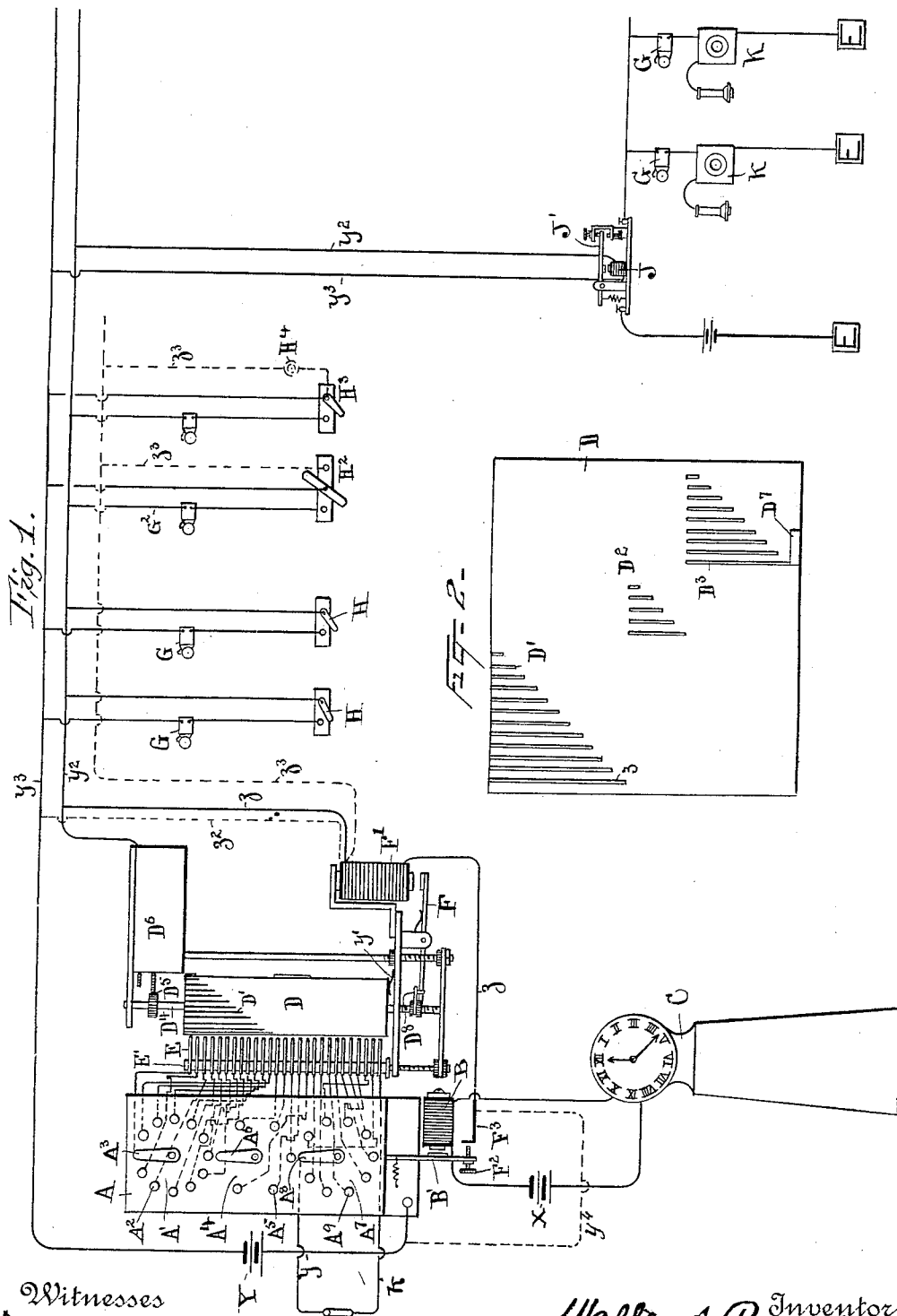


W. A. PURCELL.

ELECTRIC TIME SIGNALING SYSTEM AND APPARATUS.

No. 522,029.

Patented June 26, 1894.



Witnesses
 Ironius H. Clark.
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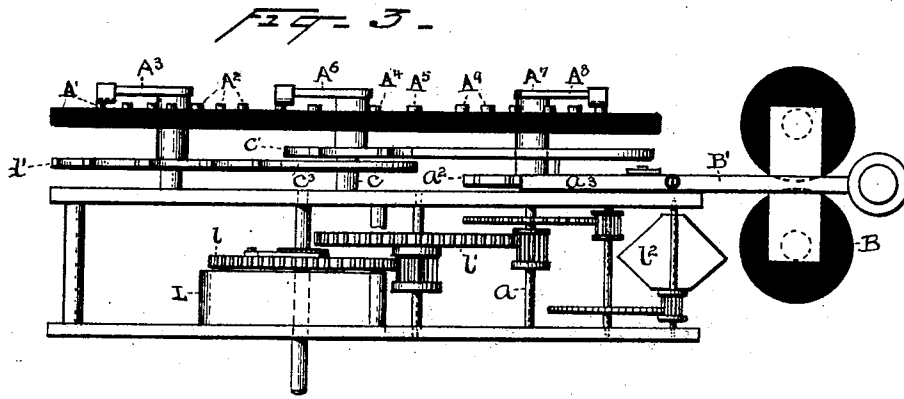
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UNITED STATES PATENT OFFICE.

WALTER A. PURCELL, OF NEWARK, NEW JERSEY.

ELECTRIC TIME-SIGNALING SYSTEM AND APPARATUS.

SPECIFICATION forming part of Letters Patent No. 522,029, dated June 26, 1894.

Application filed November 16, 1892. Serial No. 452,112. (No model.)

To all whom it may concern:

Be it known that I, WALTER A. PURCELL, a citizen of the United States, residing at Newark, county of Essex, State of New Jersey, have invented a certain new and useful Improvement in Electric Time-Signaling Systems and Apparatus, of which the following is a specification.

My invention has for its object the electrical transmission of signals for indicating time, such signals being transmitted from a central station or point to an indefinite number of sub-stations or points, the central station or point being provided with an automatic time switch device controlled by a clock and electric transmitting apparatus, and the sub-stations being provided with a bell or other receiving instrument, and a circuit controller whereby the bell or other receiving instrument will announce the time, giving the hour and minute at any given station.

What I term a "time switch device" is a device provided with three divisions, each division being divided up into suitable subdivisions to indicate respectively the hours, any equal subdivision of an hour, and the minutes in such last subdivision. Each division is provided with a given number of contact points, which are wires through suitable brushes to a circuit wheel having three series of contacts thereon with which contacts the brushes engage. Circuit through the contact points on the three several divisions of the time switch device, their respective brushes and the circuit wheel is closed by the movement of a contact arm for each division, which contact arm is operated by a spring or other motor controlled by an electro-magnet in circuit with a clock which closes the circuit every minute. When circuit is closed through the clock, the electro-magnet attracts an armature controlling the verge of the escapement-wheel of the motor operating the contact arms and releases said motor, whereby the several contact arms are moved to make contact with the contact points of their respective divisions. At the same time an arm connected with the escapement closes the circuit through an electro-magnet which controls the revolution of the circuit wheel, whose movement is effected by a suitable motor, mechanical or otherwise. At the same

time that the escapement is thus released and the motor for the contact arms is in operation to complete circuit through the brushes and circuit wheel, said wheel, being released by the closing of the circuit through its electro-magnet, will begin to revolve, and, by the arrangement of contacts upon its surface, will, should the circuit controller be closed at any signal-receiving device upon the line, transmit the time-hours, any given equal division of an hour, and minutes.

My apparatus may either transmit the time automatically every minute, or the transmitter may be normally at rest and in position to be operated by the closing of a circuit controller at any sub-station at any minute. In addition to transmitting the time automatically each minute, there may be transmitted a warning signal which will indicate the exact beginning of a minute.

In the accompanying drawings forming part of this specification, Figure 1 represents a system employing my invention. Fig. 2 represents the circuit wheel developed. Fig. 3 is an elevation of the mechanism for actuating the contact arms, and Fig. 4 is a plan view of the same, the contact arms and insulation plate carrying the dials being removed.

A represents the time switch device, which is provided with three time divisions, each division being made up of a series of contact points, each contact point being insulated from the other contact points, and the several sets of contact points being arranged in the form of a circle as shown, and each being provided with a contact-arm carried like a clock-hand on a dial and having a movement adapted to make contact successively with the contact points. I have shown the uppermost series of contacts, which I will hereinafter call dial A', as provided with twelve contact points A², each contact point representing an hour, for which period the contact arm A³ remains in contact with the contact points successively. The middle series of contact points, which I will hereinafter call dial A⁴, is shown as provided with six contact points A⁵, each contact point representing a period of ten minutes, and the contact-arm A⁶ of said dial being adapted to remain in contact with each of its contact points for that period. It is obvious that any other equal division of an hour,

as, for instance, quarters or halves, might be arranged on dial A⁴. The third series of contacts, which I will hereinafter call dial A⁷, is shown as provided with contact arm A⁸ and ten contact points A⁹, that is, one contact point for every minute of each given division of dial A⁴. Of course if dial A⁴ were divided into quarters as before referred to, dial A⁷ would be provided with fifteen contact points.

The several contact-arms are operated by a motor of any suitable description. In the present instance I have shown a spring-driven motor comprising the coil spring L and gear l which serves to operate the spindle a of the contact arm A⁸, through suitable intermediate gears l'. This mechanism will preferably be provided with a fan l². Mounted upon the spindle a is a disk a² having upon its periphery ten teeth adapted for engagement with the escapement device a³ upon the end of the armature lever B'. Similarly mounted upon said spindle a or upon a sleeve rigidly secured thereto is a disk b having a single tooth b' designed for engagement with a disk c' mounted upon the spindle c of the contact arm A⁶. This disk is provided with six peripheral indentations c². Similarly mounted upon the spindle c is a disk c³ having a single tooth c⁴ designed for engagement with a disk d' mounted upon the spindle d of the contact arm A³ and provided with twelve peripheral indentations. It will thus be seen that the mechanism above described will cause the contact-arm A⁸ of dial A⁷ to have a successive intermittent movement for the space between two contact points, and to cause the contact-arm A⁶ of dial A⁴ to move the distance between two contact points for every complete revolution of the arm A⁸ of dial A⁷, and to cause the contact-arm A³ of dial A⁴ to move the distance between two of its contact points for every complete revolution of the arm A⁶ of dial A⁴. The counters for gas and other meters furnish examples of the character of gearing which may be employed to effect the successive movements of the several contact-arms, and instead of using spring power to effect the movement of such gearing, an electro-magnet may be used to operate the same. The movement of the contact-arms is automatically controlled by a magnet B, through which circuit is completed to operate its armature B', at intervals of a minute, by a clock C, which carries on the arbor of its minute-wheel a contact point which makes contact with an insulated contact point in the well known manner at every revolution of said minute wheel. When circuit is closed through the magnet B, the armature lever B' is attracted and releases the motor operating the contact-arms, one or two or all three of which arms are therefore moved from one contact point to another, according to the time to be indicated.

The circuit wheel or drum D is shown as a cylinder provided with three series of ribs D', D² and D³, the ribs being separated from one an-

other as shown by an air space or in any other suitable manner. It is mounted to revolve upon a shaft D⁴, which shaft is maintained in suitable bearings in the apparatus frame, movement being communicated to said shaft through the gearing D⁵ from a spring or other motor located in the casing D⁶. This motor is not shown, but any suitable clockwork, preferably controlled by a fan or vane to regulate the speed, will answer.

The series of contact ribs D' is adapted to close the circuit through the contacts on the dial A', and as each one of said contacts represents an hour of the twelve, in order to transmit the proper signal each contact point must make and break the circuit a given number of times. This is provided for by the method of arranging the ribs D' on the periphery of the circuit wheel or drum, the ribs being of regularly decreasing size and being in number equal to the number of contact points, whereby if the first hour is to be indicated, circuit being closed through the contact-arm A³, contact point and circuit wheel or drum at rib 3, but a single electrical impulse will be transmitted, whereas if the hour twelve was to be indicated, twelve successive electrical impulses would be transmitted, each of the ribs D' operating successively to close the circuit.

The series D² is arranged and operated similarly to the series D', but I have shown only five ribs D² whereas there are six contact points in dial A² with which said ribs co-operate, one rib being omitted because when the contact-arm of dial A⁴ is on the sixth contact point it will correspond to zero division of the hour, the hour being represented by the dial A and the minutes less than any division of dial A⁴ being represented by dial A⁷; or a form of contact on the circuit wheel or drum different from the ribs D³ may be used for the sixth division which will transmit a signal conventionally understood to represent zero. The first contact on dial A⁴, therefore, to make contact with the ribs D² on the circuit wheel or drum D will represent the first ten minutes or other given division of an hour into which dial A⁴ is divided, the second indicating the second ten minutes, and so on, thus indicating the second digit of the minutes of any given time.

The series D³ is likewise arranged and operated similarly to the series D'. I have shown but nine ribs in the series D³ although there are ten contacts in the dial A⁷ with which said series co-operate, but for the additional contact I have shown the strip D⁷, which closes the circuit to the first contact point of the dial A⁷ and by its shape produces a signal conventionally understood to be zero. The strip D⁷, by its length, affords a longer contact to its corresponding brush than do the ribs to their respective brushes, thus producing an appreciably longer signal thereby to denote zero, when tremulous bells are used. But, should single-stroke bells be

used, it is obvious that this contact would produce but one beat in said bells which would be understood as signal 1 and not as signal 0. To rectify this, a device is employed, whereby the continued but single electric impulse transmitted to said bells by the contact of a strip of the pattern of D^7 with its brush, is automatically and rapidly broken into many impulses, thus causing said bells to vibrate tremulously like ordinary bells and thus produce in said single-stroke bells the notably long tremulous signal understood to denote zero. This device consists simply in the use of an ordinary current-breaker connected with the wire k at any point between the brush which makes contact with strip D^7 and the zero contact point of dial A^7 . When this wire k is switched into circuit with a single-stroke bell or relay through the medium of arm A^8 of dial A^7 , then and then only is the magnet or helix of the current-breaker in circuit with the bell, and as the function of a current-breaker is to make and break a circuit automatically, it makes and breaks the current in helix of the single-stroke bell or relay simultaneously and thus produces the signal understood to be zero. The second contact point on dial A^7 has its circuit closed by the longest of the ribs D^3 , and so on throughout the remaining contact points, the tenth contact point being brought into electrical connection with each of the ribs of the series D^3 and thus controlling the transmission of nine electrical impulses. The contacts at dial A^7 as controlled through the series of ribs D^3 thus indicate the first digit of the minutes at any given time.

Electrical connection is established between the contact points on the several dials A^1 , A^4 and A^7 and the circuit wheel D through the medium of a series of brushes E , carried upon an insulating shaft or rod E' , the brushes being wired to the several contact points as indicated by the broken lines in Fig. 1. Each of the contact points in the several dials is intended to transmit a signal and is therefore wired to a separate brush, with the exception of one point on the dial A^4 , which is not shown as wired at all, but which may be wired when it is arranged to transmit a signal differing from the signals transmitted by the other contact points. The brushes wired to the contacts on dial A^4 make contact with the ribs D^2 on the circuit wheel or drum later than do the brushes wired to the contacts on dial A^1 , as do the brushes wired from the contacts on dial A^7 make contact with the ribs D^3 later than the brushes wired to contacts A^4 , the difference in time being appreciable so as to distinguish the signal transmitted by each set of contacts.

On the spindle D^4 of the circuit wheel or drum D an arm D^8 is arranged, which arm is provided with a pin. As the spindle D^4 revolves, this pin is brought into the path of a pivoted armature lever F and thereby the movement of the circuit wheel or drum D is

arrested. The armature lever F is operated by a magnet F' when the circuit is closed through the said magnet by the contact point F^2 carried by the armature lever B' being brought into contact with the contact strip F^3 on the circuit of magnet F' and by the closing of a switch H to produce a signal at the bells G .

When a time-signal is to be transmitted the circuit wheel or drum begins to rotate simultaneously with the action of the time-switch, that is, at the beginning of the minute, but, as an appreciable time elapses (two or three seconds) before the first rib moves into contact with the brushes, the first beat of the time-signal occurs that period of time later than the beginning of the minute. A warning signal or a signal to denote the exact beginning of the minute may, therefore, be desirable. Such a signal, indicating the exact beginning of the minute, is effected, at sub-stations at a short distance from the central station, by simply connecting wire z^2 leading from magnet F' with wire y^3 ; the bells at the sub-stations thus being in the same circuit with magnet F' at the instant when the clock operates magnet B' , whereby the bells are actuated simultaneously with magnet F' and thus produce a signal at the exact beginning of the minute. For sub-stations at a long distance from the central station, this signal, denoting the beginning of the minute is effected, by the use, at the central station, of a relay instrument wired to the transmitting apparatus similarly as the aforesaid bells, that is, with its magnet J in the main circuit and also in circuit with magnet F' . The relay, therefore, repeating the time (like the bells) preceded by the warning signal, makes or breaks the circuit on the line wire, thus reproducing the signals in telephones K and bells at distant sub-stations G . With the circuit as shown by the unbroken lines, the circuit wheel or drum D is preserved at a state of rest until a switch is closed at any sub-station on the main circuit; said wheel or drum will then rotate automatically and transmit to said sub-station a time signal preceded by a signal denoting the exact beginning of a minute. When it is desired to preserve the circuit wheel or drum normally at rest and to send a signal on the closing of the switch but without a signal denoting the beginning of a minute, the wires y^2 and z are omitted and the magnet F' is placed directly in the line wire as indicated by the dotted line z^3 , a double pole switch being used as shown at H^2 , the bell being indicated as G^2 . By connecting the magnet F' to the line wire y^3 as shown by the dotted line z^2 (the wire z connecting said magnet and line wire y^2 being of course omitted), the circuit wheel or drum is made to rotate automatically once every minute, whether the switch on the main circuit is closed to receive signals or not. This effect would be desirable in proportion to the frequency of the demand for the time signals on

the main circuit. By providing a wire as indicated by the dotted line y^4 , permanently closing break at F^2 , F^3 , a signal may be transmitted at any instant during the lapsing of a minute by using a push-button H^4 at the point H^3 . When the relay J is used, the circuit is as indicated by the full lines, the line then being without such a break as would occur when switch H is used. The introduction of such a relay, with the circuits as stated, insures the translation of the signal once every minute, preceded by the signal denoting the beginning of the minute, and such signals are indicated at the bells G or telephones K .

What I claim is—

1. In a system for electrically transmitting time signals, the combination of a time switch device divided into circles not concentric, each circle being provided with switch points and a switch arm, brushes wired to said switch points, and a circuit wheel or drum through which one or a series of impulses may be sent, substantially as set forth.

2. A system for electrically transmitting time signals, comprising a time indicator, a time switch, a circuit wheel or drum, means for operating said circuit wheel or drum and said time switch, and means for controlling said operation comprising an electro-magnet in circuit with the time indicator and an electro-magnet in the main circuit or in a separate circuit, said electro-magnets operating armature levers to release the moving mechanism, and brushes connecting said circuit wheel or drum with said time switch, substantially as set forth.

3. A system for electrically transmitting time signals, comprising a time indicator, a time switch provided with contact points divided into series, each series being provided with a contact arm, means for operating said contact arms at suitable intervals, a series of brushes wired to said contact points, a circuit wheel or drum provided with contact ribs,

and means for revolving said circuit wheel at proper intervals, substantially as set forth.

4. In a system for electrically transmitting time signals, the combination with a clock, a motor operated by said clock at determined intervals, of a time switch device divided into circles not concentric, each circle being provided with switch points and a switch arm, brushes wired to said switch points, and engaging with contacts upon a circuit wheel or drum, substantially as set forth.

5. The combination with a time switch device provided with two or more series of contacts arranged in line, of a contact arm for each series, a circuit wheel formed as a cylinder adjacent to said time switch device, and brushes for said contact points, contacting with said cylinder to transmit one or a series of impulses through the same, substantially as set forth.

6. The combination with a circuit wheel or drum provided with a series of contact ribs of definite width, of another rib or ribs of greater width, and a circuit breaker wired to the last named rib or ribs, substantially as set forth.

7. In a system for electrically transmitting audible time signals, the combination with a time switch device provided with contact points and electrically actuated switch-arms, of a circuit wheel or drum provided with a series of contact ribs of definite width, and another rib of greater width, brushes for contacting with said ribs and wired to the contacts upon said time switch device, and a circuit breaker interposed between the contact plate and the brush engaging with the rib or ribs of greater width, substantially as set forth.

This specification signed and witnessed this 9th day of November, 1892.

WALTER A. PURCELL.

Witnesses:

GEORGE B. BUCHANAN,
EUGENE CONRAN.