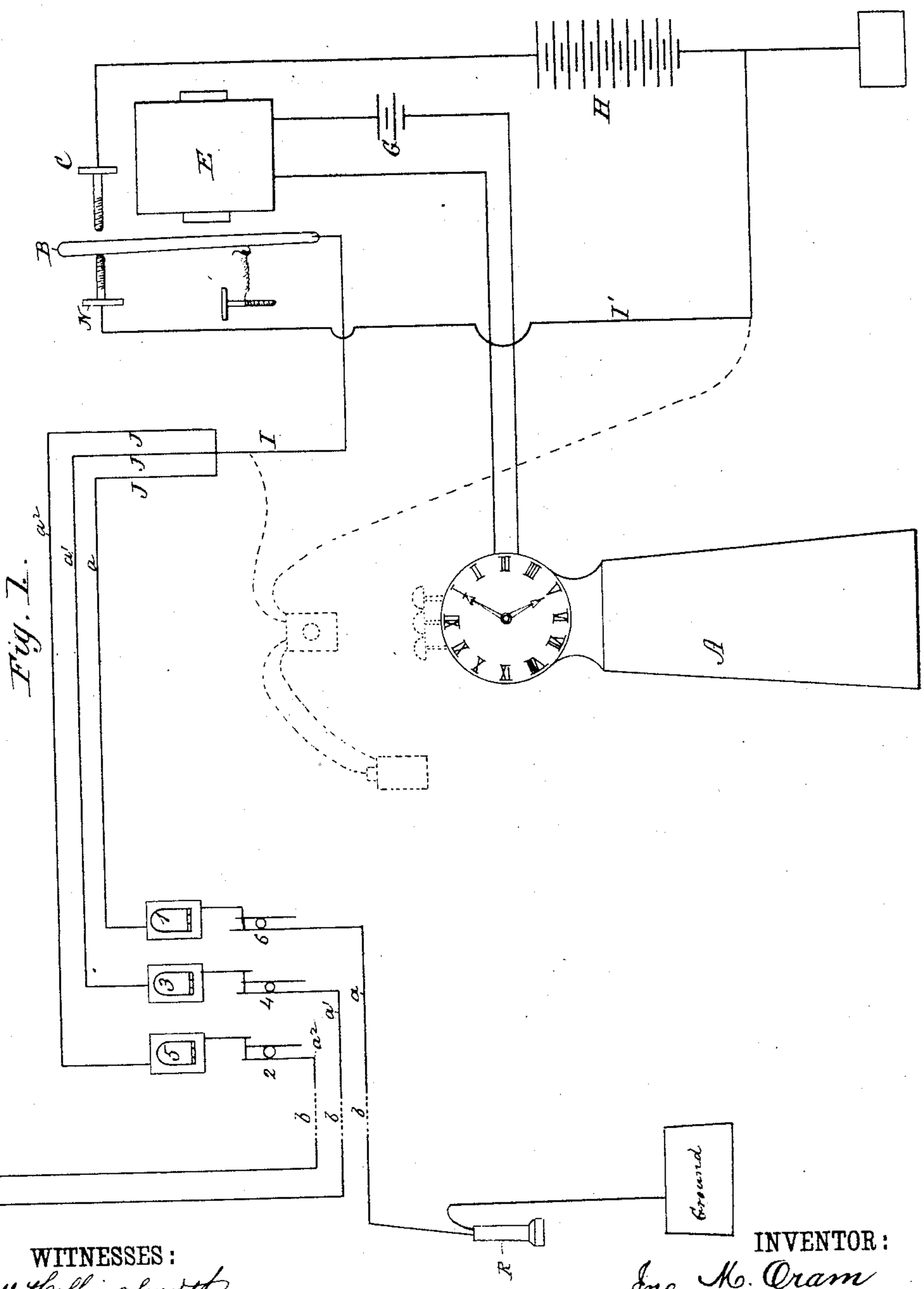
(No Model.) 4 Sheets—Sheet 1.

J. M. ORAM.

TELEPHONE TIME SIGNAL REPEATING SYSTEM.

No. 287,710. Patented Oct. 30, 1883.



WITNESSES:
W. W. Hollingsworth
Thos. Houghton.

INVENTOR:
Jno. M. Oram
BY Munn & Co

ATTORNEYS.

(No Model.) 4 Sheets—Sheet 2.

J. M. ORAM.

TELEPHONE TIME SIGNAL REPEATING SYSTEM.

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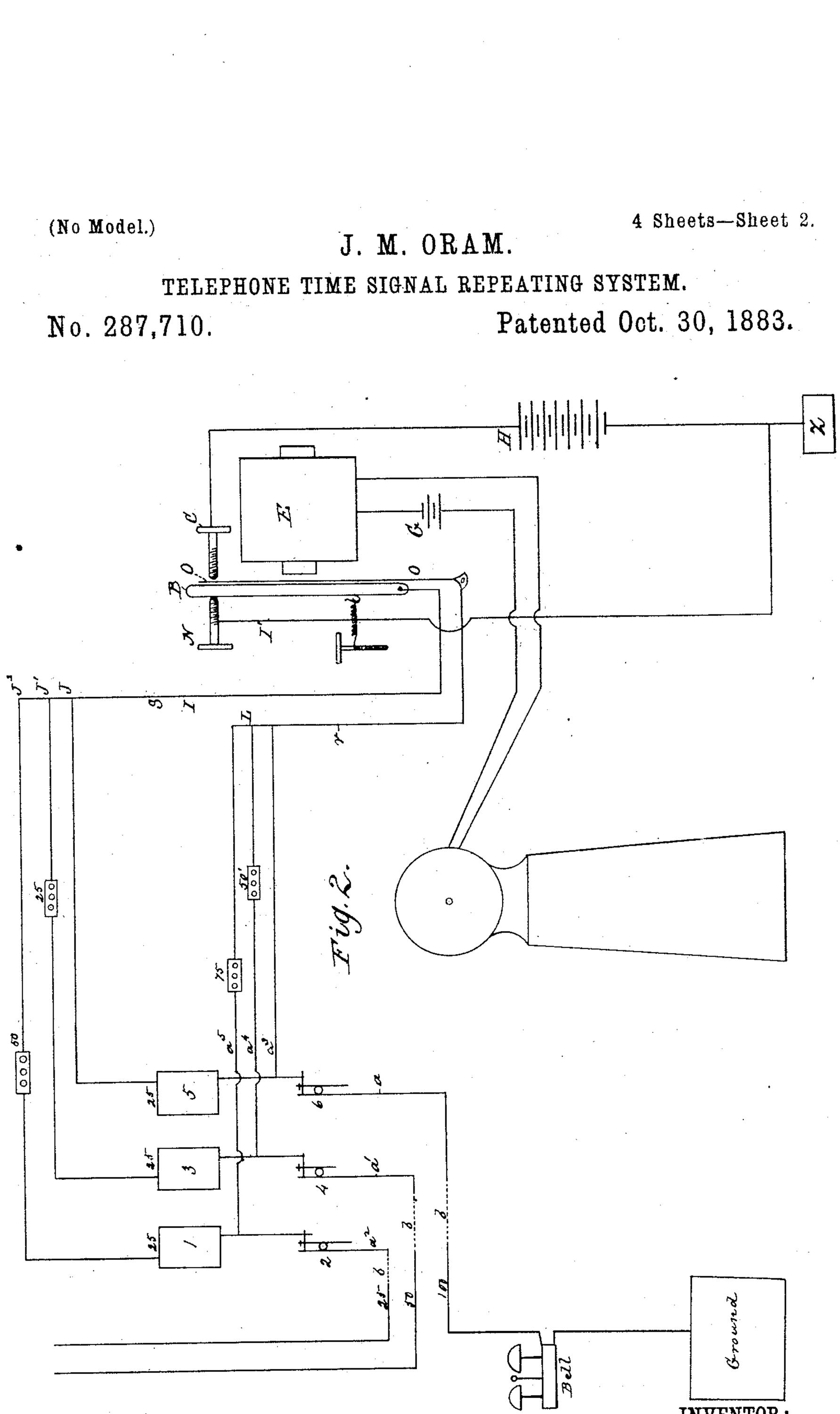

Fig. 2.

WITNESSES:

W. W. Hollingsworth,

Thos. Houghton

INVENTOR:

Jno. M. Oram

BY Munn & Co

ATTORNEYS.

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J. M. ORAM.

TELEPHONE TIME SIGNAL REPEATING SYSTEM.

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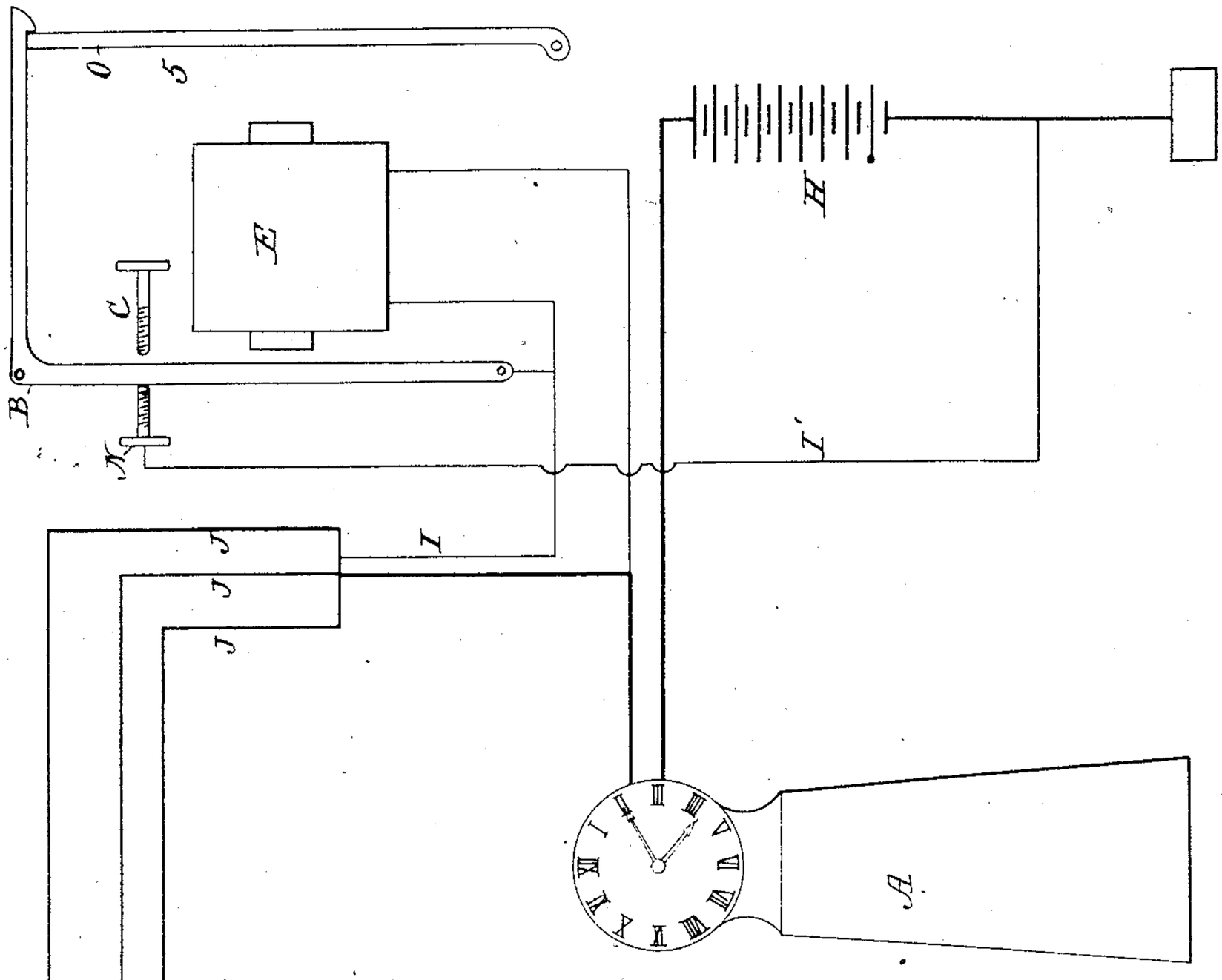
Fig. 3.



WITNESSES:

W. W. Hollingsworth

Thos. Houghton.

INVENTOR:

Jno. M. Oram

BY Munn & Co

ATTORNEYS.

(No Model.) 4 Sheets—Sheet 4.

J. M. ORAM.

TELEPHONE TIME SIGNAL REPEATING SYSTEM.

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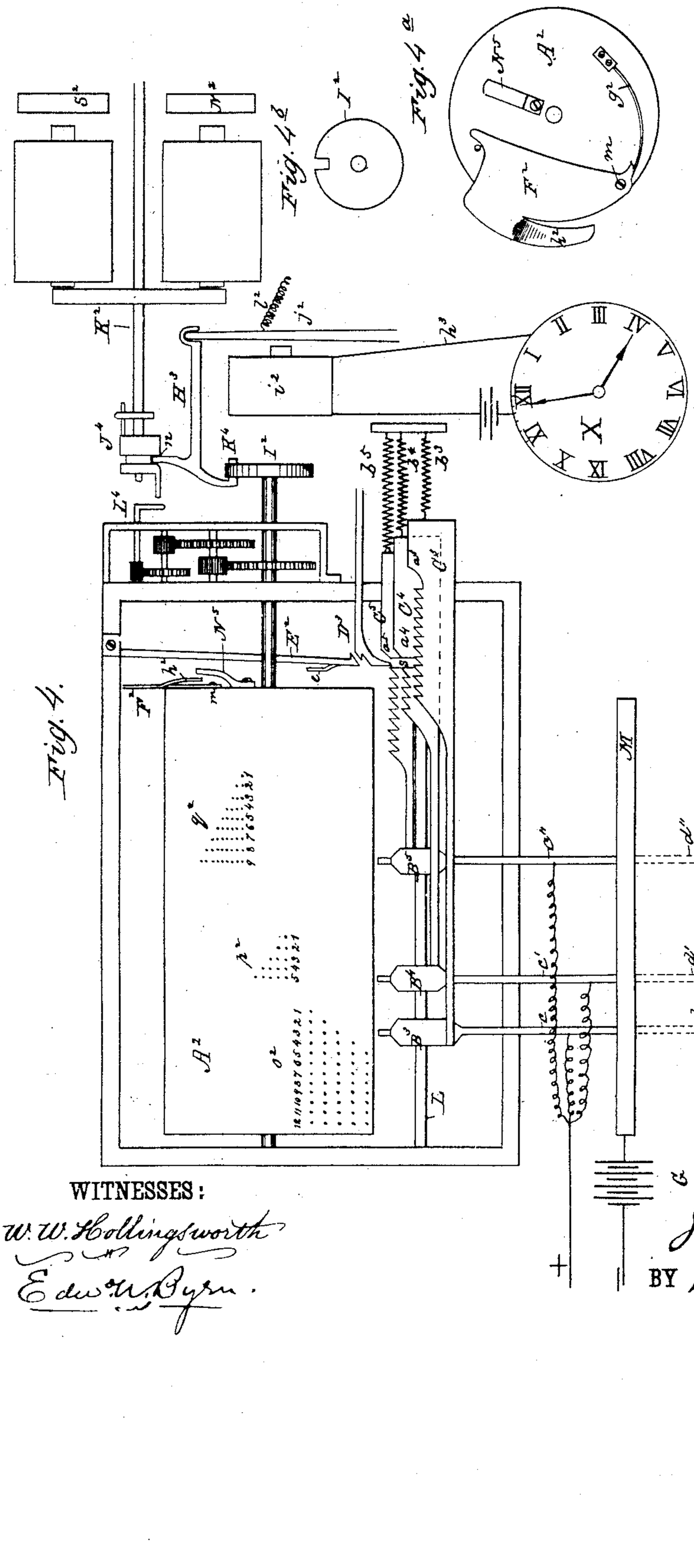

Fig. 4.

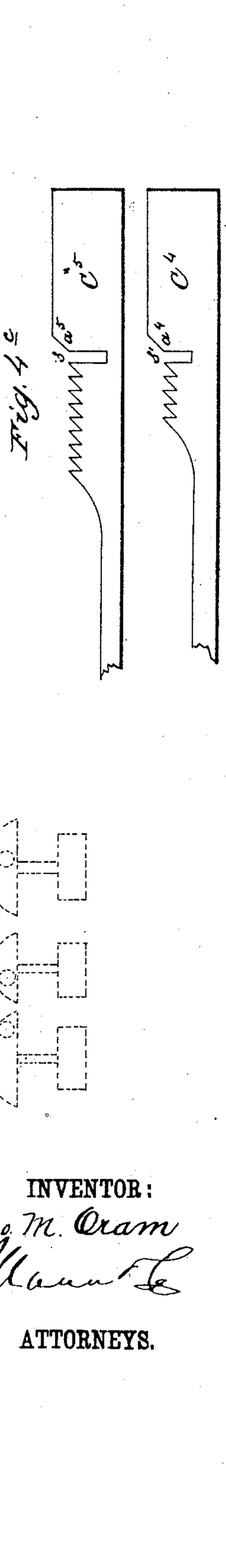

Fig. 4c.

WITNESSES:

W. W. Hollingsworth

Edw. W. Byrn.

INVENTOR:

Jno. M. Oram

BY Munn & Co

ATTORNEYS.

UNITED STATES PATENT OFFICE.

JOHN M. ORAM, OF DALLAS, TEXAS.

TELEPHONE TIME-SIGNAL REPEATING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 287,710, dated October 30, 1883.

Application filed January 6, 1883. (No model.)

To all whom it may concern:

Be it known that I, JOHN M. ORAM, of Dallas, in the county of Dallas and State of Texas, have invented a new and useful Improvement in Telephone Time-Signal Repeating Systems; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, forming a part of this specification.

My invention is designed to provide a method by which all of the subscribers of a telephonic system are put in possession of the correct time from a single standard clock by continuous signals repeated throughout all the minutes of the day, and without the necessity for electric clocks at the subscriber's end of the line, thus avoiding the necessity for a multitude of such clocks, and the expense and complication incidental to their use.

In carrying out my invention I employ a single clock of the class known as a "repeater"—*i. e.*, one that strikes (or makes a mechanical adjustment other than the movement of the hands) for every hour and minute in the day, which stroke or mechanical adjustment, in accordance with my invention, is made to transmit signals over the telephone-lines to the receivers, and which signals are, by variation of intervals between them, (or other measures,) made to convey a significance to the subscriber by either the sound of the receiver's diaphragms or by strokes on the bells of the subscribers, as hereinafter more fully described.

Figure 1 of the drawings represents a diagram in which the time-signals to the subscribers are made simply by the sound of the diaphragms of the receivers. Fig. 2 represents a diagram in which the signals are made upon the subscribers' bells so as to be generally audible; and Fig. 3 is a diagram representing a simplified modification of my invention in which a local battery and the normal ground-circuit are dispensed with, as hereinafter referred to. Figs. 4, 4^a, 4^b, and 4^c represent the internal construction of a repeating-clock such as I use with my invention.

Referring to Fig. 1, A is a repeating-clock, which is organized to repeat the time upon the following arbitrary system: The hours it strikes at intervals of two seconds of time, the division of ten minutes it strikes at intervals of one second of time, and the division of minutes it strikes at intervals of two-thirds of a second. Thus at three o'clock and fifty-nine minutes, the clock would strike three strokes at intervals of two seconds, five strokes at intervals of one second, and nine strokes at intervals of two-thirds of a second, which may be illustrated thus: $_{111}^{3}$ $_{11111}^{5}$ $_{111111111}^{9}$. Then the next minute would be four o'clock, which would make the clock strike four times with intervals of two seconds—thus, $_{1111}^{4}$. I use the term "strike" here for convenience only, as repeating-clocks do always strike; but in the application of such a clock in my invention the clock need not actually strike an audible signal, but only make a mechanical adjustment to close and break an electrical current (or vary the tension of an electrical circuit) in accordance with such subdivsion of time.

As shown, the diagram in Fig. 1 represents a central office, with the exception of that portion to the left of the breaks in the lines at *b*, and the receiver to the left of this represents one of the subscriber's stations. H is the main battery; G, the local battery, whose circuit is controlled by the clock; E, an electro-magnet; B, its armature; N C, are back and front contacts; $a\ a'\ a^2$, lines for three subscribers, and of which there may be any number; I I′, the normal ground-circuit, or circuit through which call-impulses coming from the subscriber to the central office find their way to the earth. 1 3 5 are the annunciators for the three subscribers, and 2 4 6 are the spring-jacks of the switch-board, by means of which two subscribers may be connected by plugs in the usual manner. The repeating-clock A is here shown in the central office; but it is obvious that its line-wires may be extended sufficiently to locate it in a jeweler's store, or in an observatory, where it may be more conveniently kept under constant supervision as to correctness. Now, this clock makes and breaks the circuit of local battery G, controlling the electro-magnet E of the central office, and said circuit is normally broken, so that the armature B rests back upon the back contact, N, from the tension of its spring, whereby the normal ground-circuit I I′ is closed, and gives to each subscriber's

line an outlet to the ground at the central office. Now, when in accordance with the system of signals before described the local-battery circuit is closed by the clock, magnet E attracts armature B. This breaks at N the normal ground-circuit, disconnecting lines a a' a^2 from the ground at the central office, and at the same time closing the main-battery circuit from front contact, C, through armature B, section I of normal ground-circuit, and to all the lines a a' a^2, producing in the receiver R at the subscriber's end a sound by movement of the diaphragm, and thence passing to earth. This movement of the diaphragm is the audible time-signal for the subscribers, and as the clock divides such movements into groups with different intervals of time between—as in the instance given, $1\overset{3}{1}1$ $11\overset{5}{1}11$ $1111\overset{9}{1}1111$—the subscriber knows that it is fifty-nine minutes past three o'clock, or one minute of four. These signals do not interfere with the use of the telephone for talking purposes, because the spring-jacks of any two subscribers who may happen to be talking to each other are at that time disconnected from the rest of the system. With this arrangement of my system, when the signals are simple sounds of the diaphragms in the subscribers' receivers made significant as to time by the arbitrary intervals of time between them, only a weak battery-current is required, and this is not sufficient to throw down the annunciators 1 3 5.

For making my invention available for striking a bell in the office of each subscriber, the current necessary to do this is a much stronger one, and as this would throw down all, or at least a part, of the annuciators of the central office, and thus produce great confusion and embarrassment, I have shown in Fig. 2 a provision for overcoming this difficulty. I employ between the magnet E and its armature B a spring, O, which, when armature B rests against back stop, N, occupies a position between the stop C and the armature B, but does not touch either. This spring O, I connect by wire r with the branches a^3 a^4 a^5 of the subscribers' lines, while the armature B is connected by wire I with the branches J J' J^2 of the subscribers' lines. Now, then, two sets of wires, a^3 a^4 a^5 and J J' J^2, are connected, respectively, upon opposite sides of the annunciators 1 3 5, and any current which passes through these two sets of branches from the central office is so weakened in the electro-magnets of the annunciators so as to have no effect on the latter. With this arrangement, when the clock closes the local-battery circuit and charges electro-magnet E, armature B moves forward till it strikes spring O, and then both move forward together till they both strike the front contact, C. The main-battery current, then passing through both B and O and the branches a^3 a^4 a^5 and J J' J^2, has no effect upon the doors of the annunciators, but nevertheless passes into the several subscribers' lines in sufficient energy to ring the bells at the subscribers' stations, each of which bells is tapped upon by its hammer in accordance with the prearranged system of signals as made by the clock, which bell-signals are generally audible through the room of each subscriber. As the armature B moves back again against contact N, it leaves the spring O and renews the normal ground-circuit I'. To compensate for the resistance of the electro-magnet of the annunciator, which we will assume to be 25, differential resistances are placed in the branches a^3 a^4 a^5 and J J' J^2 to balance the current. Thus for line a^2, 50 is placed in the branch J^2, which, with the 25 of the annunciator-magnet, just balances the 75 resistance in branch a^5. Resistances may also be placed in the shorter lines to equalize the effect of the current on all the bells.

In Fig. 3 is shown in heavy black lines how the normal ground-circuit and local battery may be dispensed with and the main-battery circuit controlled direct by the clock and distributed to the several subscribers' lines.

I am aware that it has been proposed to utilize telephone-lines for signaling time to a set of electrical clocks, and I do not claim any such arrangement. My invention is distinctive in the fact that only one clock is used, and that is a repeater, and the signals sent to the subscribers are not made to act upon electric clocks at such points to give their hands a progressive movement; but said signals are audible signals, possessing sufficient significance as to indicate of themselves the time continuously through the day. This permits the telephone-circuits to be utilized just as they stand without complication or interference, and dispenses with the cost of a great number of electrical clocks.

In my invention the repeating-clock need not necessarily make and break the circuit by direct electrical connections, but may vary the electrical condition of the line through sound-waves in the air acting upon a transmitter of ordinary construction, thereby sending induced or secondary currents over the line, as shown in dotted lines in Fig. 1.

In order to make my invention sufficiently clear as to enable any one skilled in the art to make and use it, I deem it best to describe one form of repeating-clock, of which only a general outline is shown in Figs. 1, 2, 3.

Referring to Fig. 4, X represents a clock proper or timing mechanism, which is arranged to complete the circuit h^3 and charge the magnet i^2 every minute in the day. This clock has its repeating mechanism shown extraneous to it, and has a battery-circuit, h^3, within it, which is here represented diagrammatically.

K^2 S^2 N^2 is a small electric motor, which is driven by a separate battery and circuit, (not shown,) and which may be replaced by a spring or weight movement. The clock X gives the time and breaks circuit h^3 at regular intervals of one minute, while the motor K^2 S^2 N^2 supplies the power for shifting and adjust-

ing the repeating mechanism by rotating shaft K^2. Whenever (every minute) the clock makes circuit k^3 and charges magnet i^2, armature j^2 is attracted, and this pushes bodily the slide-bar H^3, and simultaneously throws clutch J^4 to engagement with arm L^4 and takes arm K^4 out of the slot in disk I^2, (for side view of disk I^2 see Fig. 4^a,) which disk is on main shaft carrying repeating-cylinder A^2. The result is that the motor, through the clutch J^4, turns the shaft of arm L^4, and this shaft, through a diminishing train of wheels, slowly causes the cylinder A^2 to revolve one revolution, after which spring l^2 pulls stop K^4 into slot of disk I^2 and stops the repeating-cylinder. On the repeating-cylinder are three groups of pins, one group, o^2, being arranged in rows, which rows contain pins from one to twelve, and between which pins of each row a space representing two seconds of time in the revolution of the cylinder is left.

At p^2 is shown the group of pins representing the ten-minute division, and these are arranged in rows from one to five, and have a space between them representing a second of time.

At q^2 is shown the group of pins of the minute-subdivision, arranged in rows from one to nine.

B^3 B^4 B^5 are three levers, whose ends next to the cylinder are struck by the pins o^2 p^2 q^2, and the levers deflected thereby. As shown, lever B^3 is in the row of three pins of the hour-group, B^4 is in the row of five pins of the ten-minute division, and the lever B^5 is in the row of nine of the minute-subdivision, so that a revolution of the cylinder would deflect lever B^3 three times at intervals of two seconds, lever B^4 five times at intervals of one second, and lever B^5 nine times at intervals of two-thirds of a second; and these levers being made one of the terminals of battery-circuit G of Fig. 1, and the bar M, Fig. 4, another terminal of said circuit, it is easily seen how the local current in Fig. 1 is broken into the significant signals of time. To shift the levers B^3 B^4 B^5 to correspond with the passage of each minute of time the following mechanism is provided: To each of said levers B^3 B^4 B^5 is attached a slide-bar, C^3 C^4 C^5, of which C^3 has twelve ratchet-teeth corresponding to the twelve rows of pins, o^2, and of which C^4 has five ratchet-teeth corresponding to the five rows of pins, p^2, while C^5 has nine teeth corresponding to the nine rows of teeth, q^2. Each of these toothed slides is drawn to the right by spiral springs b^3 b^4 b^5, and as they are moved against the tension of said springs they are held to said adjustment by separate detents D^3, &c. The lower slide, C^5, represents minutes, and is acted on every minute, and is closest to the cylinder A^2. The next slide, C^4, above is farthest away from the cylinder, and is acted on once in ten minutes, and the upper slide, C^3, is still farther from the cylinder, and is acted on once every hour, thus giving them the proper adjustment in relation to the repeating-pins o^2 p^2 q^2 to strike the successive times of day in distinctive signals. For giving this adjustment to the slides C^3 C^4 C^5 the end of cylinder A^2 is provided with a spring-cam, F^2, Fig. 4^a, pivoted at m and forced outwardly by spring g^2 till its upper end is held by a stop. The wing h^2 of this cam is inclined to the plane of revolution, and by engaging with the teeth of the slide-bars C^3 C^4 C^5 moves them along. In the lower slides, C^5 and C^4, at the end of these series of teeth, there are slots s s', Fig. 4^6, whose function is as follows: Each revolution of cylinder A^2 causes the wing h^2 of cam F^2 to enter a tooth of the lower bar, C^5, and move it one tooth. After nine successive movements of this bar the slot s at the end of the series comes into the plane of wing h^2, and the latter is free from the action of spring g^2 to move outward still farther and move the second bar, C^4. Then, again, at the end of five such motions of bar C^4 the slot s' in said bar coincides with slot s of bar C^5, and the wing h^2 of the cam can penetrate still deeper and move not only bars C^5 and C^4, but also the bar C^3, which latter is moved only once in sixty movements of bar C^5 and indicates the hours. When the shoulders a^3 a^4 a^5 of the toothed slides strike detents D^3, &c., the latter are thrown up and caught by spring-hook E^2, until arm N^5 on the end of cylinder A^2 comes around and pulls the hooks away from the detents. As shown, the strokes of levers B^3 B^4 B^5 on bar M are made to control the local-battery circuit G and operate the armature E of Fig. 1; but when the signals are to be transmitted through air-vibrations impinging against a transmitter the stems c c' c^2 are extended and made to strike the bells shown in dotted lines.

Having thus described by invention, what I claim as new is—

1. The method herein described of supplying standard time to any number of subscribers in a telephonic system, which consists in continuously making and breaking (or varying the electrical condition of) the main circuit into significant signals, having different intervals of time between the signals of the several groups denoting different subdivisions of time, whereby the audible signals are made recognizable and significant as to time in each receiver, separate receiving-clocks at each subscriber's station are dispensed with, and the simplicity and efficiency of the telephonic system preserved without interference or interruption, as described.

2. The method of striking standard time upon the bells of any number of subscribers in a telephone system, which consists in continuously making and breaking the electric current into recognizable signals, having different intervals of time between the signals of the several groups, and dividing this current at the central office upon opposite sides of the annunciators to prevent the dropping of the annunciator-doors from said signals, as described.

3. The combination, with a telephone system and a suitable battery, of a clock, constructed as described, to repeat continuously throughout the whole day, and break or vary the current on the line into recognizable significant signals of time, as described.

4. The combination, with the bells of the receivers, their several lines, and their annunciators and jacks, of a repeating-clock, a local circuit controlled thereby, an electro-magnet operated by said circuit, a main-line circuit, and the armature B and spring O, connected, respectively, to branch lines leading to the opposite sides of the subscribers' annunciators, as and for the purpose set forth.

JOHN M. ORAM.

Witnesses:
T. S. MILLER,
ALFRED H. BENNERS.