

No. 771,548.

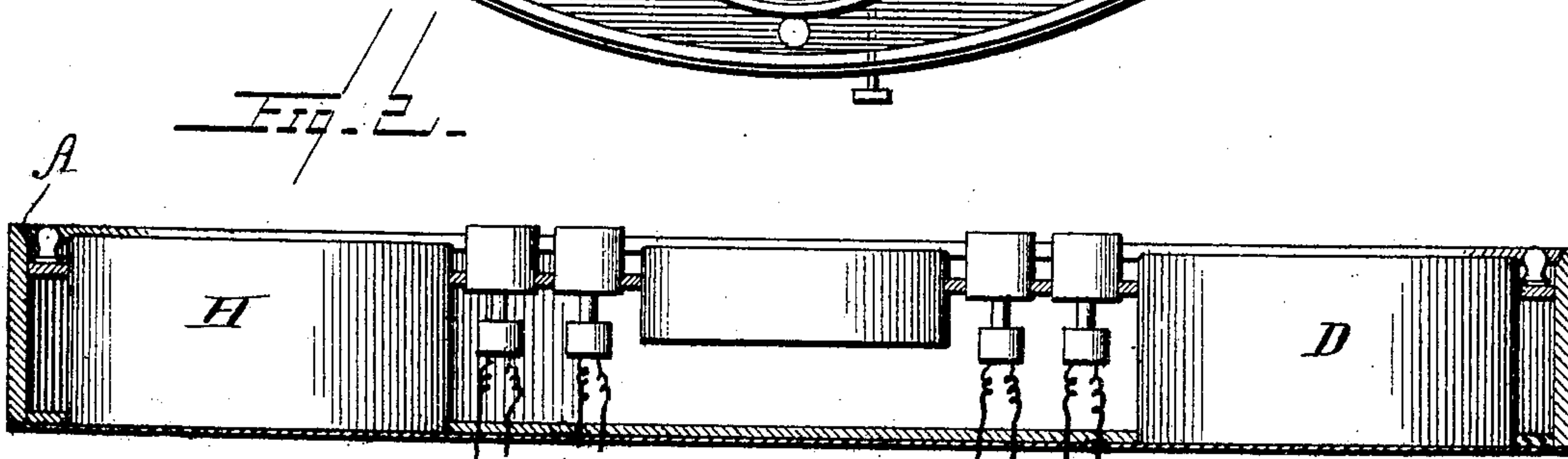
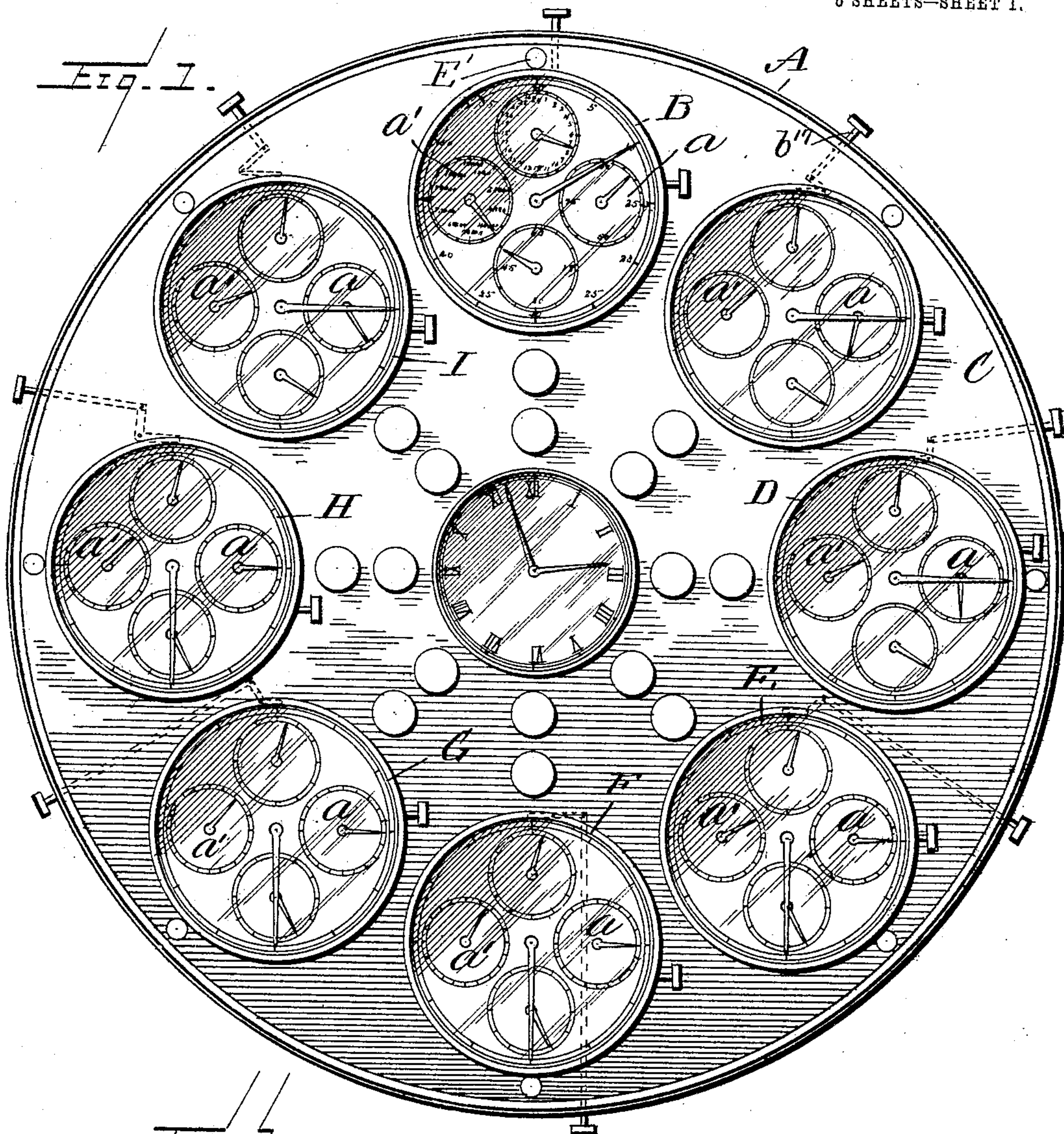
PATENTED OCT. 4, 1904.

E. K. HERTFORD.  
TELEPHONE CALL REGISTER AND TIME INDICATOR.

APPLICATION FILED JAN. 25, 1904.

NO MODEL.

5 SHEETS—SHEET 1.



WITNESSES:

*Wm. F. Doyle*  
*L. E. Barkley*

INVENTOR

*Edward K. Hertford*

BY *Frank Appleman*  
Attorney



No. 771,548.

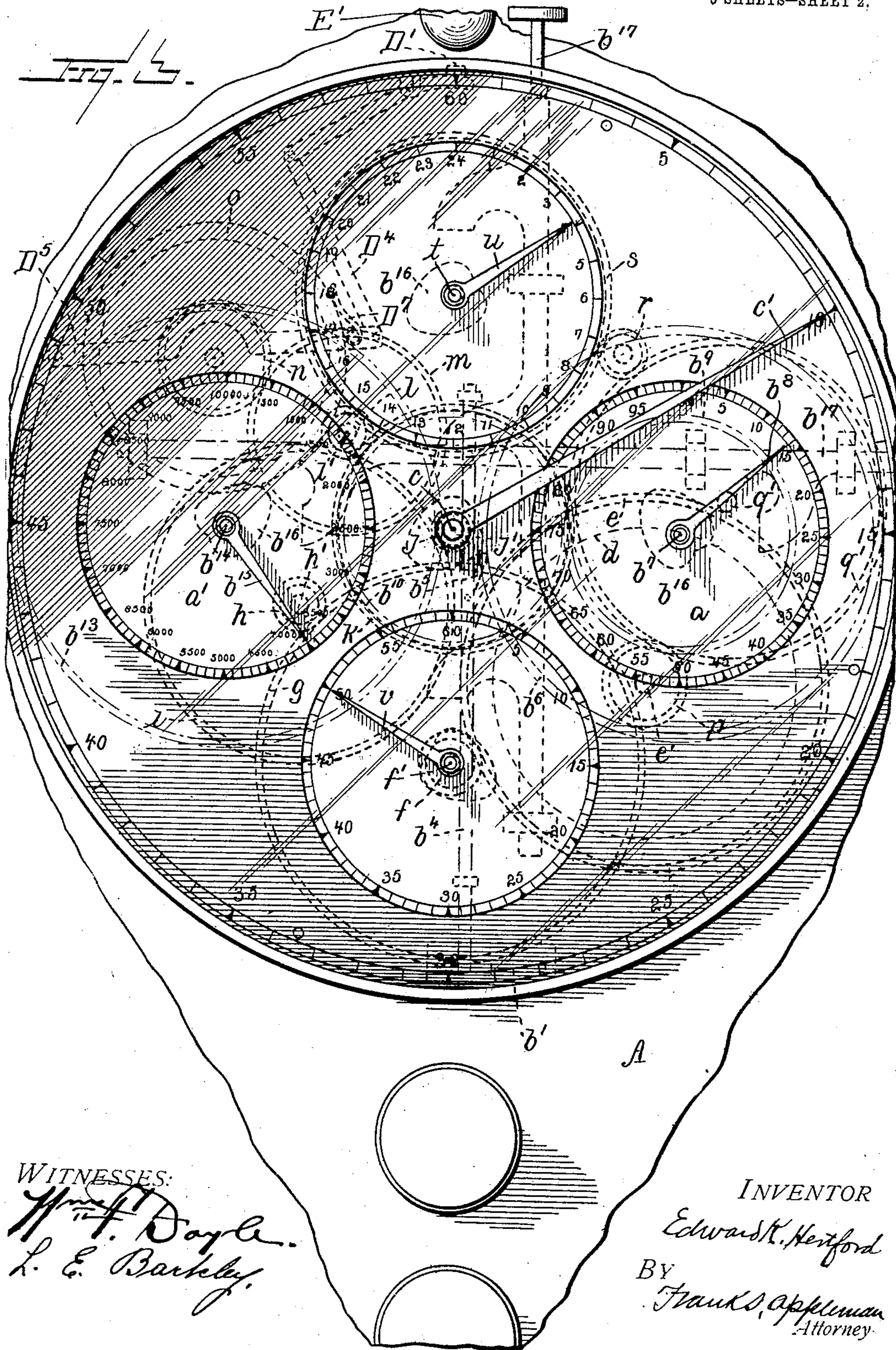
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WITNESSES:

*Wm. F. Doyle*  
*L. E. Barkley*

INVENTOR

*Edward K. Hertford*

BY

*Frank S. Appleman*  
Attorney



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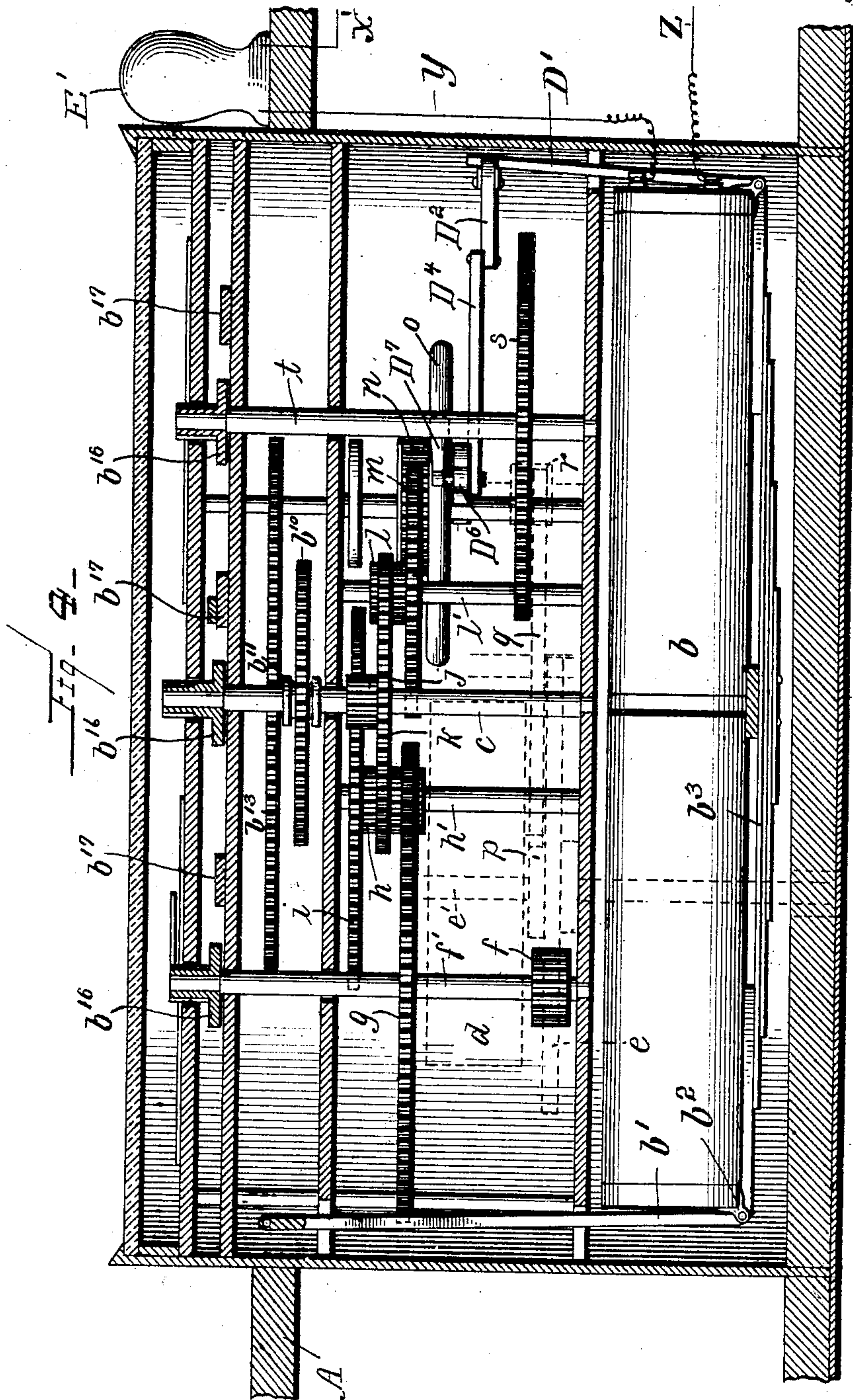
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5 SHEETS—SHEET 3.



WITNESSES:

*Wm. F. Doyle*  
*L. E. Barkley*

INVENTOR

*Edward K. Hertford*

BY *Frank S. Appelman*  
Attorney



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5 SHEETS—SHEET 4.

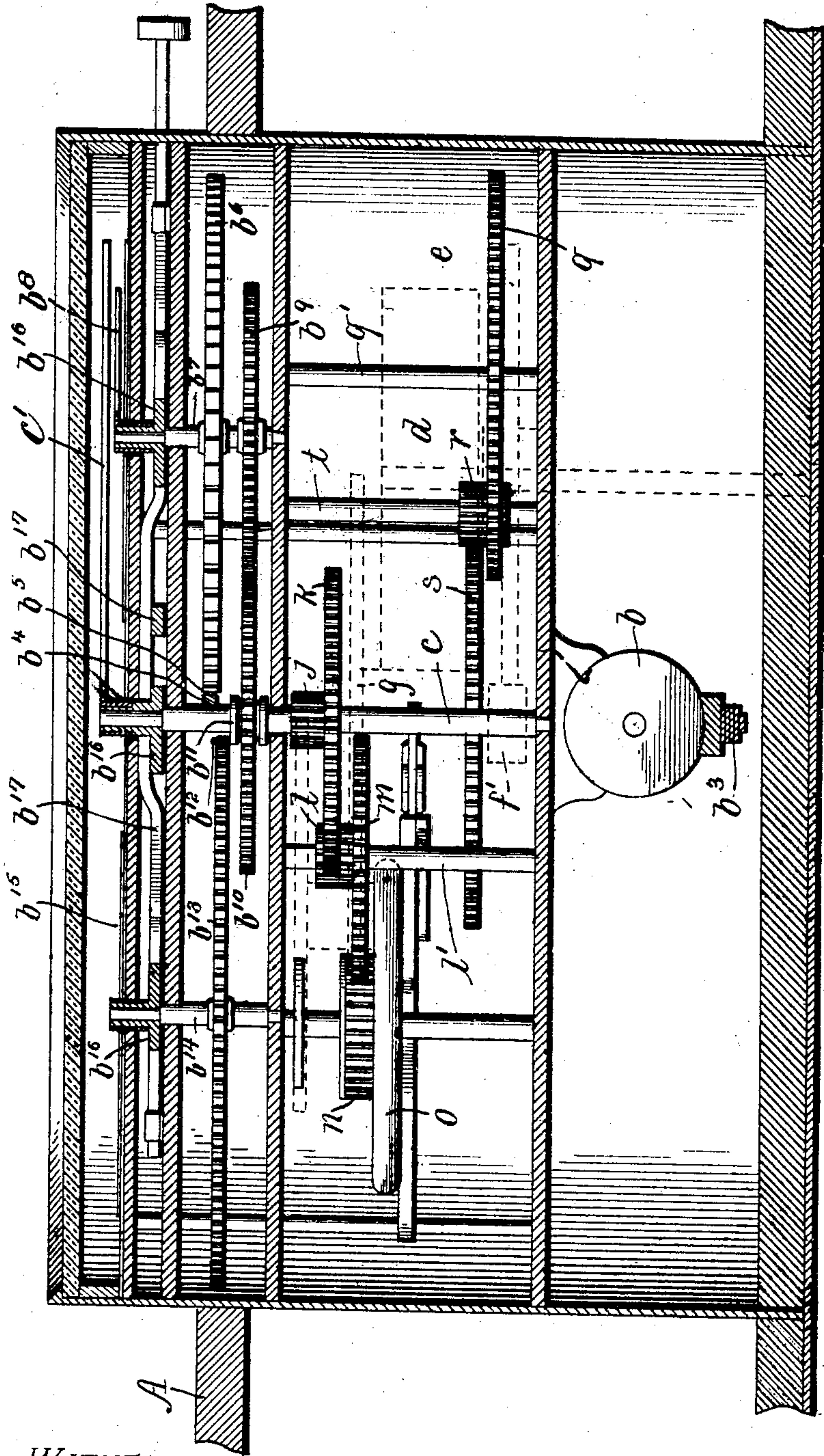


Fig. 5.

WITNESSES:

*Wm. F. Doyle*  
*L. E. Barkley*

INVENTOR

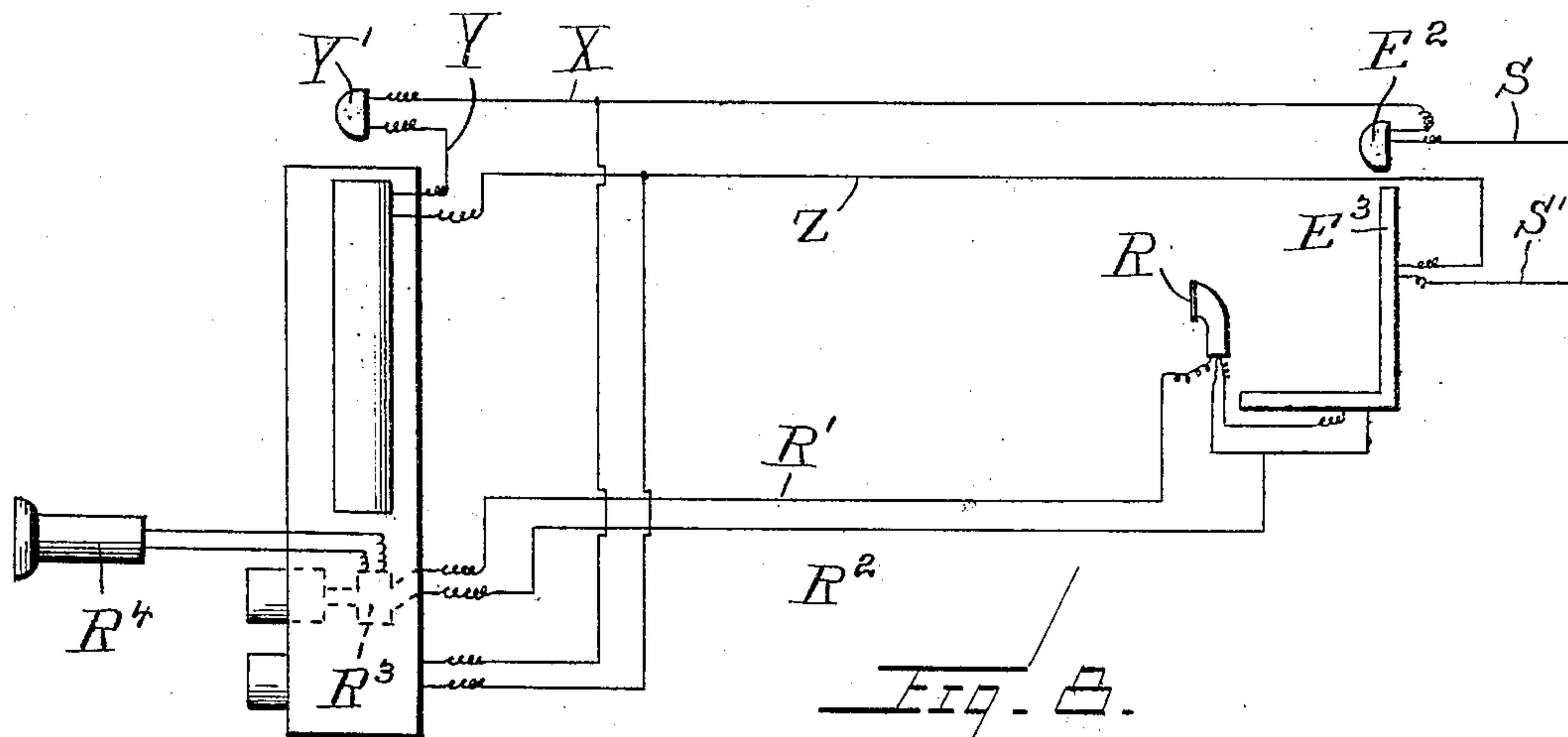
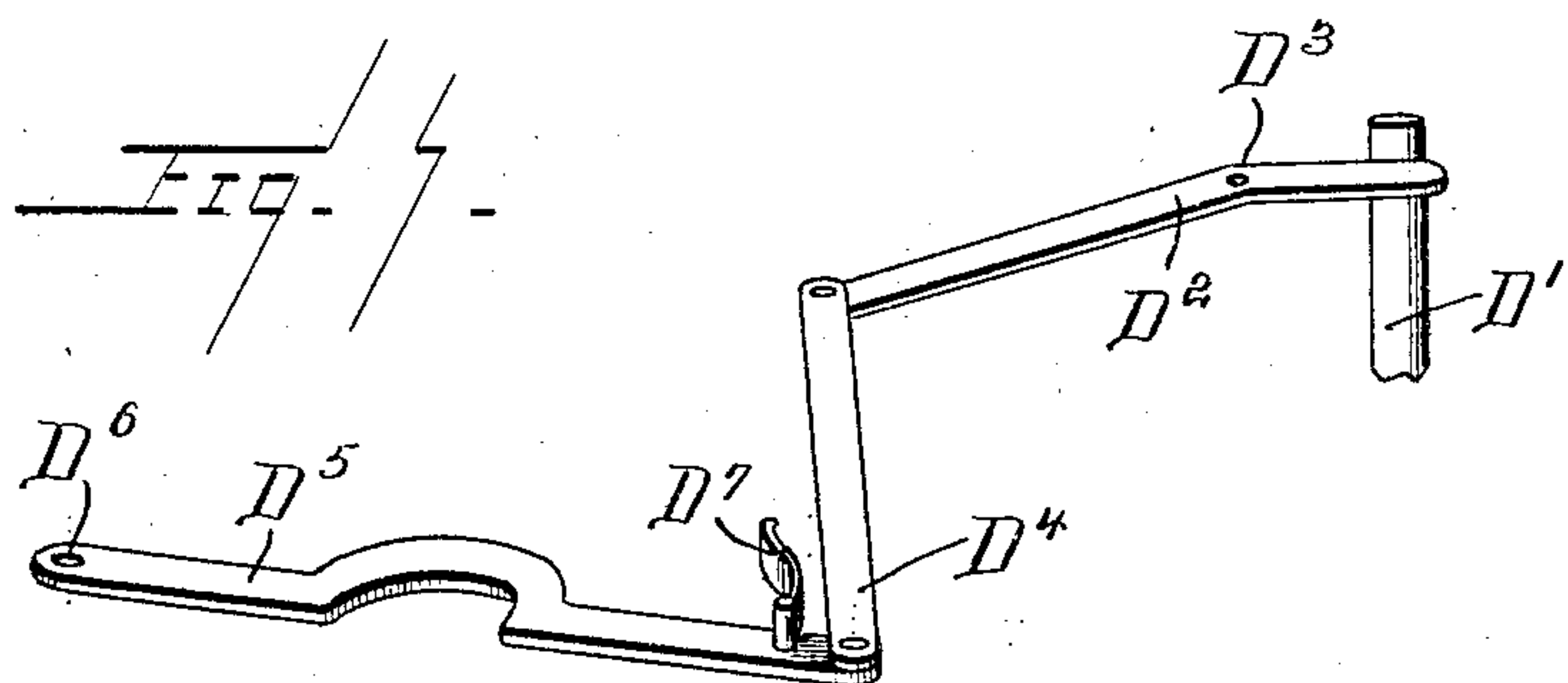
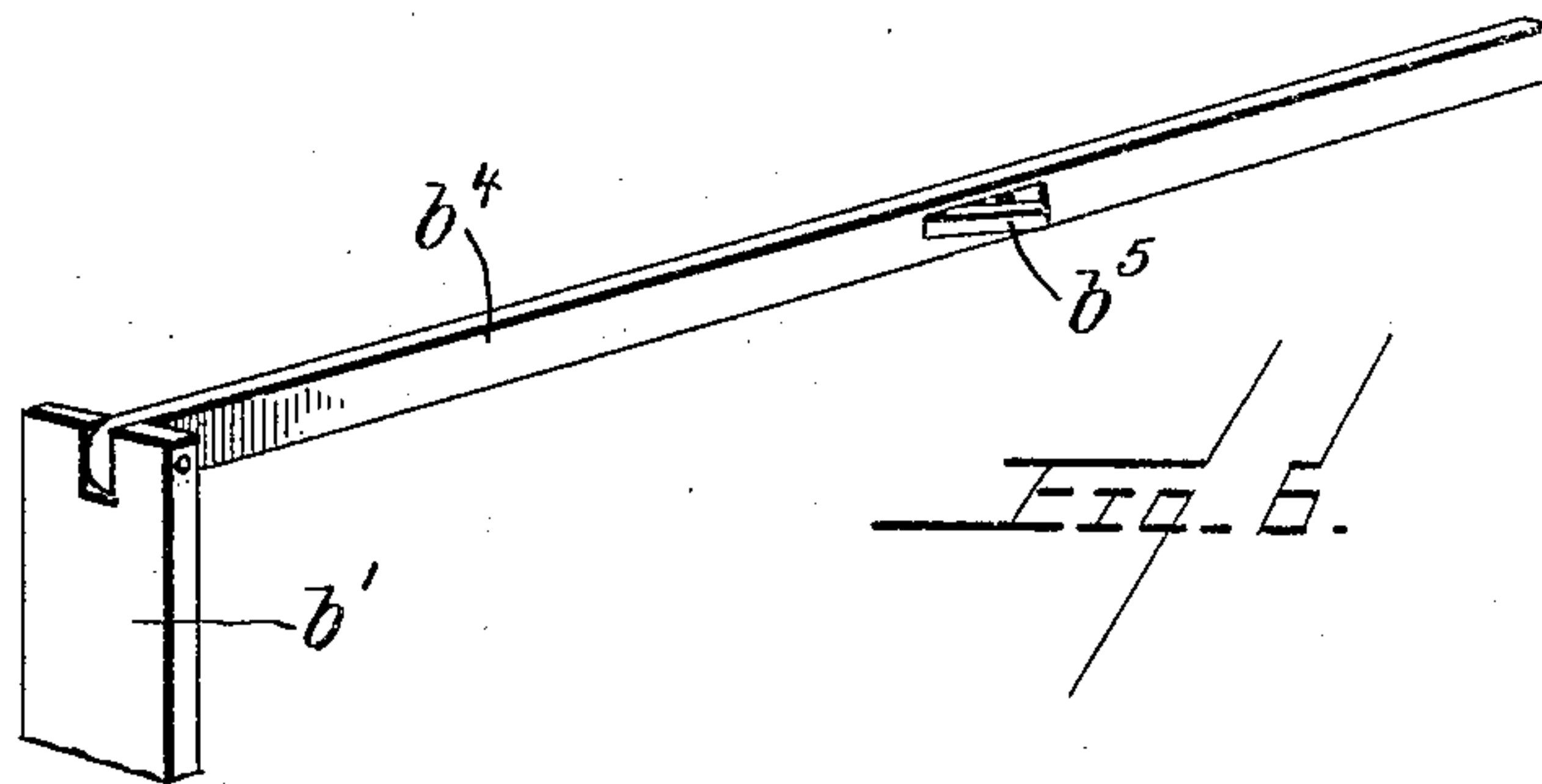
*Edward K. Hertford*  
BY  
*Frank S. Appelman*  
Attorney

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NO MODEL.

5 SHEETS—SHEET 5.



WITNESSES:

*Wm. F. Doyle*  
*L. E. Barkley*

INVENTOR

*Edward K. Hertford*  
By *Frank S. Applin*  
Attorney



# UNITED STATES PATENT OFFICE.

EDWARD K. HERTFORD, OF WASHINGTON, INDIANA, ASSIGNOR TO  
AUTOMATIC MONITOR COMPANY, OF TOLEDO, OHIO, A CORPORA-  
TION OF OHIO.

## TELEPHONE CALL-REGISTER AND TIME-INDICATOR.

SPECIFICATION forming part of Letters Patent No. 771,548, dated October 4, 1904.

Application filed January 25, 1904. Serial No. 190,562. (No model.)

*To all whom it may concern:*

Be it known that I, EDWARD K. HERTFORD, a citizen of the United States of America, residing at Washington, in the county of Daviess and State of Indiana, have invented certain new and useful Improvements in Telephone Call-Registers and Time-Indicators, of which the following is a specification.

This invention relates to indicators, and particularly to a device for registering the time consumed by operators in telephone-exchanges in answering a call or a series of calls.

An object of the invention is to produce novel means whereby the number of calls coming into a switchboard or a telephone-exchange is automatically registered, and, in combination therewith, means for indicating or registering the time consumed by the operator in "plugging out" the call or series of calls, thereby enabling the management of a telephone-exchange to figure the efficiency of an operator and ascertain the degree of perfection of the service.

Furthermore, an object of the invention is to provide novel means by starting a time mechanism at the instant the call is made on the switchboard as indicated by the pilot and line lights, means for arresting the timing mechanism, and the promptness with which a call was answered.

The invention further contemplates the provision of novel means coacting with the time-starting mechanism whereby a call-indicator is moved one degree on the receipt of each call on a section of a switchboard, it being my purpose to provide one instrument for each section of the switchboard of a telephone-exchange.

Furthermore, an object of the invention is to provide means whereby the manager or official of the company who superintends the work of the operators may observe the time of the call at a point remote from the operators occupying the sections of the switchboard, it being the purpose of this invention to have the mechanism connected electrically in series with the conductors for supplying

electricity to the lights of the switchboard and to the receiver in possession of the operator.

Finally, an object of this invention is to produce a system designed to coact with an ordinary telephone-exchange switchboard by which a register of each section is taken as mentioned above, the said apparatus being compact in structure and being comparatively simple in its construction, proving satisfactory in use, and comparatively inexpensive.

With the foregoing and other objects in view the invention consists in the details of construction and in the arrangement and combination of parts to be hereinafter more fully set forth and specifically claimed.

In describing the invention in detail reference will be had to the accompanying drawings, forming part of this specification, wherein like characters denote corresponding parts throughout the several views, in which—

Figure 1 is a view in elevation, illustrating an indicator or a series of indicators. Fig. 2 is a sectional view of the casing shown in Fig. 1. Fig. 3 is an enlarged plan view illustrating one of the sections of the indicator which is designed for the purpose of being connected to indicate one section of the switchboard. Fig. 4 is a vertical sectional view approximately centrally of Fig. 1. Fig. 5 is a sectional view taken approximately at right angles to the section shown in Fig. 4. Fig. 6 is a perspective view of the call-actuating device. Fig. 7 is a perspective view of the timing-controller. Fig. 8 is a diagrammatic view of the circuits, showing parts in elevation.

In the drawings, A indicates a casing containing a series of registers, (here shown as eight, indicated by the letters B, C, D, E, F, G, H, and I,) all of which are supposed to be connected to a switchboard of a telephone-exchange, one of said registers being electrically connected to a section of a switchboard.

The registering device is designed for the purpose of indicating the calls which are to be registered on the dials *a* and *a'*, the former numbering the calls up to one hundred and the latter being actuated so that the indicators



move one space when the indicator on the section  $a$  has made a complete rotation.

The mechanism for operating the call-indicator is automatically operated electrically and when a call is registered on a switchboard as indicated by the pilot-light and the lime-light on said switchboard. To that end a magnet is provided for each of the indicators B to I, inclusive, the said magnet being electrically connected to an ordinary switchboard, or it may be connected with the pilot-light, so that when the pilot-light is plugged out by an operator the current through the magnet is broken. It is also my purpose to have the apparatus connected to the supervisor below the "ring-off" light as well as to the original pilot-light in order that there may be indicated on the timing and call mechanism the time consumed by the operator in disconnecting or cutting out the subscribers after they have finished their conversation.

Referring to Fig. 4, a magnet  $b$  is illustrated having a double pole, one pole of which is designed for the purpose of actuating a time-arresting mechanism (to be hereinafter described) and the other pole being designed for the purpose of attracting the armature  $b'$ , which armature is hinged to the ears  $b^2$ . The armature  $b'$  has an angular extension lying under the magnet, which is engaged by a spring  $b^3$ , here illustrated as an ordinary leaf-spring. The spring shown holds the armature normally out of contact with the pole of the magnet; but the tension of the spring is such that it is overcome when the magnet is energized and the armature is attracted thereby. To the upper end of this armature  $b'$  is pivotally connected an operating-arm  $b^4$ , which has struck therefrom a pawl  $b^5$ , designed and positioned to engage successively the teeth of the toothed wheel  $b^6$  on the spindle  $b^7$ , the said spindle carrying the indicator  $b^8$ , which travels over the face of the register  $a$ .

Each time the magnet is energized, which occurs each time the pilot-light is illuminated, the armature is attracted and the operating-arm is projected to bring the pawl into engagement with a tooth of the wheel  $b^6$ , thereby moving the said wheel the distance of one tooth. On the retrograde movement of the operating-arm the yielding action of the pawl permits it to ride over and back of the next succeeding tooth for a repetition of the operation just mentioned.

Referring to Fig. 5, it will be observed that a gear-wheel  $b^9$  is mounted to turn with the spindle  $b^7$  and meshes in turn with a gear-wheel  $b^{10}$ , which is loosely mounted on the central arbor  $c$  of the timing mechanism. The gear-wheel  $b^{10}$  carries a collar  $b^{11}$ , which rotates with the said wheel, and projecting from the upper surface of the collar is a stud  $b^{12}$ , which with each rotation of the collar engages a tooth of a gear-wheel  $b^{13}$ , which is mounted

on a spindle  $b^{14}$ , the last-named spindle carrying an indicator  $b^{15}$ , which is moved one space of the registering-surface.

In order to give an example of the operation, reference will be had to Fig. 3, in which the registers  $a$  and  $a'$  stand at "14" and "4,000," respectively, thus showing that the indicator  $b^8$  has turned forty times and has moved in addition thereto fourteen spaces on another revolution, thus designating that four thousand and fourteen calls have been made on the section of the switchboard to which this particular indicator is connected.

I may, if found desirable, restore the indicators to the zero-point, which action might be termed a "neutralization" of the indicators. I accomplish this result by an old mechanism common to stop-watches through the medium of cams  $b^{16}$  and a sliding rod  $b^{17}$ , designed to turn the indicators at the will of the operator. As such neutralizing mechanism is old in the art, a detail description of the means by which it is accomplished need not, it is thought, be given.

Having now described the manner of registering the calls, the timing mechanism will be disclosed.

In Fig. 3 the gearing for the timing mechanism is well shown in dotted lines, and as any ordinary timing movement may be employed it is believed unnecessary to dwell at length on this phase of the combination.

The outline of the mainspring of the timing mechanism is shown by the dotted line  $d$ , and the gear-wheel  $e$  is mounted on the arbor  $e'$ , rotated by the mainspring. The gear-wheel  $e$  is in mesh with the pinion  $f$  on the arbor  $f'$ .

A gear-wheel  $g$  is carried by the arbor  $f'$ , and it meshes with a pinion  $h$  on the arbor  $h'$ . A gear-wheel  $i$  is carried on the arbor  $h'$ , the said wheel  $i$  meshing with the pinion  $j$  on the arbor  $j'$ . The arbor  $j'$  carries a wheel  $k$ , meshing with a pinion  $l$  on the arbor  $L'$ . A gear-wheel  $m$  on the arbor  $L'$  meshes with the pinion  $n$ , which pinion is controlled by the balance-wheel  $o$ .

By means of the train of gearing described the arbor  $c$  of the seconds-hand  $c'$  is rotated, the said seconds-hand being of the sweep type.

A pinion  $p$  is carried by the arbor  $e'$ , and a gear-wheel  $q$  on the arbor  $q'$  meshes therewith and with the pinion  $r$ , which pinion  $r$  meshes with the wheel  $s$  on the arbor  $t$  of the hour-hand  $u$ . The minute-hand  $v$  is mounted on the arbor  $f'$ , and by the gearing described the seconds-hand  $c'$ , the minute-hand  $v$ , and the hour-hand  $u$  are moved.

It is to be understood that I do not wish to be limited with respect to the construction and arrangement of the timing movement, as any ordinary device may be used.

Cams  $b^{16}$  and an operating-rod  $b^{17}$  are also provided for neutralizing the seconds, minute, and hour hands similar to that used for neutralizing the call-register.



In order to start the timing mechanism simultaneously with the receipt of a call and the illumination of the pilot-light and to stop the timing mechanism when the light is plugged out by the operator, I provide an electromagnetically-operated starting and a mechanically-operated stopping mechanism coacting with the balance-wheel, hair-spring, or other part of the movement. To accomplish the result, an armature  $D'$  of the shape and arrangement of the armature  $b'$  is mounted to be attracted by the other pole of the double magnet. A lever  $D^2$  is pivoted at  $D^3$  and has one end connected to the armature  $D'$ . The lever  $D^2$  has its end pivoted to a link  $D^4$ , and the link in turn is connected to a sweep-arm  $D^5$ , having its end  $D^6$  pivoted to the casing.

The sweep-arm carries a spring-shoe  $D^7$ , which is designed to engage the balance-wheel of the timing mechanism. When the armature  $D'$  is attracted, it moves the parts to throw the shoe lightly into engagement with the balance-wheel and with a reverse movement, which should be pronounced, the shoe acts to move the balance-wheel to start the same in order to prevent the stopping of the said balance-wheel on what is known as the "dead-center." The armature  $D'$  is moved when released by the magnet by the spring  $b^3$ , as fully shown in Fig. 4.

A pilot-light  $E'$  is provided for each register, the said light and the magnet being connected in series with the pilot-light  $E^2$  of the switchboard  $E^3$  through the conductors  $X Y Z$ .

The operator's receiver  $R$  is connected in series by the conductors  $R'$  and  $R^2$ , through the switch  $R^3$ , with an instrument  $R^4$ , by which the chief operator may cut in on the operator's receiver in order that the instrument  $R^4$  may receive the same as the operator's receiver, thus enabling the chief operator to tell whether the operator is cutting in on a line for the purpose of listening.

The subscriber's line, comprising the conductors  $S$  and  $S'$ , is connected to the switch  $E^3$  and to the pilot-light  $E^2$ .

In operation when the subscriber calls the pilot-light  $E^2$  will be illuminated, and as the pilot-light  $Y'$  in the chief operator's room is in series with the pilot-light  $E^2$  it will be illuminated at the same time, and as soon as the call is plugged by the operator pushing the plug in the switch-jack of the board the pilot-light will be cut out. The magnet, which is also in series with the pilot-light, will be energized when the pilot-lights are illuminated, and it will be demagnetized with the cutting out of the pilot-lights. With the energization of the double magnet with each call, as above stated, the armatures  $b'$  and  $D'$  will be simultaneously attracted, the one,  $b'$ , operating the call-indicator the distance of one tooth, and the other,  $D'$ , causing the disengagement of the brake-shoe with the balance-wheel of

the timing mechanism, which will run until the armature  $D'$  is disengaged from the pole of the magnet, which is accomplished by the cutting out of the pilot-light, the demagnetization of the magnet, and the action of the spring  $b^3$ , which throws the armature from the pole of the magnet and by the mechanism heretofore described throwing the brake-shoe into engagement to the balance-wheel of the timing mechanism.

It will thus be observed that the timing mechanism runs only until a call is answered by the operator. Hence the time indicated on the several dials will be the time consumed in answering the number of calls indicated on the call-register, and the chief operator may know what time has been consumed in answering the number of calls in order that the efficiency of said operator may be judged.

The construction, operation, and advantages will, it is thought, be understood from the foregoing description, it being noted that various changes may be resorted to in the proportions and details of construction for successfully carrying the invention into practice without departing from its scope.

Having fully described the invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a call-timing register, suitable timing mechanism, suitable call-indicating mechanism, electromagnetically-operated devices for controlling the timing mechanism, an indicating-circuit for a switchboard of a telephone-exchange, and means for electrically connecting the said controlling mechanism to said indicating-circuit.

2. In a call-timing register, suitable timing mechanism, suitable call-indicating mechanism, electromagnetically-operated devices for controlling the timing mechanism, conductors for connecting the electromagnetic device in series with a switchboard, whereby the said electromagnetic device is energized and demagnetized respectively when a call is made and plugged out.

3. In a call indicator and timer, timing mechanism and call-registering mechanism, a magnet connected in series with a switchboard, armatures attracted by the magnet, means for moving the armatures from the poles of the magnet, a connection from one armature for moving the call-register, a connection from the other armature for starting and arresting a timing mechanism, the said magnet being energized and demagnetized respectively when the subscriber calls, and the call is plugged out.

4. In a call indicator and timer, timing mechanism and call-registering mechanism, a magnet, armatures on each end of the magnet, a connection from one armature for moving the call-registering mechanism, a connection from the other armature for starting and arresting the timing mechanism, a switchboard, conductors from the switchboard to



the magnet, connecting the said magnet in series with the switchboard, whereby the magnet is energized when a call is made and demagnetized when the call is plugged out, a pilot-light for the registering device, and conductors for connecting the pilot-light in series with the switchboard.

5. In a call indicator and timer, timing mechanism and call-registering mechanism, a magnet, armatures on each end of the magnet, a connection from one armature for moving the call-registering mechanism, a connection from the other armature for starting and arresting the timing mechanism, a pilot-light for each timing mechanism, conductors for connecting the magnet and the last-named pilot-light of a telephone-switchboard, whereby the pilot-light is illuminated and cut out and whereby the magnet is energized and demagnetized respectively when a call comes into the switchboard and is plugged out.

6. In a call register and timing device, timing mechanism and call-registering mechanism, a magnet having a double pole, armatures for the poles, a spring for holding the armatures normally out of engagement with the poles, a connection from one armature for actuating the call-registering mechanism, a series of links and levers operated by the other armature, a spring-shoe carried by one of the levers positioned to alternately release and engage a part of the timing mechanism for the purpose of starting and arresting said mechanism, the relation of parts being such that the timing mechanism is started when a call is registered and arrested when

the magnet is demagnetized, a telephone switchboard, conductors for connecting the magnet in series with the switch-jacks, a pilot-light near the timing and call register, conductors for connecting the pilot-light in series with the operator-controlled circuits of the switchboard, the relation being such, that the light is illuminated and the magnet is energized on the receipt of the call and that the light be cut out and the magnet be demagnetized with the plugging out of the call at the switchboard.

7. In a call-timing register; a suitable timing mechanism; a suitable call-indicating mechanism; means for controlling the timing and call-indicating mechanism; an indicating-circuit for a switchboard of a telephone-exchange; and means for utilizing a current of the indicating-circuit to actuate the timing and call-registering controlling means.

8. In a call-timing register; a suitable timing mechanism; a suitable call-indicating mechanism; means for controlling the timing and call-indicating mechanism; an indicating-circuit for a switchboard of a telephone-exchange; and means for moving the timing and call-registering controlling means with each change of current in the indicating-circuit.

In testimony whereof I affix my signature, in the presence of two witnesses, this 21st day of January, 1904.

EDWARD K. HERTFORD.

Witnesses:

JAMES W. OGDON,  
EPHRAIM INMAN.