(No Model.) 6 Sheets—Sheet 1.

D. H. RICE.

TELEPHONE CALL.

No. 446,614. Patented Feb. 17, 1891.

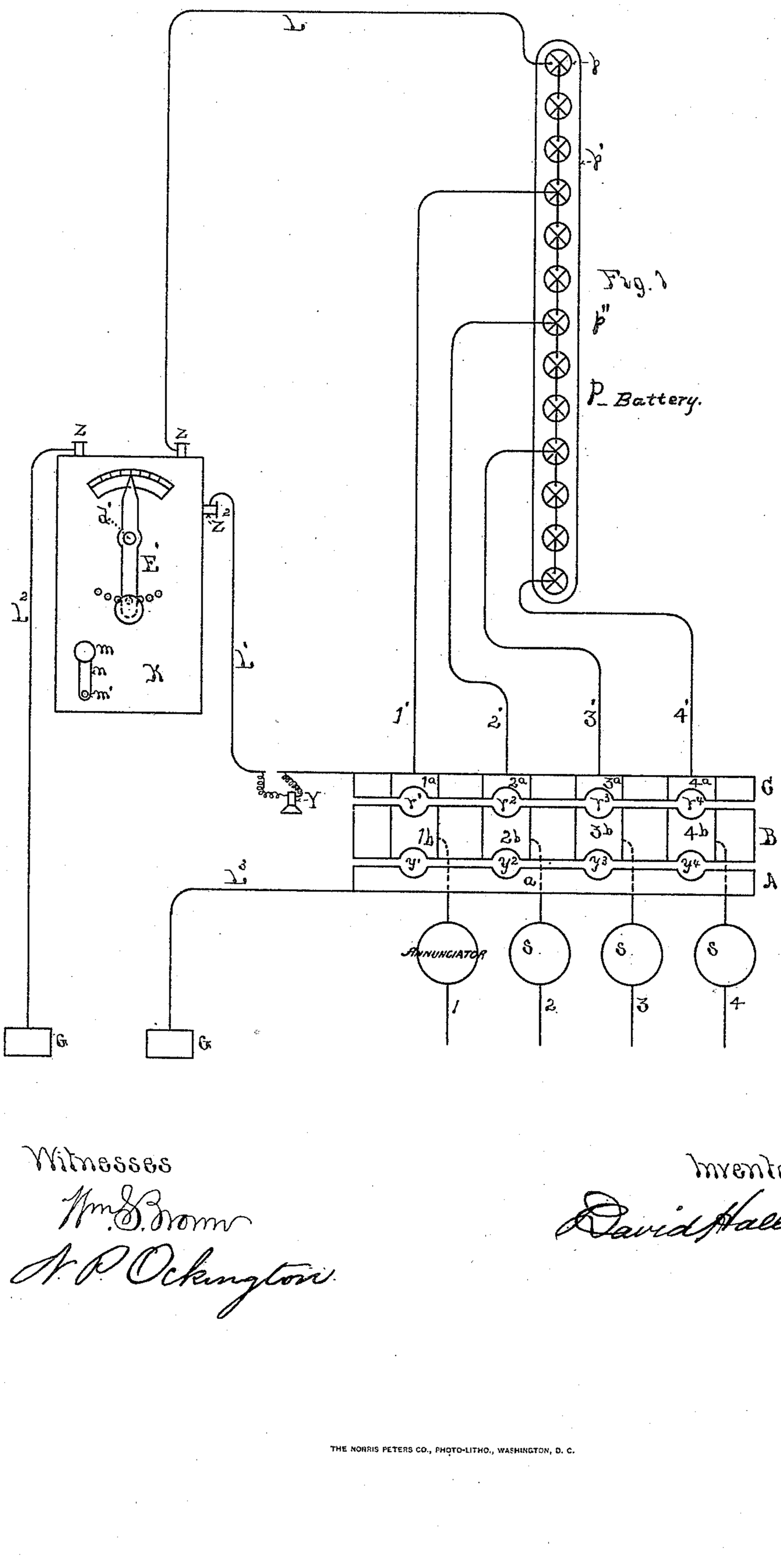

Fig. 1

Witnesses

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Fig. 2

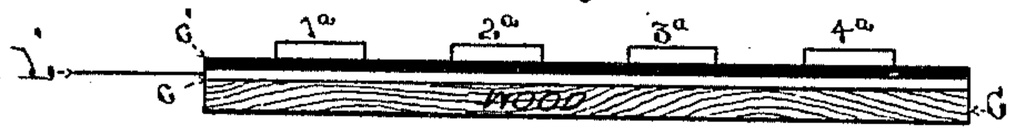


Fig. 3

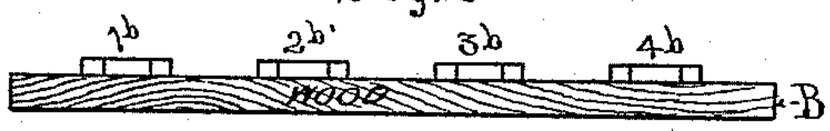
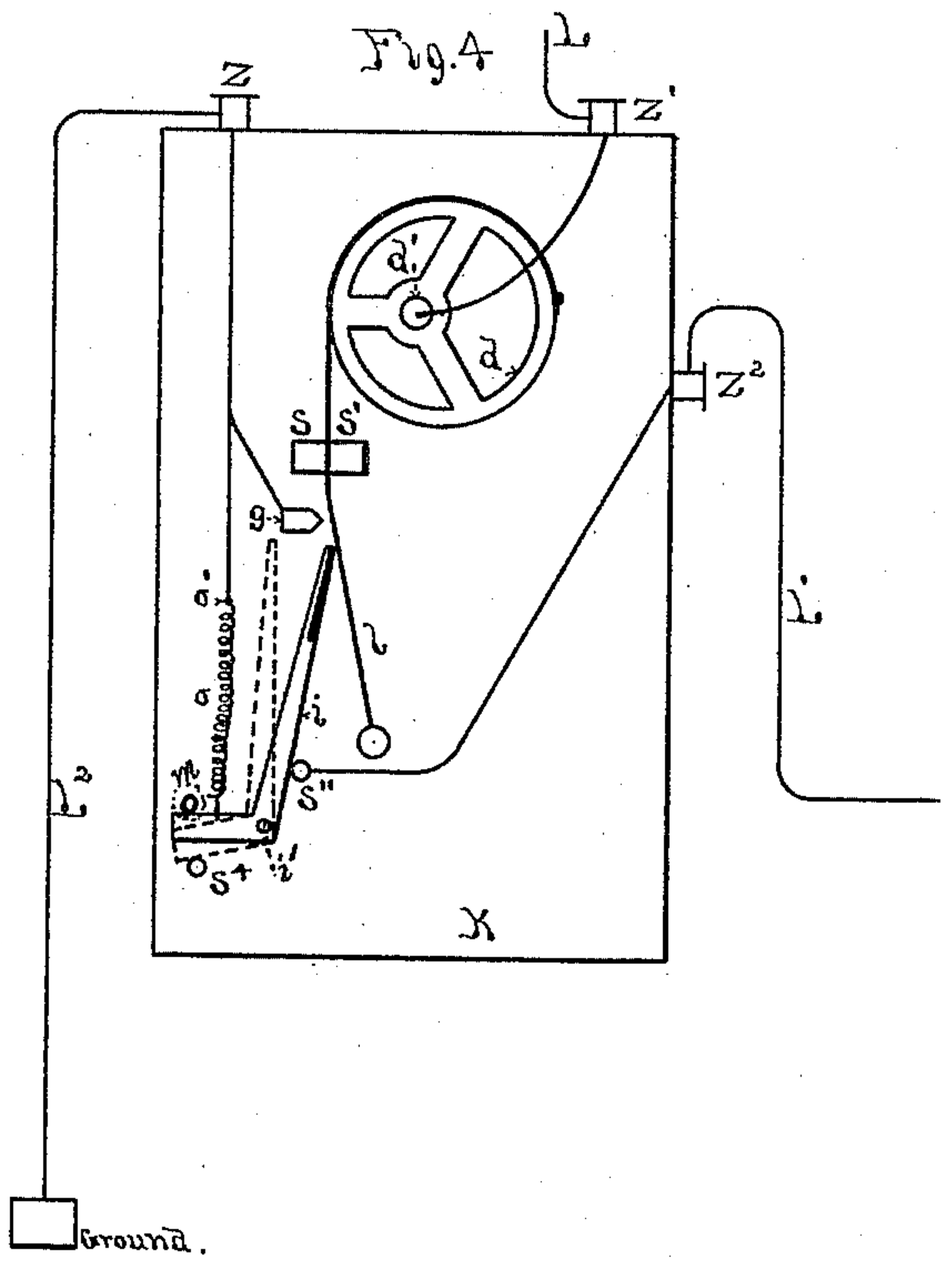


Fig. 4



Witnesses
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6 Sheets—Sheet 3.

D. H. RICE.

TELEPHONE CALL.

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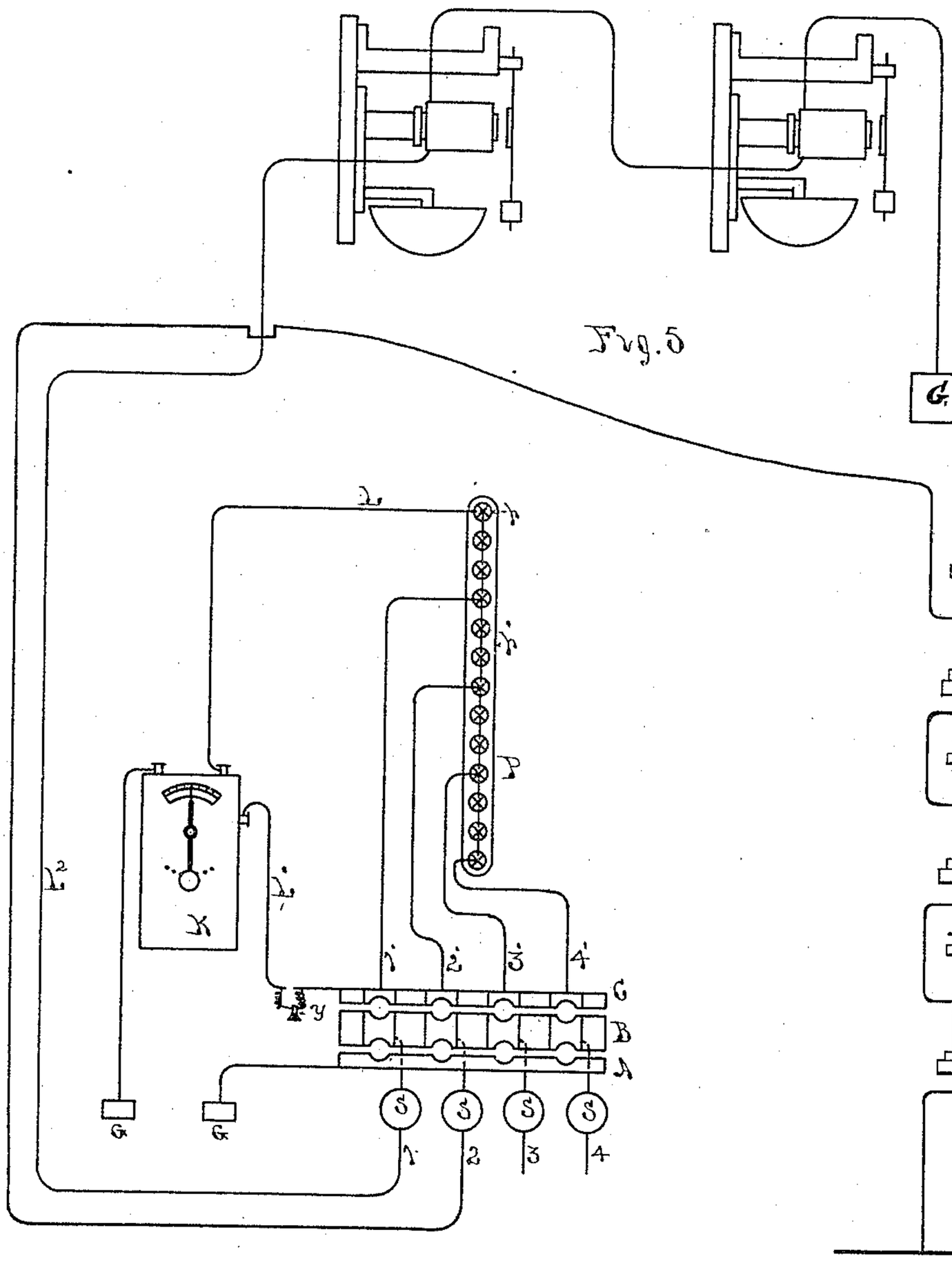
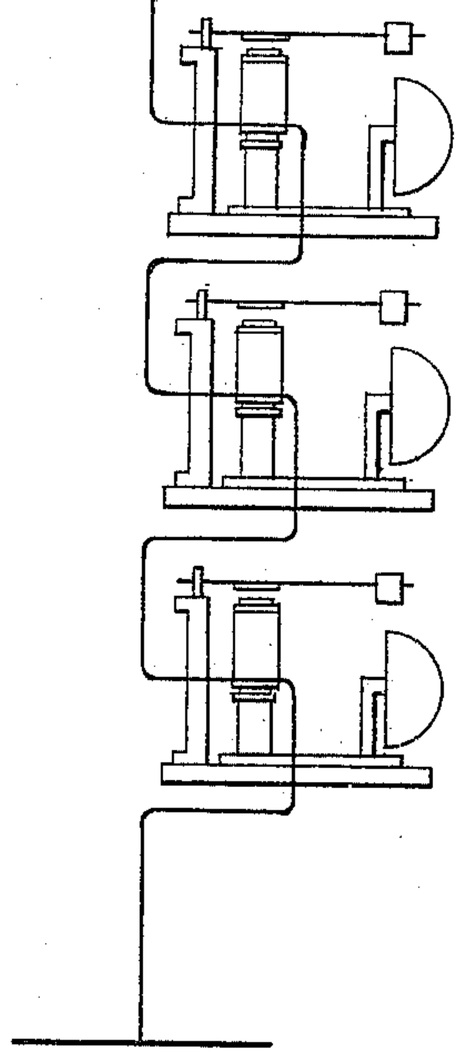


Fig. 5



Witnesses
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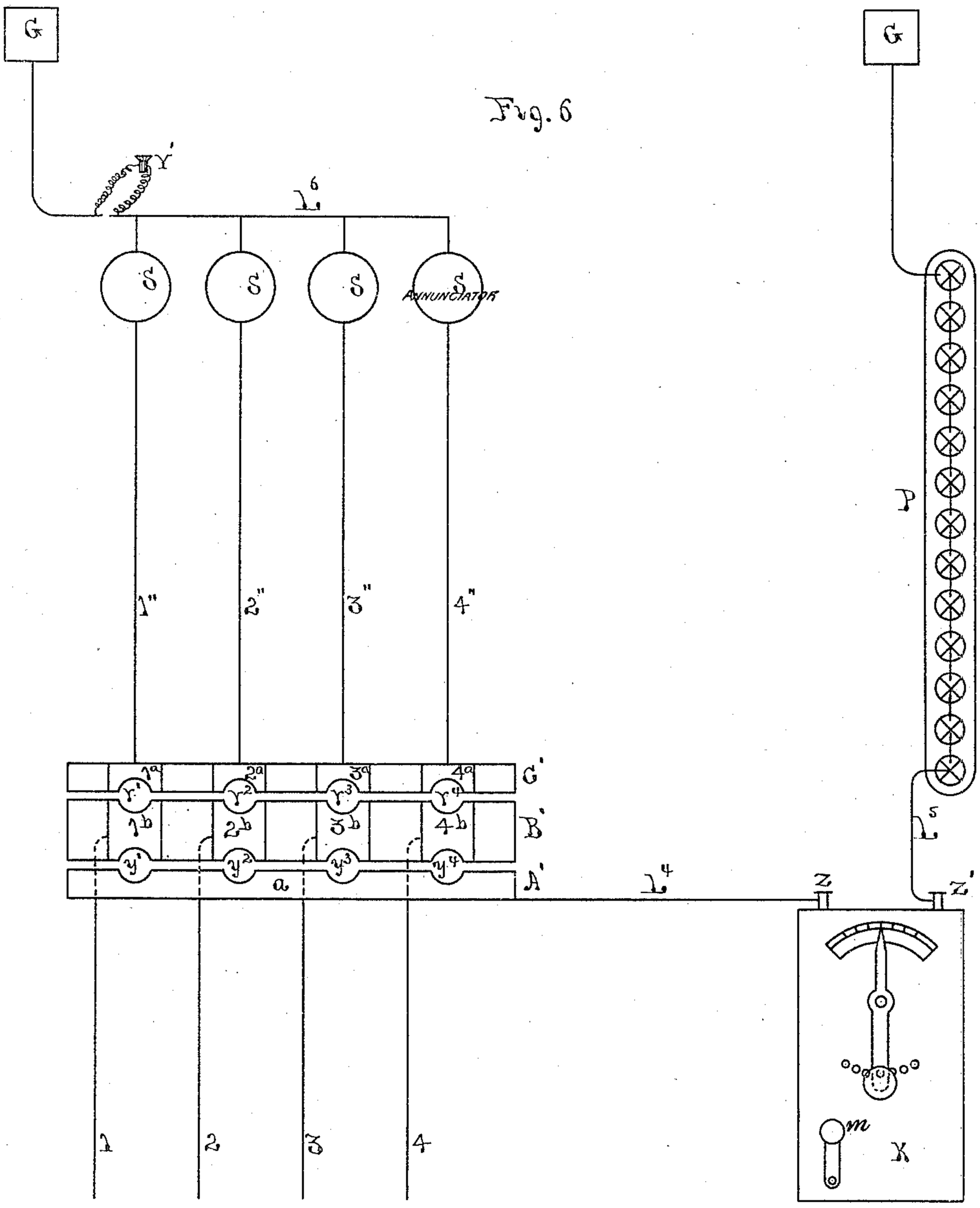
TELEPHONE CALL.

No. 446,614. Patented Feb. 17, 1891.

Fig. 6



Witnesses
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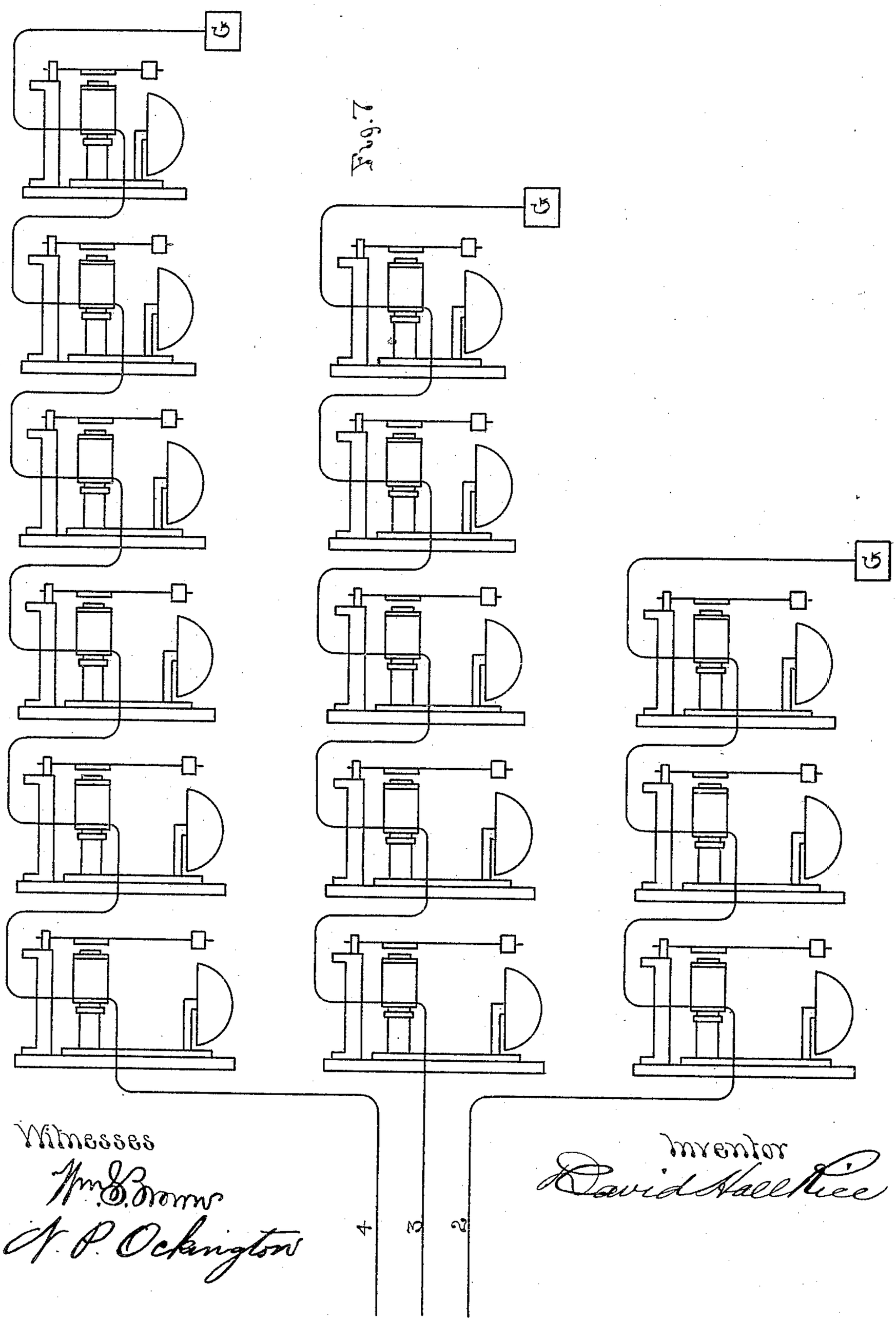
(No Model.)

6 Sheets—Sheet 5.

D. H. RICE.

TELEPHONE CALL.

No. 446,614. Patented Feb. 17, 1891.



Witnesses
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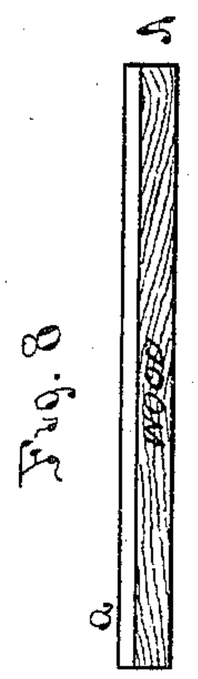

Fig. 8.

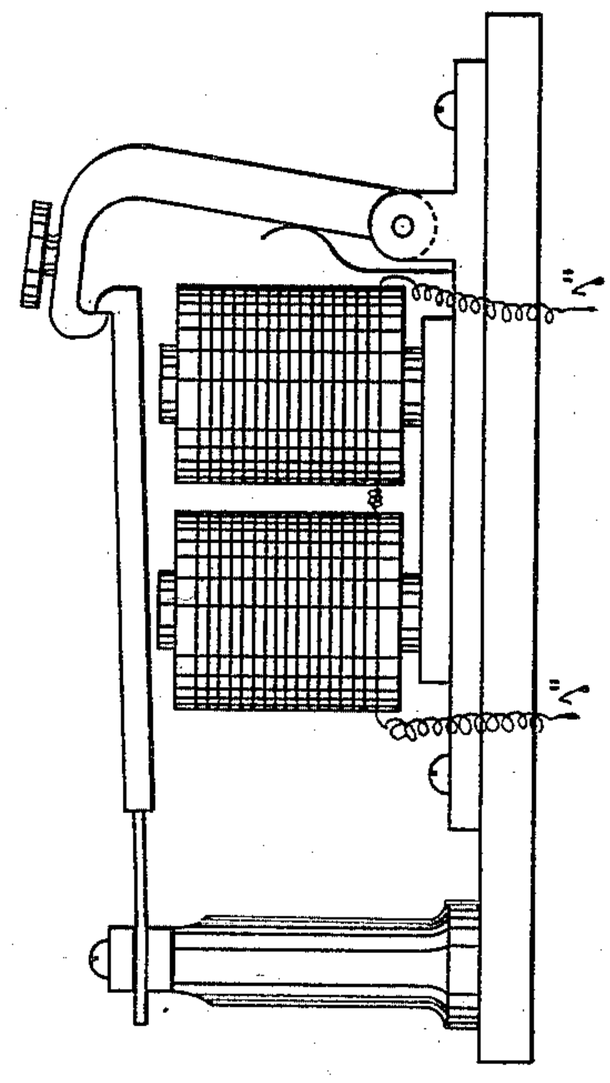

Fig. 9.

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UNITED STATES PATENT OFFICE.

DAVID HALL RICE, OF LOWELL, MASSACHUSETTS, ASSIGNOR TO THE CURRIER TELEPHONE BELL COMPANY, OF MASSACHUSETTS.

TELEPHONE-CALL.

SPECIFICATION forming part of Letters Patent No. 446,614, dated February 17, 1891.

Application filed October 15, 1881. Serial No. 43,846. (No model.)

To all whom it may concern:

Be it known that I, DAVID HALL RICE, of Lowell, in the county of Middlesex and State of Massachusetts, have invented a new and useful Improvement in a System of Telephone-Calls, of which the following is a specification.

My invention relates to the system of individual telephone call-bells and calling apparatus patented to Jacob B. Currier August 30, 1881, No. 246,374; and it consists, first, in placing upon an independent ground connection the magnets drop-button or other equivalent mechanism for enabling the subscriber to call the central office in such a manner that the operation of the caller will not affect the drop-button, as hereinafter described; secondly, in connecting several independent electrical circuits with the same vibrating calling-instrument by means of a switch mechanism, thereby enabling one calling-instrument to be used on any number of circuits; thirdly, in a novel manner of connecting several circuits to the battery and calling-instrument, so as to apportion to each circuit when it is connected with the battery the proper amount of electrical power to ring the number of bells on that circuit, thus preventing the use of an excess of battery-power on any circuit and consequent expense, as well as causing the individual bells on the circuit to ring more perfectly and certainly; fourthly, to arranging the bells on two or more subscribers' circuits so that one or more bells on one of the circuits shall correspond in the respective times of the vibrations of their armature-hammers with the respective times of the vibrations of the armature-hammers of a like number of bells (each with each) upon the other circuit, all the different bells upon either one of the circuits alone varying from each other in time of vibration of their hammers, as described in said Currier patent, the object of this part of the invention being to enable a single calling device to call any bell upon any circuit of the exchange which may be switched onto it, and thus save the annoyance and expense of providing and working a calling device for each separate circuit or one having a different scale to which it is adjusted for each circuit, as heretofore used.

In the drawings, Figure 1 is a plan view of my improved electrical system. Fig. 2 is an edge view of a part of the switch-board. Fig. 3 is an edge view of another part of the switch-board. Fig. 4 is a view of the calling-instrument with its working parts exposed to view, containing an automatic non-battery circuit leading through it. Fig. 5 represents a complete circuit with the bells on the different stations and my ground connection. Fig. 6 is a view of my novel arrangement of the drop-button mechanism upon the independent ground-circuits at the central station. Fig. 7 represents circuits 2, 3, and 4 complete with a different number of bells at the different stations, a like number of which on each circuit have their vibrating hammers respectively vibrating on the times of the hammers of the bells of any other circuit. Fig. 8 shows a side view of the strip of wood A of the switch, with its strip of brass *a* on top of it, as hereinafter described. Fig. 9 shows a side view of one of the drop-buttons which are placed at S in the circuits with the line connected to it, as hereinafter described.

1 2 3 4 represent four different telephone-circuits leading out to the different stations from the switch-board A B C.

In Fig. 1 circuit 1 is supposed to have two bells and telephone-subscribers on it. Circuit 2 is supposed to have three subscribers and bells at different stations upon it. Circuit 3 is supposed to have five subscribers and bells, and circuit 4 to have six subscribers and bells.

B is a strip of wood having semi-holes in its opposite edges y' y^2, &c., and r' r^2, &c., as shown in Fig. 1. On top of the wood B are a series of metal plates 1^b, 2^b, 3^b, and 4^b, having like semi-holes and corresponding to the number of circuits.

At S on the circuits are placed the common magneto drop-buttons, of any well-known construction, to enable the subscribers at the different out-stations to call the central office at which the switch and apparatus herein described are supposed to be. Each circuit is grounded beyond the farthest out-station in the usual manner. Each circuit leads to one of the metal plates 1^b 2^b, &c.

A is a strip of wood having corresponding

semi-holes to B on the edge adjacent to it and a strip of metal *a*, with like semi-holes, fastened on top of it, extending the whole length of it. From the strip *a* the line L^3 leads to the ground, as shown. A series of metal pins closely fitting the holes y' y^2, &c., and r' r^2, &c., are now placed in y', y^2, y^3, and y^4, thus grounding each circuit through L^3 and placing it in position to be called over by a subscriber to the central office.

C is a third strip of wood, with semi-holes corresponding to B on its adjacent edge. First on top of the wood is attached a strip of metal, *c*, Fig. 2, extending its whole length having corresponding semi-holes and connected to the line L′, leading to the calling-instrument, and through it to the ground over the line L^2, as hereinafter described. On this line L′ is placed the central-office telephone at Y. Next over the metal *c* of C is placed a strip of non-conducting material *c′*, as shown. On *c′* are secured metal pieces 1^a, 2^a, 3^a, and 4^a, having semi-holes corresponding to B, and strip of metal *c* below. It is of course understood that the semi-holes through the wooden strips A B C are slightly larger than the corresponding ones in the metal strips attached, so as to allow the metal pins used to make a perfect electrical contact.

From each of the metal plates 1^a 2^a, &c., leads a line 1′ 2′, &c., to one pole of the battery P, as shown. Line 1′, corresponding to circuit 1, connects with this pole of but four cells, having but two bells to be called. Line 2 2′, having more bells, connects with this pole of a greater number of cells. Line 3 3′ connects with this pole of a greater number, and line 4 4′ connects with this pole of all the battery-cells, having on it a full complement of bells. From the opposite pole of the battery the line L leads to the calling-instrument, and, as hereinafter explained, connects with the earth through it and line L^2 when the instrument is in operation, thus putting the battery in circuit.

K is the calling-instrument for setting in operation any desired bell on a circuit without sounding any other. The exterior face of it has a dial with figures indicating where the pointer is to be set to call any desired bell on a circuit. In this instance each one of the bell-hammers at station No. 1 on either circuit is supposed to vibrate in the same time, and hence with the pointer at figure 1 on the dial the caller will sound the bell at telephone-station 1 on each line, and so on for each station of like number on any circuit. This arrangement enables one calling-instrument to be used on a great number of circuits, which is advantageous. The pointer E′ of the caller is attached to the spindle *d′*. Projecting from the face of the caller is a button *m*, which slides downward in the slot *n* in the face of the caller to the position *m′* (shown in dotted line) when pressed downward by the operator to set the caller in operation.

Fig. 4 shows the internal construction of the caller. The spindle of the button *m* extends inward over the horizontal arm of the metallic lever *i*, which is pivoted to the back of the caller-case at *i′*. The caller-case is constructed of some non-conducting material. The horizontal arm of the lever *i* is drawn upward by the spiral spring *o*, which presses its vertical arm against the vibrating caller *l* and holds it in position to be set in motion when this arm of the lever is suddenly withdrawn by pressing down upon the button *m*, when the lever takes the position shown in dotted lines, Fig. 4. A drum *d*, of metal, has wound on its periphery the upper end of the vibrator *l*, and by revolving the drum the vibrator is lengthened and shortened to correspond with the bell-hammer of the station to be called. To the spindle *d′* of this drum the pointer E′ is attached. A line connects this metal spindle *d′* with the screw *z′* and line L. A metal contact-point *g* is secured in the case, so as to enable the vibrator to impinge upon it and form an electrical contact at each oscillation. The contact-point *g* is connected by a line to the screw *z* and ground-line L^2, as shown. This completes the calling-instrument for calling any bell on a circuit when the battery connection with the circuit is established.

So far as I have described it the calling-instrument is that of said Jacob B. Currier, as perfected and used by him, and I do not claim any of its parts. There has been added to it for the metal lever *i*, which is faced with non-conducting material where it bears against the vibrator *l*, the metal stop *s″*, and connecting the latter by a line to the screw z^2, and line L′, leading through the telephone and switch and magneto drop-button, and connecting the spring *o* by a line with the screw *z* and ground-line L^2, so that when the caller is in a state of rest and the battery-circuit is broken permanently for the time being there will be a non-battery circuit established through the instrument by its automatic action. This enables the telephone to be used the instant the caller has ceased to operate without further adjustment of switches and is a great convenience in working the system. When the calling-instrument is introduced in the circuit between the telephone and the subscriber's station, or between the magneto call-button and that station, this non-battery circuit through the caller is essential to enable the subscriber to call or talk with the central office with the caller at rest and the battery out of circuit, as must be done to successfully and economically operate the circuit.

Suppose it be desired to call a particular subscriber on circuit 2. The metal pin is withdrawn from the hole y^2 and placed in the hole r^2, thus breaking the ground connection of the circuit through A and connecting the pole *p″* of the battery with it through plate 2^a, and also establishing a new ground connection through metal strip *c*, line L′, tele-

phone Y, screw z^2, block s'', lever i, spring o, screw z, and line L^2. Next the button m is pressed down quickly to the position m', breaking the circuit last described at s'' and setting the vibrator l in oscillation, forming an intermittent electrical contact with the point g and grounding through L^2, thus sending an intermittent current over the circuit and sounding the corresponding bell, as described in said Currier's patent referred to. As soon as the bell is sounded sufficiently the non-battery circuit is automatically re-established through the stop s'' by the release of the button m, and the operator without further movement or delay can hear the subscriber called through the telephone Y. When done using the latter, the pin is replaced from r^2 to y^2 and the telephone battery and caller are by one movement taken out of circuit, as is desirable.

My improvement of attaching the different circuit connections 1′ 2′, &c., to the battery P, so as to connect the pole p of a different number of cells with each circuit in proportion to the number of bells thereon, is especially valuable with an individual bell-circuit in this way: the greater the number of bells in the line the greater the resistance and the more the battery-power required to ring any one bell. Hence on circuit 4, having a full complement of bells, the whole battery is attached. On circuit 1, however, or 2, there being a much less number of bells, the power exerted per bell is much greater, and, in fact, so great as to sound more than one bell when too great battery-power is used, thus destroying their individual character and increasing the expense of battery unnecessarily. This is because the individual character of the system of calling by a series of synchronous vibrations of electricity depends upon a limited amount of the electric current being employed for a circuit in proportion to the number of bells upon it, and herein it differs from other systems wherein an excess of the current does no harm, but produces a better call. If more than one battery is used to overcome this difficulty, the expense will be augmented, while if rheostats are introduced into the different circuits to equalize their resistance the same effect follows. By my method of attachment of the circuits, however, one battery is made to operate the individual bells on a number of circuits and only the necessary battery is apportioned to each circuit.

Fig. 5 shows the subscribers' stations of circuit 1, with its bells and ground connection at the outer end of the line in the usual form.

Fig. 6 shows another method of connecting the switch and its ground connection with the main circuit and placing the magneto drop-buttons at S, so as to be out of the influence of the calling mechanism. A′ B′ C′ is the switch, which is made, as before described, except that the strip C′ differs from C in having the metal strip c and line L′ omitted, Fig. 2, and the metal pieces 1^a 2^a, &c., are set directly on the wood base C′ and opposite the metal pieces 1^b 2^b, &c., as shown in Fig. 6. As before, 1, 2, 3, and 4 are the out-circuits leading to the subscribers' stations and connected to 1^b, 2^b, 3^b, and 4^b. From the metal strip a leads the line-wire L^4 to the screw-cup of the caller z, which is connected with z', as before described, the screw-cup z^2 and its corresponding connections being omitted in the calling-instrument. A line-wire L^5 leads to one pole of the battery P, while the other pole is grounded at G, as shown. Line-wires 1″, 2″, 3″, and 4″ lead from the metal switch-pieces 1^a, 2^a, 3^a, and 4^a of C′ to the wire L^6, which is grounded at G, as shown. On these independent ground connections are placed the magneto drop-buttons at S and on the wire L^6 the telephone at Y′. A series of pins closely fitting the holes r' r^2, &c., is now provided, and when in place in those holes the main circuit through the calling-instrument and battery is broken and the ground connections 1″, 2″, 3″, and 4″ are switched into circuit and the magneto drop-buttons at S allowed to operate. If it is desired to call a subscriber on any circuit—as, for instance, 2—the pin is shifted from r^2 to y^2 and the circuit through the caller K and the battery established by pressing on the button m, as before described. When the calling is done, the pin is replaced in r^2 and the telephone is ready for use. The advantage of this connection is that with many forms of magneto drop-buttons the peculiar action of this particular caller causes the spring of the magnet of the drop-button to rattle on account of its vibrating quite violently when the battery-current passes through the drop-button magnet, thus interfering with the work in the central office materially, where silence is desirable in using telephones. The vibration of the drop-button also interferes seriously with the synchronosity of the vibrations produced by the caller, because, being out of time with the latter, its armature varies the current by induction, producing a more feeble action. By my improved switch and ground connections 1″, 2″, 3″, and 4″ all this annoyance is avoided, and the same calling-instrument can be used with any number of circuits, which is also important.

It is obvious that some other form of switch may be adopted than the one I have described, operating upon the same principle to connect the circuits to the caller, telephone, and battery, and I do not confine myself to the use of pins alone for that purpose.

What I claim as new and of my invention is—

1. In combination with a number of electrical circuits provided with individual call-bells thereon adapted to be operated by synchronous pulsations of electricity, the corresponding lines 1′ 2′, &c., adapted to connect each circuit with a different number of cells of electric battery, and a vibrating calling mechanism adapted to transmit synchronous pulsations of electricity to ring one or more of said bells, substantially as described.

2. The combination of the plates 1^b 2^b, &c., with the metal strip *c* and the corresponding insulated plates 1^a 2^a, &c., and two or more electrical circuits connected to plates 1^b 2^b, &c., forming a switch mechanism, substantially as described.

3. In combination with an electric circuit leading through the caller *l*, having a vibrating armature adapted to transmit synchronous pulsations of the electric current over the circuit, and one or more vibrating alarm-strikers on the latter and battery, a switch mechanism and an independent ground connection 1″, having on it the magnet of the drop-button call, constructed and arranged substantially as described.

4. In combination with the vibrating circuit-breaker *l* by suitable intermediate connecting mechanism, two main electrical circuits, each provided with a magnet and vibrating striker adapted to be operated by said circuit-breaker and vibrating in the same time as the striker of the other circuit, substantially as described.

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