

(No Model.)

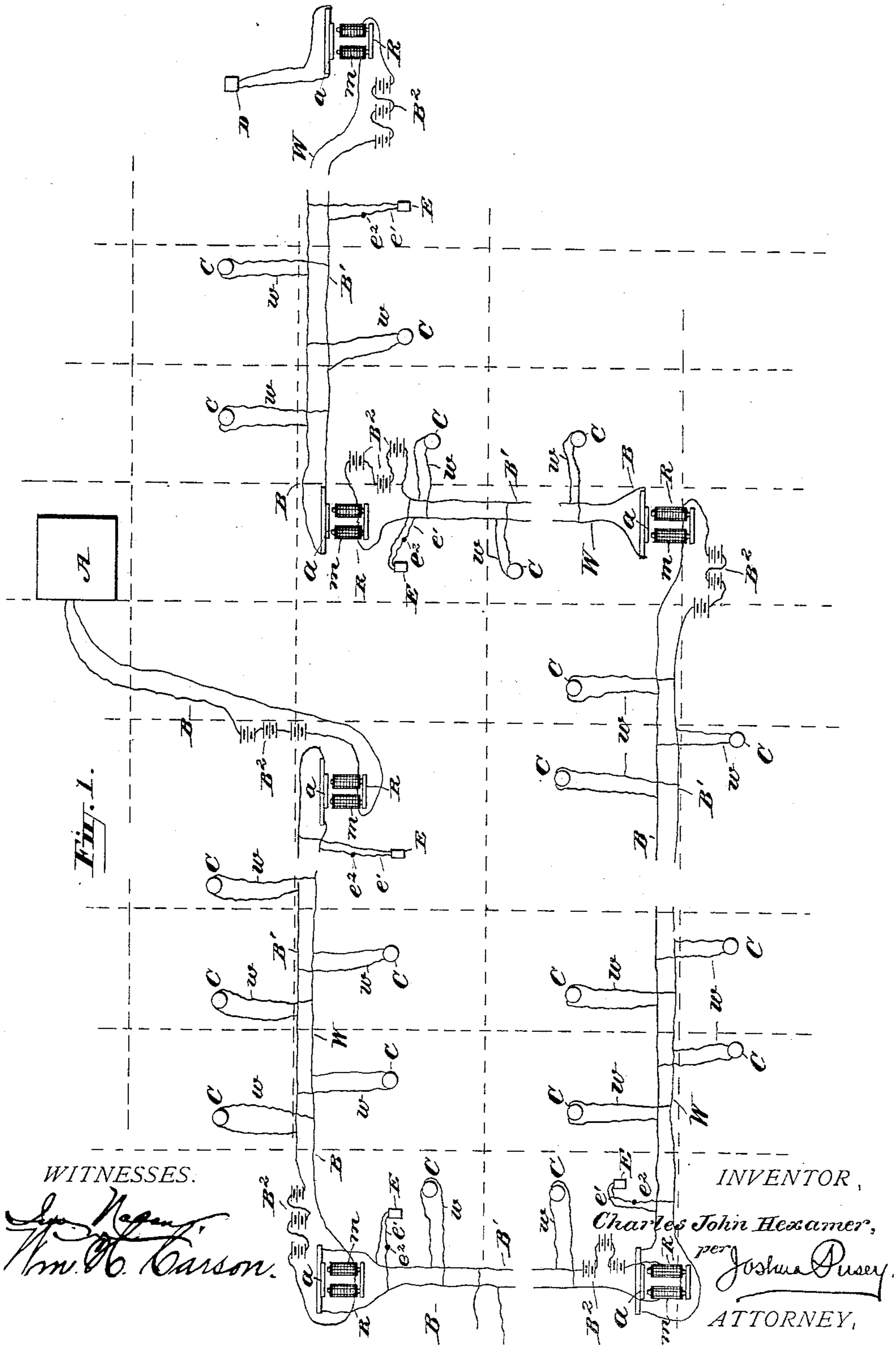
4 Sheets—Sheet 1.

C. J. HEXAMER.

ELECTRIC CLOCK SYNCHRONIZING SYSTEM.

No. 387,974.

Patented Aug. 14, 1888.



WITNESSES.

Wm. H. Carson.

INVENTOR,

Charles John Hexamer,

per Joshua Pusey.

ATTORNEY,

(No Model.)

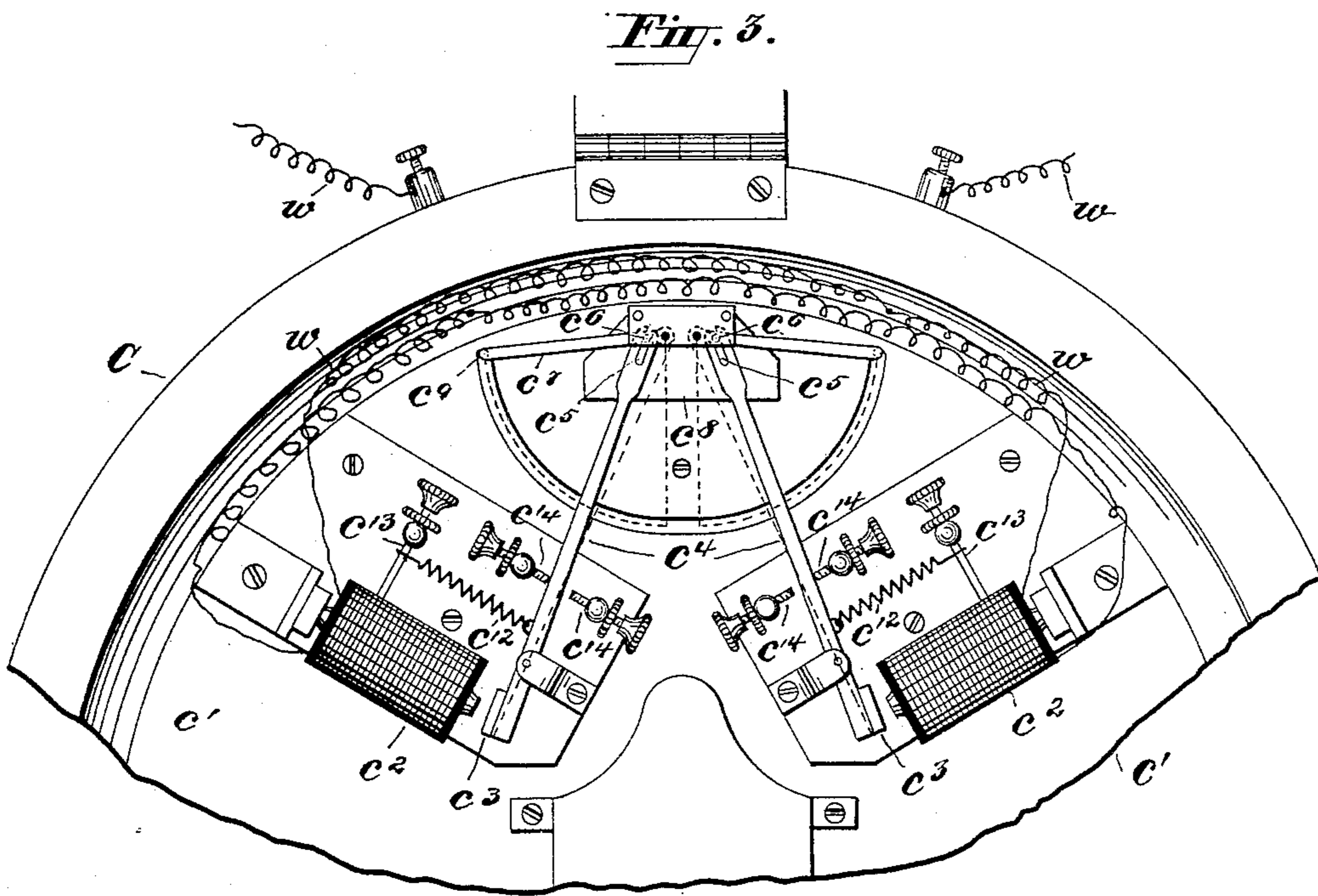
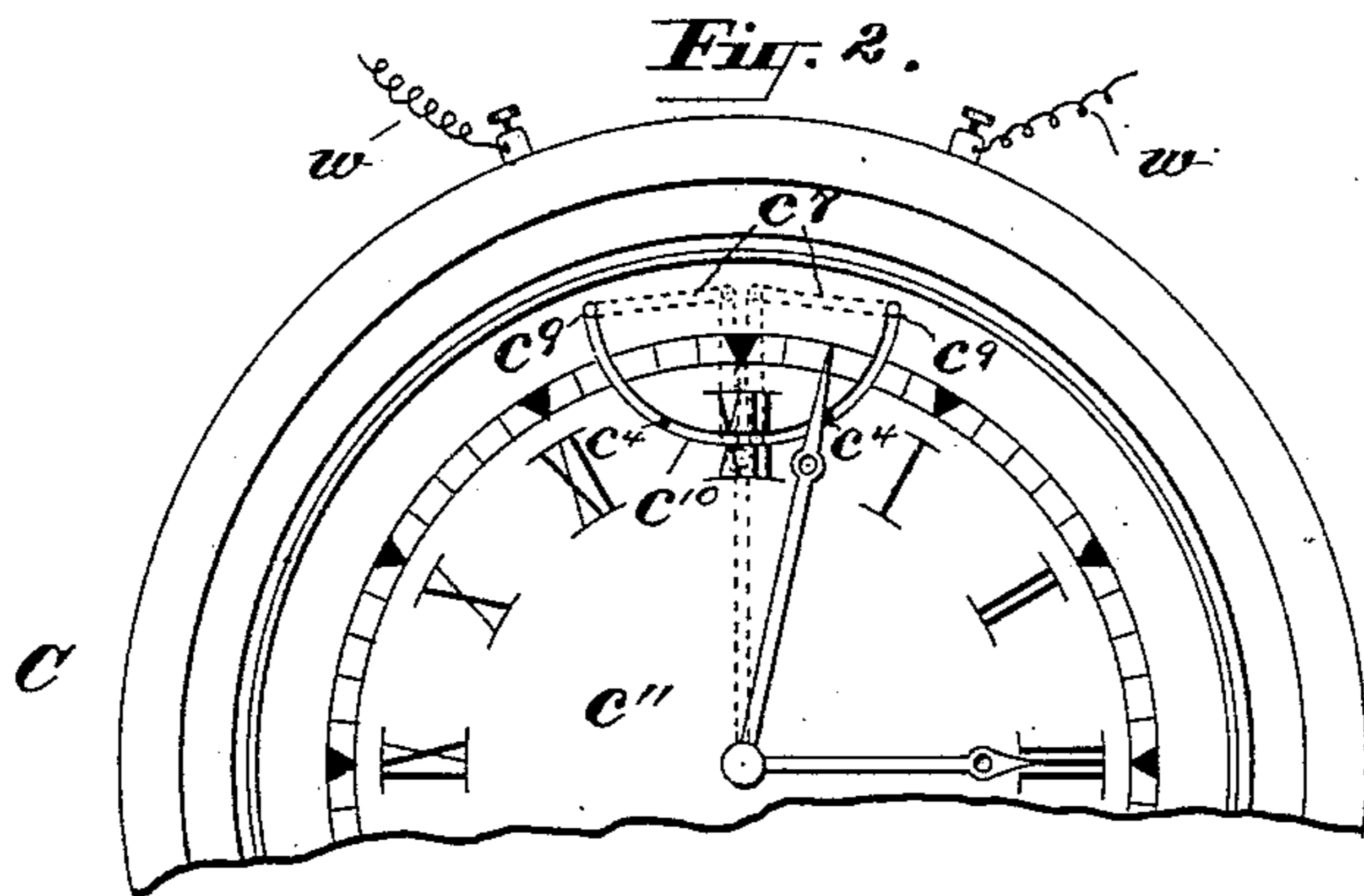
4 Sheets—Sheet 2.

C. J. HEXAMER.

ELECTRIC CLOCK SYNCHRONIZING SYSTEM.

No. 387,974.

Patented Aug. 14, 1888.



WITNESSES:

Geo. H. Rogers
Wm. H. Carson

INVENTOR.

Charles John Hexamer,
per Joshua Pusey.
ATTORNEY.

(No Model.)

4 Sheets—Sheet 3.

C. J. HEXAMER.

ELECTRIC CLOCK SYNCHRONIZING SYSTEM.

No. 387,974.

Patented Aug. 14, 1888.

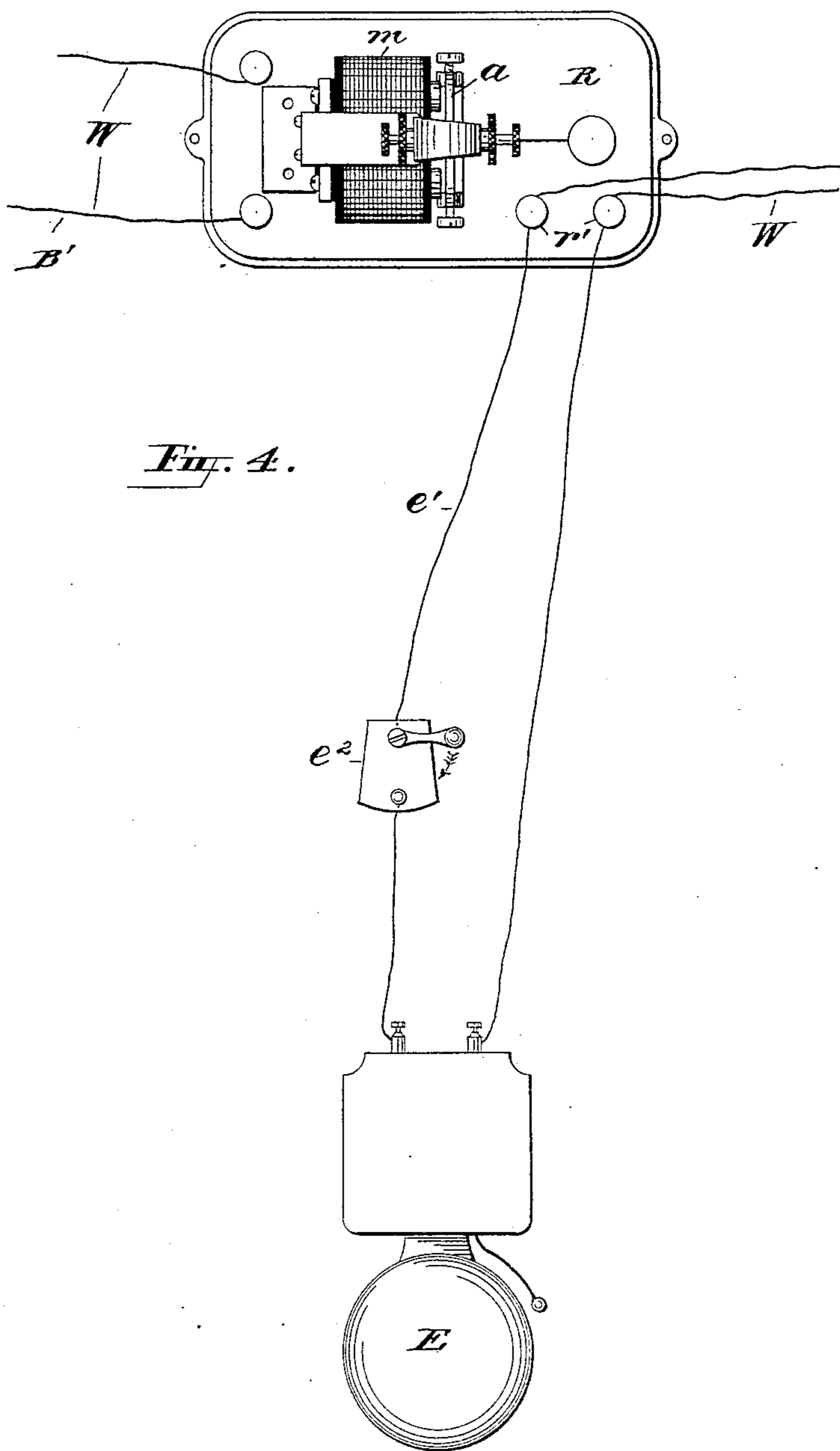


Fig. 4.

WITNESSES:
Wm. H. Carson.
Geo. Noe.

INVENTOR.
Charles John Hexamer,
per Joshua Pusey.
ATTORNEY.

(No Model.)

4 Sheets—Sheet 4.

C. J. HEXAMER.

ELECTRIC CLOCK SYNCHRONIZING SYSTEM.

No. 387,974.

Patented Aug. 14, 1888.

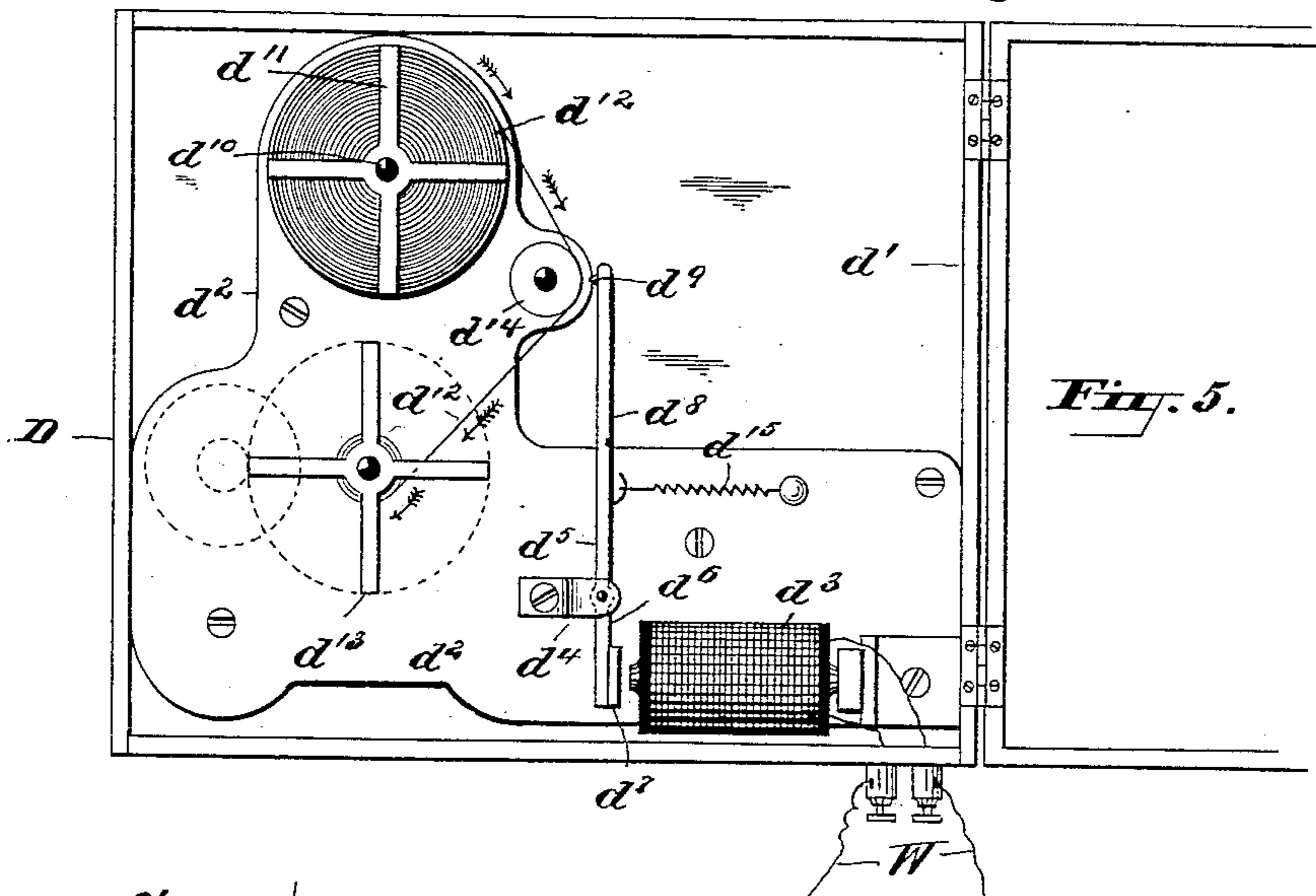


Fig. 5.

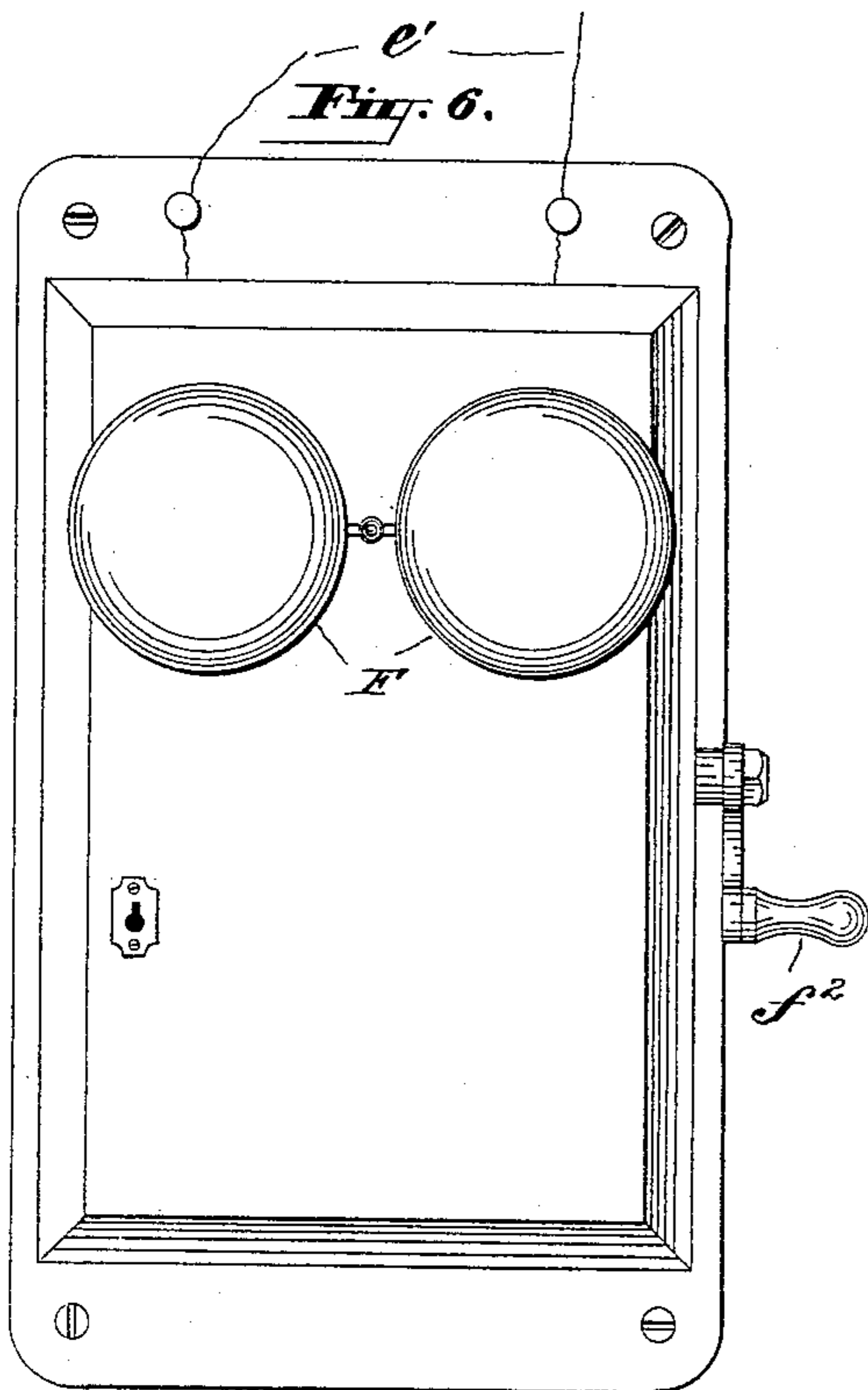


Fig. 6.

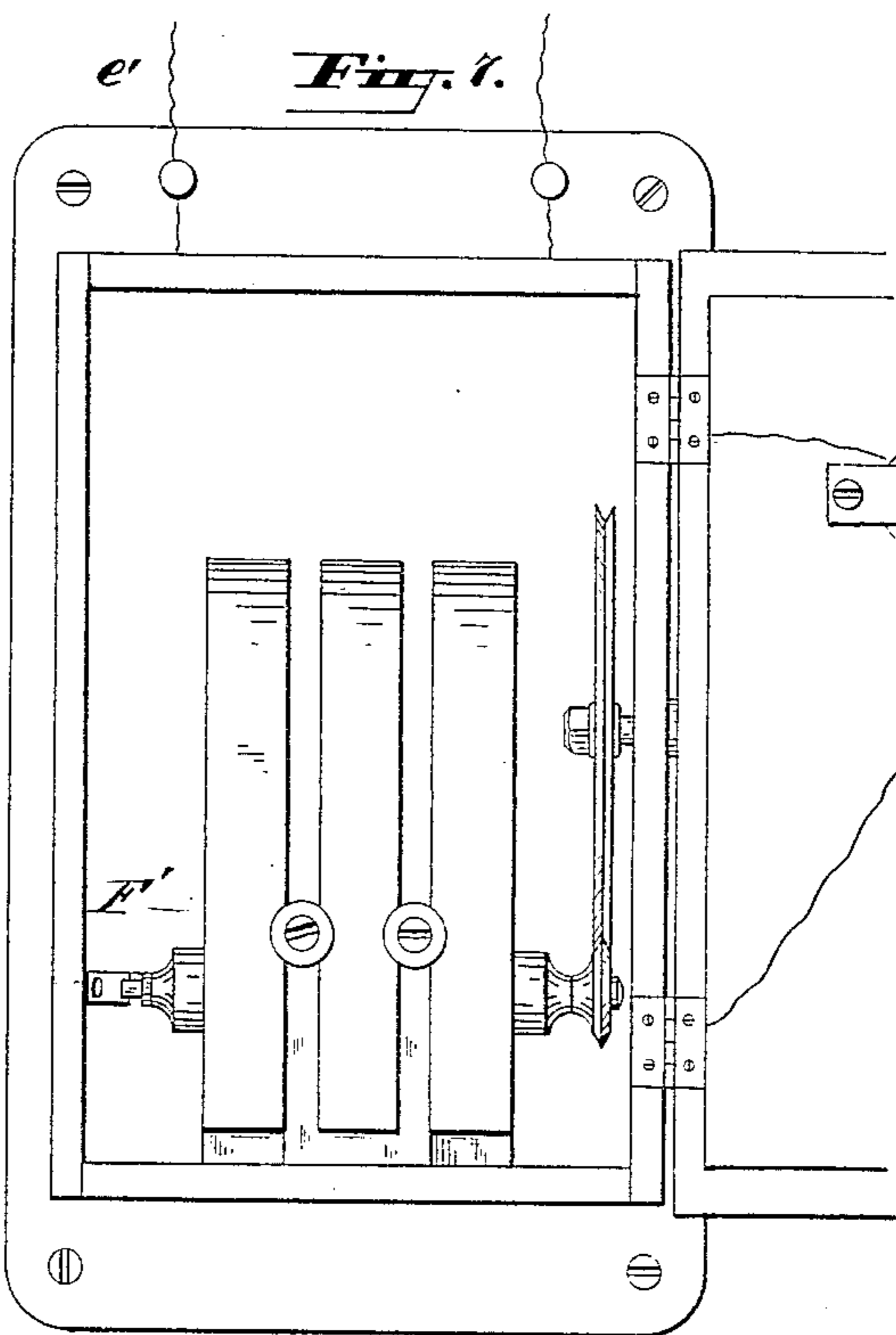


Fig. 7.

WITNESSES:

John H. Carson
Wm. H. Carson

INVENTOR

Charles John Hexamer,

per

Joshua Pusey,

ATTORNEY.

UNITED STATES PATENT OFFICE.

CHARLES JOHN HEXAMER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR
TO THE PHILADELPHIA TIME TELEGRAPH COMPANY, OF SAME PLACE.

ELECTRIC CLOCK-SYNCHRONIZING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 387,974, dated August 14, 1888.

Application filed January 10, 1887. Serial No. 223,850. (No model.)

To all whom it may concern:

Be it known that I, CHARLES JOHN HEXAMER, a citizen of the United States, residing at the city and county of Philadelphia, and State of Pennsylvania, have invented certain new and useful Improvements in Electric Clock-Synchronizing Systems, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, of which—

Figure 1, Sheet 1, is a diagram of the system. Fig. 2, Sheet 2, is a face view of the upper part of a clock provided with a synchronizing apparatus. Fig. 3 is a rear view of the clock, enlarged, the back plate being removed. Fig. 4, Sheet 3, is a view of the relay, electric bell, switch, &c. Fig. 5, Sheet 4, is an elevation of the recorder at the end of the main circuit. Figs. 6 and 7 are elevations of another form of electric bell, the door of the case being respectively closed and open.

The nature of this invention is an electric clock-synchronizing system wherein a series of clock-synchronizing devices for correcting the clocks hourly, if either fast or slow, may be controlled by and at long distances from a primary time-piece or "regulator."

The invention consists, first, in the combination, with the usual regulator, of a main circuit controlled thereby and composed of a series of adjacent sectional circuits whose ends, respectively, are alternately connected to relay-magnets and armatures, each of said magnets being provided with a battery or batteries, and to which sectional circuits there are connected at intervals a series of clocks provided with suitable synchronizing devices, whereby, upon the main circuit being closed hourly by the regulator, a current of electricity will pass along said circuit by means of the relays to the synchronizers, which simultaneously act upon and correctly set the hands of the clocks if behind or ahead of time; secondly, in the combination, with the regulator, the main circuit, and the batteries, of a registering device at the end of said circuit for indicating the hourly currents of electricity, whereby it may be readily learned at the end of the main circuit whether the line is intact, as hereinafter described; thirdly, in the combination, with the regulator, the sec-

tional circuit, and its relay and batteries, of an electric bell connected at a convenient point with said circuit, whereby the condition of the sectional line may be readily known by closing said switch, the bell thereupon ringing if the circuit be complete, and the converse.

The invention consists, finally, in certain details of construction, to be hereinafter pointed out.

Referring, now, to the annexed drawings, A, Fig. 1, indicates the well-known primary clock or regulator, and B the main line or circuit, which is hourly closed and broken by the regulator. This circuit is divided into sectional circuits B', whose ends are connected to the binding-posts of the relays R, the opposite sections being alternately connected to the relay-magnets *m* and the armatures *a* thereof, respectively. Each relay R is provided with a battery or batteries, B², and at intervals along each section there are disposed clocks C, provided with synchronizing devices S, which are connected by wires *w* to the line-wires W. There are preferably ten synchronizers in each section. The electric energy from the local batteries B² does not act upon said synchronizers or upon the relay-magnets; but upon the circuit being closed by the regulator A at the end of each hour the primary electric current, combined with that of the local batteries, will connect the several sectional circuits, and thus complete the main circuit, the synchronizers S being set in action simultaneously and the several clocks correctly regulated thereby. The sections B' of the main circuit may be continued for an indefinite distance.

The form of synchronizing apparatus preferred by me is shown in Figs. 2 and 3, Sheet 2, and constitutes the subject of Letters Patent No. 373,138, granted to me November 15, 1887. In said figures, C represents an ordinary clock, within which, on either side of the face-plate *c'* thereof, is secured an electro-magnet, *c²*, to whose armature *c³* is secured the short arm of a pivoted lever, *c⁴*. The levers converge upwardly and are provided at their free extremities with longitudinal slots *c⁵*, into which respectively pass pins *c⁶* on a pair of arms, *c⁷*, pivoted in a frame, *c⁸*, at the top of plate *c'*. Near the free end of each of these

arms there is a laterally-projecting pin, c^9 , which passes through and beyond a semicircular slot, c^{10} , in the plate c' and dial c^{11} , intersecting the path of the upper part of the minute-hand at a point adjacent to the meridian XII. Thus, upon a current of electricity passing to said magnets c^2 in the manner above stated, the respective armatures c^3 will be attracted to the latter and the levers c^4 and arms c^7 thrown inward, the projecting pins c^9 on the end of the latter in their movement striking against and correctly setting the minute-hand of the clock if fast or slow, whereupon, the circuit being broken at the regulator, the spring c^{12} , connected to the long arms of the levers and to pins c^{13} , returns the parts to their former position, the movement thereof being limited by the adjusting-screws c^{14} .

In order to readily learn whether the circuit is intact and uninjured without inspecting each section, I provide at the end of the main circuit a recording device, D, which is constructed as follows, reference being had to Fig. 5, Sheet 4: Within a box or frame, d' , there is secured a plate, d^2 , upon which is supported an electro-magnet, d^3 . In a bracket, d^4 , adjacent to said magnet is pivoted a lever, d^5 , to whose short arm d^6 is connected the armature d^7 , and at the end of whose long arm d^8 is a laterally-projecting point, d^9 . Upon a stud, d^{10} , projecting from the plate d^2 , is borne a wheel, d^{11} , which contains a roll of paper, d^{12} , whose free end is connected to a lower wheel, d^{13} , passing thereto by way of and over a roller, d^{14} , adjacent to and in line with the point d^9 on the lever. It will be readily seen that upon the main circuit being closed at the regulator the electric current passing to the magnet d^3 will cause the latter to attract thereto, against the stress of a spring, d^{15} , the armature d^7 and the short arm d^6 of the lever d^5 . Thus the stud or point upon the longer arm of the lever, being thrown outward, strikes against and punctures the paper d^{12} , whereupon, the circuit being broken, the spring d^{15} returns the parts to their normal position. The strip of paper is rolled very slowly upon the wheel d^{13} , the latter being connected to a clock-movement.

The lineman at certain periods—say once a day—inspects the recorder D, and if the paper has been duly punctured he at once knows that the wires are intact, but if not so punctured that there is a break in one of the sections, which it is his duty to proceed to rectify.

It will be understood that I do not limit myself to a recording device of the specific construction just described, as any suitable electrically-controlled recorder may be substituted therefor without departing from the spirit of my invention.

If the recorder indicates a break along the line, it is desirable that means be provided whereby the broken section may be readily discovered. To this end I provide each section B' of the main circuit with an electric bell, E, which may be controlled wholly by the local battery B², or partly thereby and by a small magneto-dynamo, F', Fig. 7, of well-known construction.

In Fig. 4, Sheet 3, the bell is shown connected to the binding-posts r' of the relay R and controlled by the local battery. One of the wires e' leading to the bell is provided with an ordinary switch, e^2 , whose normal position is open, as shown. It will be obvious that upon closing this switch, if the sectional circuit be intact, the bell will ring; but if the line be broken it will not. If this section be complete, the inspector goes to the others successively until he discovers the broken section.

In lieu of the bell and switch device described I have sometimes used a bell, F, controlled partly by a magneto-dynamo, F'. (See Fig. 7, Sheet 4.) This construction of electric bell is well known and requires no special description. When it is used, the electricity is generated by turning a handle, f^2 , the current, when the switch e^2 is closed, in connection with that from the battery B², causing the bell to ring if the line be unbroken. The first construction, however, is preferable, although, I may remark, I do not confine myself to the use of any particular form of electric bell.

Having thus described my invention, I claim as new and wish to secure by Letters Patent—

1. In a clock-synchronizing system, the combination of the regulator, the main sectional circuit, the relays connected to the respective sections of said circuit, the local batteries, the synchronizers, and the clocks, together with the electric bells connected to said sections and the switches, the parts being combined, constructed, and adapted to operate substantially as and for the purpose set forth.

2. In a clock-synchronizing system, the combination of the regulator, the main circuit composed of a series of sections, the relays connected to said sections, the local batteries, the synchronizing devices, and the clocks, together with the recorder at the end of the main circuit and the electric bells connected to said sections and provided with switches, substantially as and for the purpose set forth.

In testimony whereof I have hereunto affixed my signature this 31st day of December, A. D. 1886.

CHARLES JOHN HEXAMER.

Witnesses:

JNO. NOLAN,

P. O'DONNELL.