closure of the switch S the current from the
40 battery B energizes the howler by way of the binding post a , contacts 51, 53, point o , thence through the winding of the magnet 5 and back to the battery by way of the binding post b . By the operation of the howler
45 a varying difference of potential is produced between the points a and o which causes a varying current of relatively large amplitude to flow from the post a to condenser C'' , thence to post d , through the non-inductive
50 resistance R to post d , thence to condenser C' and back to the point o . In this manner a varying difference of potential is developed between the posts c , d , which are connected by suitable leads to the switchboard, so that
55 when the subscriber's circuit is connected through the switchboard with the posts c , d , a varying current of relatively large amplitude is developed in his receiving set, and the condenser C'' , non-inductive resistance
60 R , and condenser C' which are connected across the contacts 51, 53 to prevent the sparking which otherwise would there take place. Upon the closure of the switch S' , the magnets 11 of the busy-back vibrator are
65 energized by current flowing by way of the

point v , posts k and j , thence through coils 11 to point p , vibrating armature 111, spring-contact 114, contact-point 112, and thence back to the battery by way of the post 1. Thus there will be developed between the
70 post j and the point p a varying difference of potential which will cause current to flow from the post j to the point s , thence to the post m , the switchboard connections, the post n , and t , inductance L , post g , contacts 103, 102, post h , post i and back to the point p .
75 In this manner when the operator makes the proper connection at the switch-board, a vibratory current having the basic or fundamental frequency determined by the period
80 of the busy-back vibrator, will be developed in the subscriber's circuit at a cadence determined by the rate of vibration of the spring 10 which carries the contact 102. At the same time the non-inductive resist-
85 ance R'' is connected across the contacts 112 and 114 to prevent the sparking which otherwise would there occur. The current for energizing the magnets 6 flows from the battery B by way of the points v , g , u , the bind-
90 ing post f , contacts 8, 81, arm 75, vertical rod 7, pin 71, spring 72, thence through the magnets 6 and back to the battery by way of the post e and point r . Across the contacts 8,
95 81 the non-inductive resistance R' and condenser C are connected in series, the circuit being traced from the contact 81 to resistance R' , thence to condenser C , and back to the contact 8 by way of the point u , the
100 function of this arrangement being to prevent sparking at the contacts 8, 81. The contacts 102, 103, being connected in series with windings 11 and the inductance L , do not require other protection against
105 sparking.

It will be understood that while I have described with some particularity one form of apparatus an dcircuit arrangements whereby my invention has been successfully practiced,
110 I do not wish to limit myself thereto inasmuch as both the apparatus and circuit arrangements may be subjected to a wide range of variation without departing from the spirit of my invention.

I claim:

1. In a telephone signaling system, the combination with a source of direct current and an electrically-operated vibrator arranged to vary the same, of a circuit connected in shunt with the winding of said vi-
120 brator, a pair of contacts in said circuit and automatic means for periodically closing and opening said circuit at said contacts.

2. In a telephone signaling system, the combination with a source of direct current and an electrically-operated vibrator arranged to vary the same, of a circuit connected in shunt with the winding of said vi-
125 brator, a pair of contacts in said circuit and automatic means for periodically closing and
130

opening said circuit at said contacts at a rate lower than the frequency of said vibrator.

3. In a telephone signaling system, the combination with a source of direct current and an electrically-operated vibrator arranged to vary the same, of a circuit connected in shunt with the winding of said vibrator, a pair of contacts in said circuit and automatic electrically-operated means for periodically closing and opening said circuit at said contacts.

4. In a telephone signaling system, the combination with a source of direct current and an electrically-operated vibrator arranged to vary the same, of a circuit connected in shunt with the winding of said vibrator, a pair of contacts in said circuit and automatic electrically-operated means for periodically closing and opening said circuit at said contacts at a rate lower than the frequency of said vibrator.

5. In a telephone signaling system, a source of direct current, means in series therewith for periodically varying the same and automatic electrically-operated means also in series with said source of direct current for periodically interrupting the varying current produced by the first mentioned means.

6. In a telephone signaling system, a source of direct current, a vibrator in series therewith and automatic electrically-operated means also in series with said source of direct current for periodically interrupting the varying current produced by said vibrator.

7. In a telephone signaling system, a source of direct current, a vibrator in series therewith and automatic electrically-operated means also in series with said source of direct current for periodically interrupting the varying current produced by said vibrator at a rate lower than the frequency of said vibrator.

8. In a telephone signaling system, a source of direct current, a vibrator in series therewith, a circuit associated with said vibrator, a pair of contacts in said circuit and automatic electrically-operated means also in series with said source of direct current for periodically closing and opening said circuit at said contacts.

9. In a telephone signaling system, a source of direct current, a vibrator in series therewith, a circuit associated with said vibrator, a pair of contacts in said circuit and automatic electrically-operated means also in series with said source of direct current for periodically closing and opening said circuit at said contacts at a rate lower than the frequency of said vibrator.

10. In a telephone signaling system, a source of direct current, a vibrator in series therewith, a circuit connected in shunt with

the winding of said vibrator, a pair of contacts in said circuit and automatic electrically-operated means also in series with said source of direct current for periodically closing and opening said circuit at said contacts.

11. In a telephone signaling system, a source of direct current, a vibrator in series therewith, a circuit connected in shunt with the winding of said vibrator, a pair of contacts in said circuit and automatic electrically-operated means also in series with said source of direct current for periodically closing and opening said circuit at said contacts at a rate lower than the frequency of said vibrator.

12. In a telephone signaling system, the combination with a source of direct current and a continuously-operating electrical vibrator arranged to periodically vary the same, of an automatically acting timer for periodically varying said current to produce a distinctive signal, means for preventing sparking at the contacts of said vibrator, and other means for preventing sparking at the contacts of said timer.

13. In a telephone signaling system, the combination with a source of direct current and a continuously-operating electrical vibrator arranged to periodically vary the same, of an automatically acting timer for periodically interrupting said current to produce a distinctive signal, a non-inductive resistance bridged across the contacts of said vibrator and a circuit including a condenser and a non-inductive resistance bridged across the contacts of said timer.

14. In a telephone signaling system, a base having a howler, a busy-back timer and busy-back vibrator secured thereon, three sets of condensers, three non-inductive resistances, and three circuits connected across the circuit controlling contacts of said howler, timer, and vibrator, respectively; the circuit across the howler-contacts serially including one of said non-inductive resistances and two of said condensers, the circuit across the timer-contacts serially including another one of said non-inductive resistances and the third condenser, and the circuit across the vibrator contacts including the third non-inductive resistance.

15. In a telephone signaling system, a base having a howler, a busy-back timer and busy-back vibrator secured thereon, three sets of condensers arranged in a casing mounted on said base, three non-inductive resistances mounted on said base, and three circuits connected across the circuit controlling contacts of said howler, timer and vibrator, respectively; the circuit across the howler-contacts serially including one of said non-inductive resistances and two of said condensers, the circuit across the timer-contacts serially including another one of

said non-inductive resistances and the third condenser, and the circuit across the vibrator contacts including the third non-inductive resistance; and an adjustable inductance for regulating the strength of the varying current produced by said vibrator, said adjustable inductance being mounted on said casing.

In testimony whereof, I have hereunto subscribed my name this 9th day of March 10 1910.

EGMONT MAX TORMIN.

Witnesses:

GEO. K. WOODWORTH,
E. B. TOMLINSON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
