

(No Model.)

2 Sheets—Sheet 1.

J. M. ORAM.

TIME SIGNAL TRANSMITTING SYSTEM.

No. 328,055.

Patented Oct. 13, 1885.

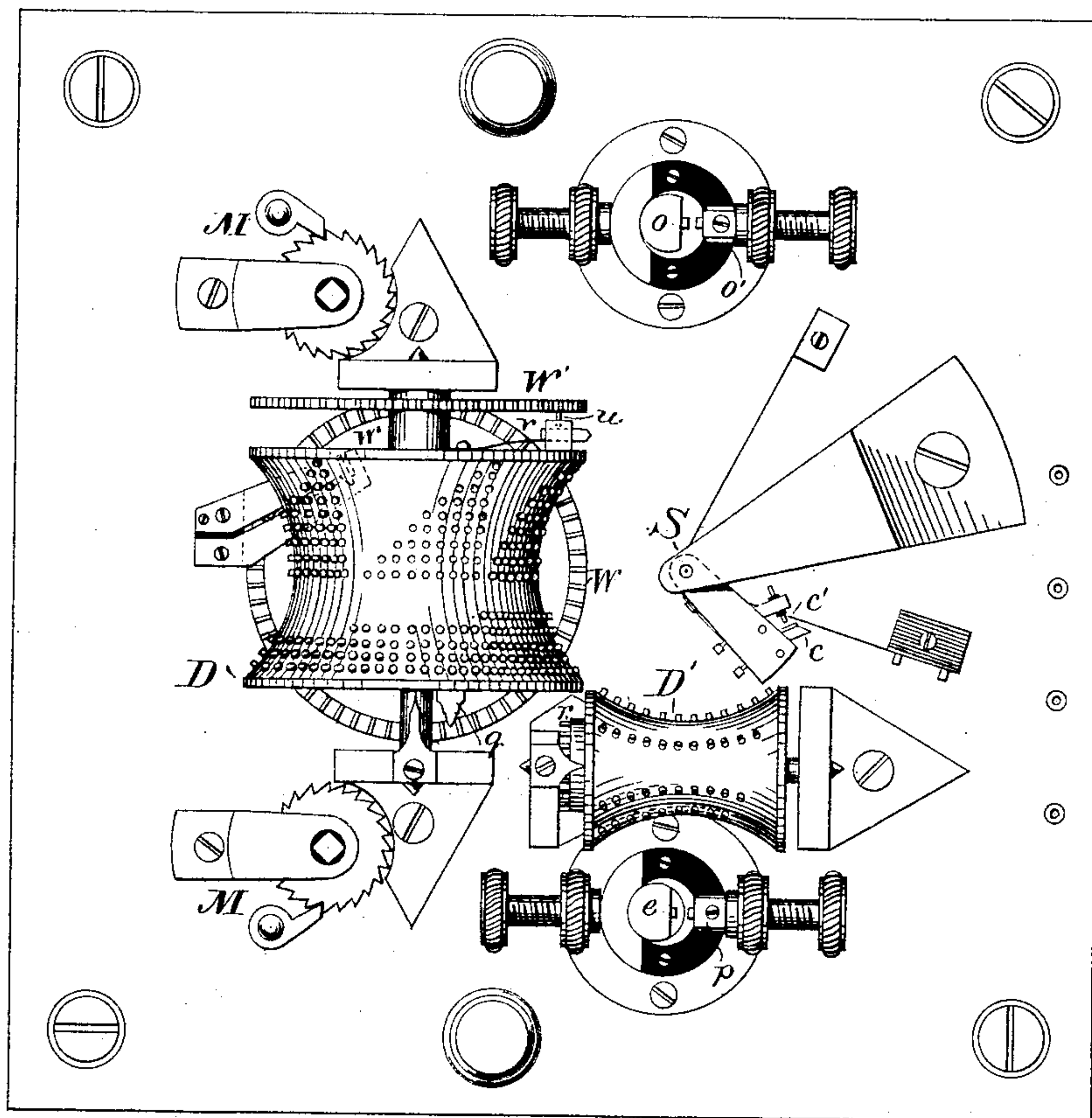


Fig. 1.

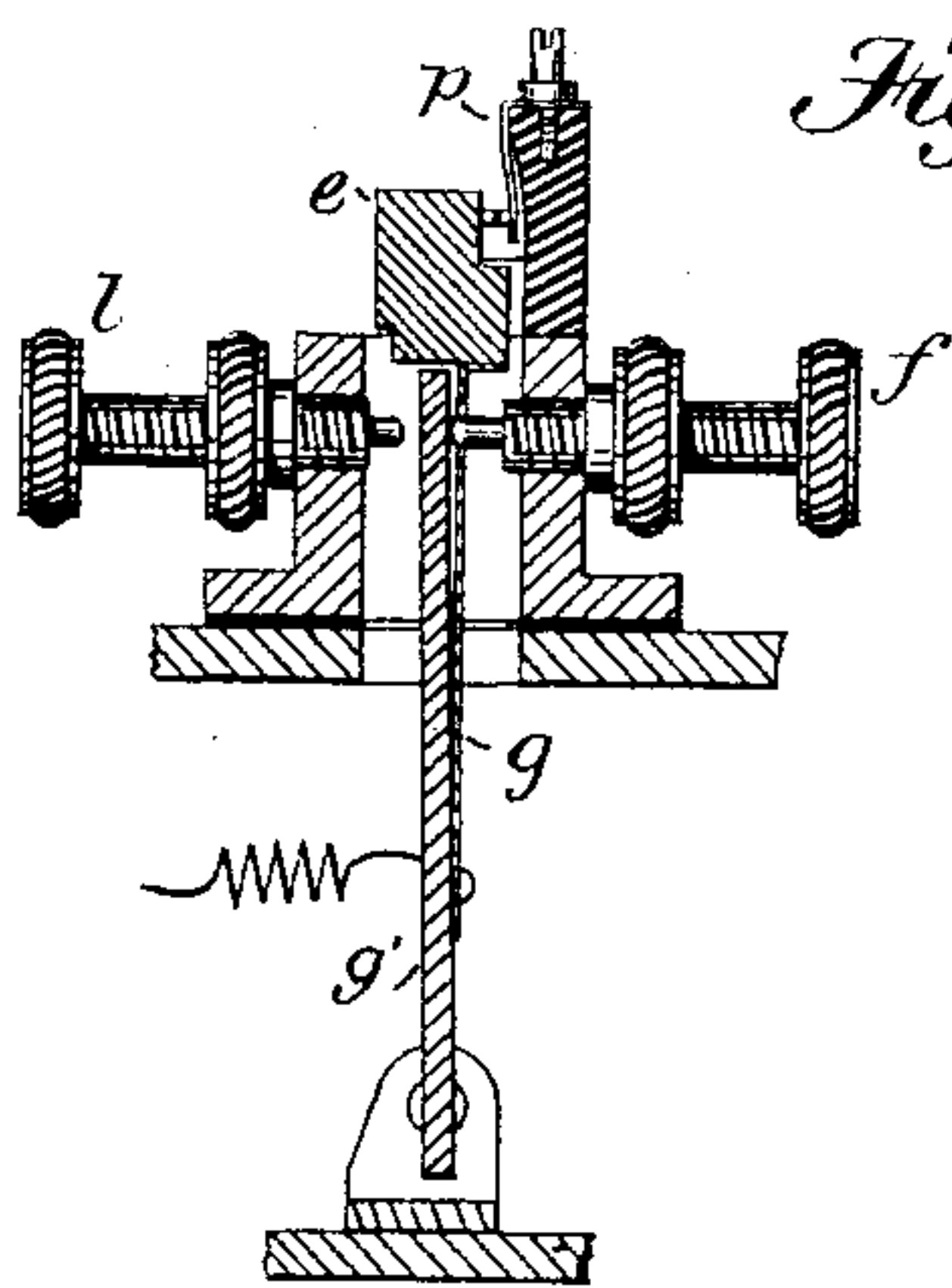


Fig. 4.

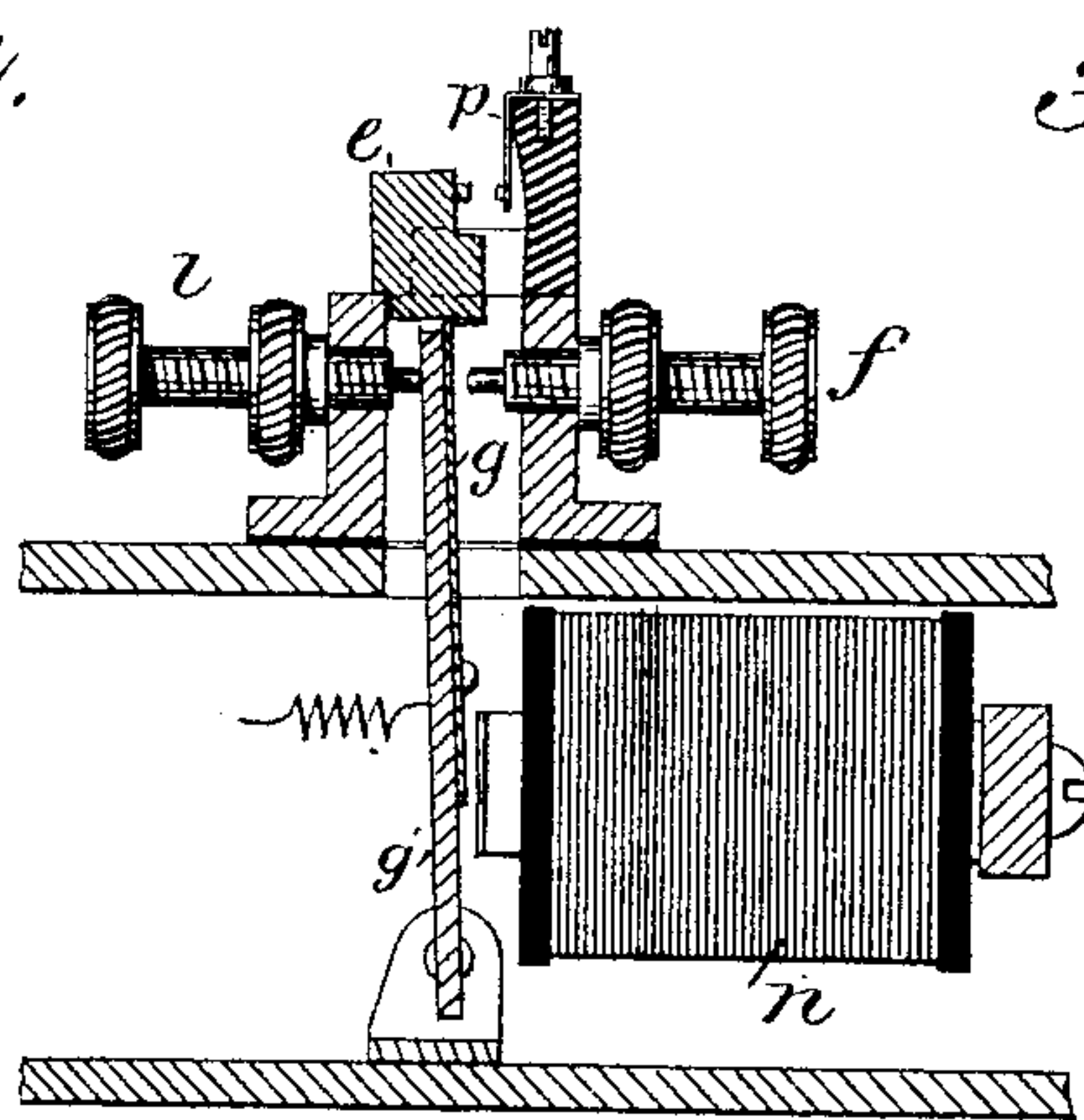


Fig. 3.

Witnesses.  
Geo. Willis Pierce  
Fred J. F. Schwartz.

Inventor.  
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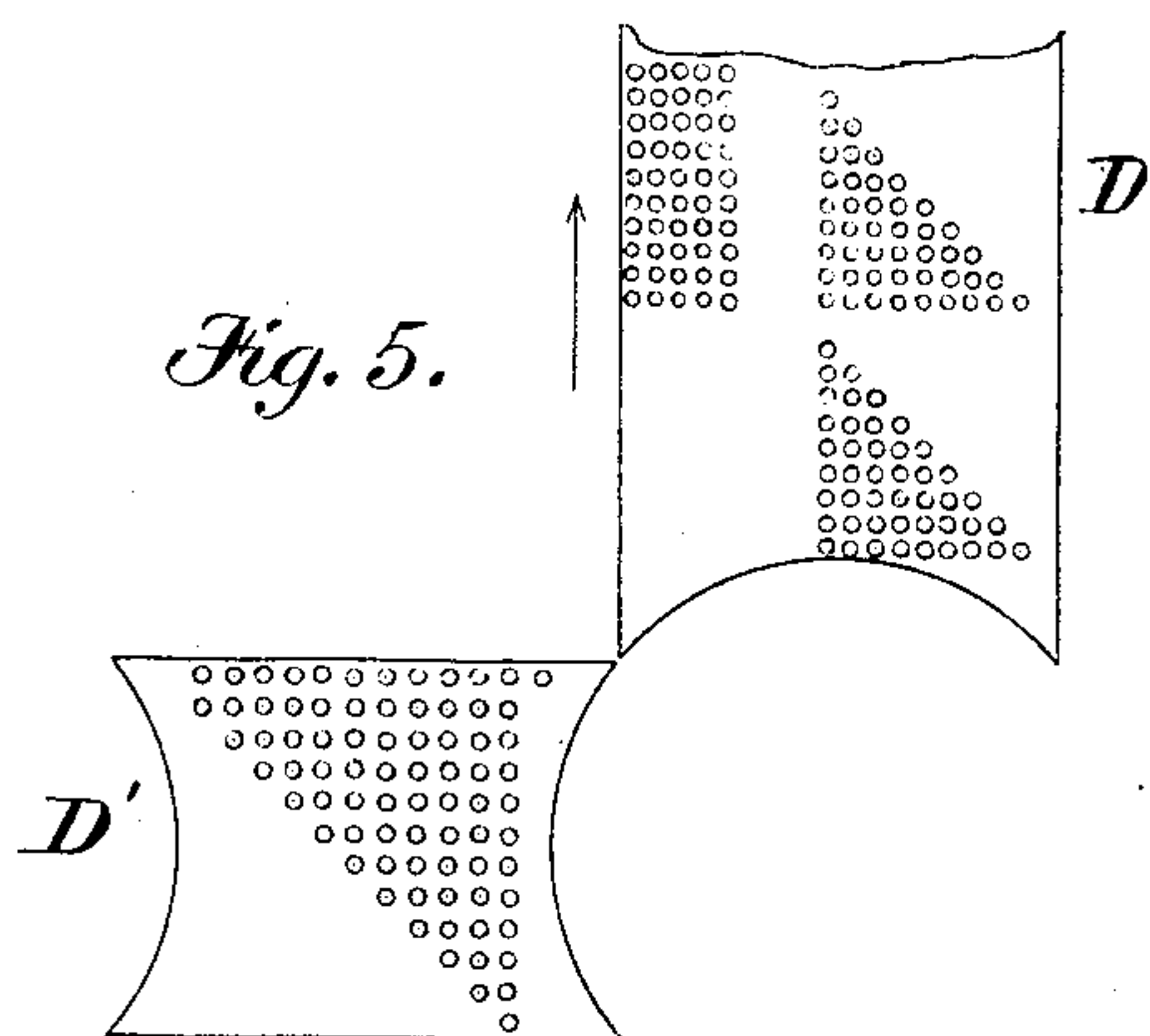
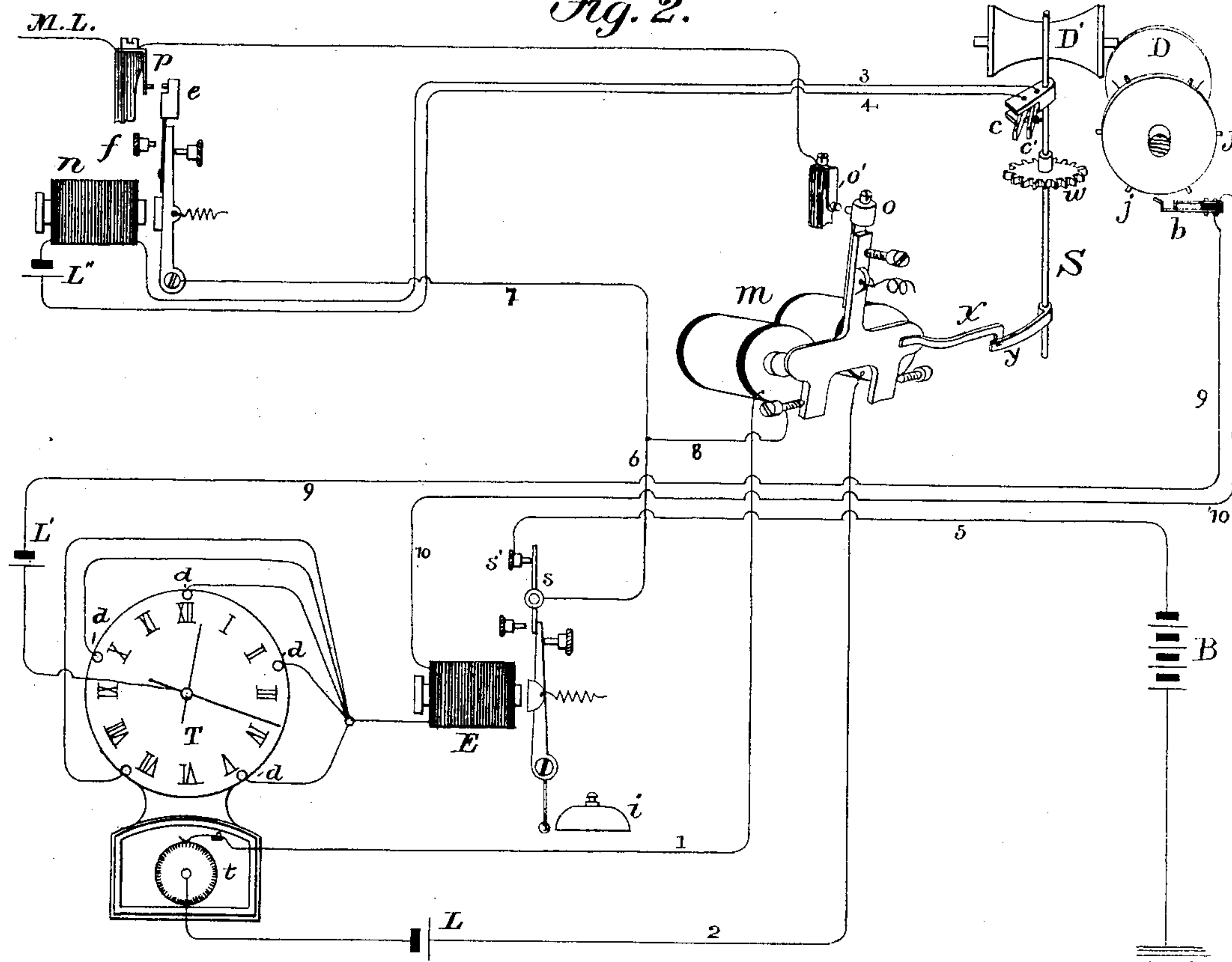
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Fig. 2.



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# UNITED STATES PATENT OFFICE.

JOHN M. ORAM, OF BOSTON, MASSACHUSETTS.

## TIME-SIGNAL TRANSMITTING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 328,055, dated October 13, 1885.

Application filed June 10, 1885. Serial No. 168,243. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN M. ORAM, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Time-Signal Transmitting Systems, of which the following is a specification.

My invention relates to the transmission of time-signals upon electrical circuits.

In United States Letters Patent No. 287,710, dated October 30, 1883, there is described an arrangement of apparatus called a "repeating-clock," consisting of a variable signal-transmitter, combined with a clock or time-piece, for transmitting time-signals upon electrical circuits, the invention as described being to transmit the correct time at frequent intervals—as at the expiration of each and every minute of the day. These signals, consisting of short impulses of electricity divided into groups (each group may be characteristically spaced) to denote hours, tens of minutes, and units of minutes, are received upon an electro-magnetic instrument—as an electro-magnetic bell or a receiving-telephone; and it is in connection with a telephone-exchange that this invention is found to be of great utility.

In this system of signaling, as heretofore practiced, the standard clock controls mechanism for transmitting an electrical signal. This transmitter is changed at the end of each period of time so transmitted into position for transmitting the next signal. For the purpose of making these changes in the transmitting apparatus, a motor controlled by the clock is provided. The connection between motor and transmitter is broken at the termination of each signal. It has been found that this disconnection of motor and transmitter gives rise to faulty operation; and one feature of my invention consists in connecting the motor and transmitter together positively by gearing, which is started and stopped by the regulating-clock through the medium of an electro-magnet.

Another improvement consists in the form and arrangement of the variable signal mechanism and the means for changing the signal at the end of each transmission. I provide two or more drums having concave surfaces, upon which are located the design-lines or circuit-closing points. The drums are so ar-

ranged relative to each other that their concave surfaces form the arc of a circle, at the center of which the arbor carrying the rotating circuit-closer is pivoted. I have shown two drums, each containing two or more design-lines or rows of circuit-closing points. One drum has upon its surface twelve design-lines or rows of points to denote the hour. The end of the second drum adjoining this has similar rows of points denoting tens of minutes, and the opposite end thereof has corresponding rows of points for indicating units of minutes. The drums are upon independent bearings. That one bearing design-lines indicating tens and units is geared with the motor and advances one step during each signal. It also moves the second or hour drum once each complete revolution one step ahead. I also provide means for manually connecting and disconnecting that portion of the transmitter carrying the design-lines with the motor, so that the position of the design-lines and the rotating circuit-breaker with respect to each other may be varied or set at pleasure.

A further improvement consists of means for preventing the transmission of an erroneous signal. For this purpose I provide a switch arranged to open the circuit over which time-signals are being transmitted should the controlling-clock and its signaling mechanism get out of unison. To operate this switch I place a pair of circuit-breaking points in a local circuit with an electro-magnet. These points are opened for a brief interval by projections on the circuit wheel or drum periodically—as once every ten minutes. In the same local circuit there are circuit-closing points controlled by the clock located at the same ten-minute intervals. The circuit is closed at these points at the same instant and for the same space of time that it is opened at the break-points controlled by the drum. Now, if the apparatus is in unison the local circuit will always be open at one point or the other as long as unison is maintained; but should the apparatus get out of unison both points will be closed simultaneously, and the electro-magnet will be operated to sound an alarm and change the position of the switch located in the main line, whereby said line is opened and the transmission of erroneous signals prevented.



Another improvement is in applying to the electro-magnet operating to transmit time-signals in the main circuit such a form of circuit-closer as will give a clear sharply-defined impulse. This consists in providing a stationary contact-point for one terminal of the circuit, and providing a flat spring pivoted to the armature, carrying upon its free end a weighted contact-point. A limiting-stop is placed in position to intercept the armature just before the two contact-points come together, when the weighted contact-point, by reason of its inertia, keeps on its movement, striking the fixed contact and rebounding. The fixed contact-point is also upon a spring, which tends to prolong the contact.

The invention further consists in details of construction and arrangement and combination of parts, to be referred to by aid of the diagram.

The accompanying drawings illustrate my invention. Figure 1 is a plan view of the transmitting apparatus complete, including variable signal, motor, and electro-magnets. Fig. 2 is a theoretical diagram showing the arrangement of circuits and relation of the parts. Figs. 3 and 4 show the constructions of the electro-magnet for transmitting a clear unbroken pulsation. Fig. 5 is a plan view of the arrangement of design-lines on the surface of the transmitting-drums. The hour-drum is complete, and the tens and units drum partly so.

Referring to Fig. 2, T is a clock or time-piece containing a circuit-closer, as *t*, operating to close the circuit  $I^2$  of local battery L at intervals, as once each minute, thus actuating electro-magnet *m*. S is the last shaft of a train of clock-work having a constant tendency to rotation imparted to it by any suitable motor, as M, Fig. 1. *y* is an arm projecting from this shaft, which arm takes against arm *x*, firmly fixed to armature of electro-magnet *m*. When electro-magnet *m* is operated, arm *x* is moved out of the path of arm *y*, and the wheel-train starts into action.

W, Fig. 1, is a gear-wheel driven by the same motor. Wheel W gears into a similar wheel, W', on the shaft of drum D.

D and D' are two drums having concave surfaces. The outline of these concave surfaces forms the arc of the circle, at the center of which is located the circuit-closer *c c'*, which is on shaft S, and is rotated thereby. I have shown but two drums; but it is obvious that more may be added until the circle is completed. Upon the concave surfaces of the drums D D' are located a series of "design-lines." By design-lines I mean lines of points or projections, or any mechanical equivalent therefor, as lines of holes, the function of which is to cause the circuit-closer *c c'* to complete a circuit, as 3 4, through a magnet, *n*. Upon drum D' there are twelve design-lines to indicate the twelve hours of the day. Upon the adjoining end of drum D there are design-lines indicating tens of minutes. There

is provided five groups of lines, each group containing ten lines—that is, there are ten lines indicating the single tens, ten lines for the twenties, ten lines for the thirties, and so on. On the opposite end of the same drum are design-lines indicating units of minutes, there being one line of units opposite each line of tens, except the first. Commencing with naught each line increases by one for each line of each group of tens.

Referring to Fig. 5, D' has twelve design-lines representing the twelve hours of the day. D moves in the direction of the arrow, and it is represented at that point in its rotation where the time from 12.50 to 1.10 has been transmitted. There are ten lines of the fifties. The units-line opposite the first line of fifty is blank. The successive lines of fifties have opposite them lines increasing by one from 1 to 9. Succeeding 12.59 there is a change of the drum D', and the hour 1 is represented. The drum D presents ten blank lines on the tens end, and nine lines of units, each line increasing by one successively. The arrangement of tens represented for the fifties is the same for the other four groups of tens. Drum D is released to advance one step periodically, as once per minute. The circuit-breaker *c c'* is simultaneously released and rotates in the arc of a circle across the design-line of drum D'. Each time the points *c c'* strike a projection the spring separating *c* and *c'* is overcome, and the two points *c* and *c'* are forced together, closing circuit through the local battery L, magnet *n*, and wires 3 4. The circuit-closer *c c'* makes but one revolution each time magnet *m* is actuated, and as it passes over the design-line of drum D' circuit is closed to indicate the hour; then as it passes across the surface of D it strikes the design-line indicating tens of minutes, then upon the opposite end units of minutes, and by the time it has made one rotation the drum D has gradually advanced far enough to present a design-line having one more point or projection on the units end. The tens end has not changed, however, and it is for this reason that while each design-line increases upon the units end by one, the tens are repeated ten times. After the units have changed ten times the tens change, and the same operation is continued until drum D has made a complete rotation, when the lug *g* on D strikes the gear-wheel *r* on drum D' and moves it one space, thus presenting a design-line indicating the succeeding hour.

The circuit-closer *c c'* is composed of two contact-points forming the terminals of a local circuit. These points are normally separated by a spring. When point *c* strikes a projection, it is forced against point *c'*, and the circuit is closed.

It is obvious that instead of placing projections upon the drum, lines of holes may be substituted, into which a projection upon the circuit-closer may drop, thus allowing the points to come together and close the circuit; or the connections may be so arranged that



the drums form one terminal of the circuit and the rotating circuit-closer the other.

The electro-magnet *n*, Figs. 2, 3, and 4, is constructed to transmit into the main circuit upon which time-signals are sent. It consists of an ordinary electro-magnet, its armature, and armature-bar. There is an insulated contact-point, *p*, formed of a spring to prolong the contact with point *e*. *e* is a contact-point located upon the end of a flat spring, *g*, attached to the armature. There is a hole in spring *g*, through which contact-point *f* may pass to contact with the armature-bar *g'*. Point *e* is weighted, and when the magnet is energized the armature is drawn up, *f* taking against *g'* before *e* can reach *p*; but *e*, by its inertia, keeps on in its movement and strikes a sharp blow upon *p*, (see Fig. 4,) immediately rebounding to the position (shown in Fig. 3) from which it started. This form of contact is only found desirable for use where signals are received upon telephones, which, on account of their sensitiveness, will reproduce the slightest variation from a single undivided impulse. For the purpose of repeating into lines where electro-magnetic bells are employed, I prefer to make connection between armature-bar *g'* and fixed contact *f*, as such contact would be of greater duration. By means of the apparatus shown circuits containing instruments of both kinds may be operated simultaneously.

The main line *M L*, upon which the time-signals are to be transmitted, is connected to the contact-point *p* of magnet *n*. A branch also extends to contact-point *o'* of magnet *m*. The other contact-points, *e* and *o*, of these magnets are connected to a grounded battery, *B*. The contact-point *o* of magnet *m* is upon the extreme end of a spring attached to the armature of magnet *m*, its function being described and claimed in United States Letters Patent No. 299,562, dated June 3, 1884, and is, in brief, to transmit a buzz-signal at the exact instant of time, which is to be immediately thereafter signaled.

The operation of the apparatus, so far as described, is as follows: The clock *T*, through its circuit-closer *t*, actuates magnet *m*, contact-points *o* and *o'* are brought together, and a signal is transmitted *via* earth, battery *B*, elements 5 *s' s* 6 8 *o o'* *M L*. As the armature of *m* is attracted, arm *x* is moved out of the path of *y*, and the motor starts into operation, carrying circuit-breaker *c c'* over the design-lines on *D* and *D'*. *D* meanwhile slowly advances, so that by the time *x* and *y* again make contact *D* has advanced sufficiently to change the signal, presenting one to be next transmitted. As *c c'* makes and breaks circuit through magnet *n* the main circuit is made and broken, the connections being from earth *via* battery *B*, 5 *s' s* 6 7 *e p M L*, and a signal is transmitted composed of one, two, or three groups of electric impulses, according to the time-signal transmitted. These groups may or may not be spaced to give each division of time a characteristic designation or identity; but such

spacing is preferable, and is fully described in the said Letters Patent No. 287,710.

The apparatus for preventing the transmission of an erroneous signal and for sounding an alarm in case the transmitter and clock get out of unison is arranged as follows: *E* is an electro-magnet operating a bell-hammer to sound bell *i*. It is in a local circuit, 9 10, with battery *L'*. The circuit-closer *b* in the same circuit is normally closed, but is opened momentarily at intervals—say once every ten minutes—by projections *j* on the drum *D*. In the same circuit, at identically the same intervals, the hand of clock *T* closes this circuit at a point, *d*, where it is normally open. Circuit is therefore closed at *d* and opened at *b* simultaneously, and for the same period of time, so that circuit 9 10 is never closed so long as *T* and *D* are in unison; but should *D* fail to open circuit at the exact instant that *T* closes it, the circuit will be complete at both points and the alarm *i* will be sounded. For the purpose of preventing the transmission of a false signal, the switch-arm is held upon the contact *s'* by a friction-bearing, and the circuit 5 6 is held normally closed. When, however, magnet *E* is operated, the point *s'* and arm *s* are separated, and the main circuit 5 6 is held open until closed by the attendant. The transmission of an erroneous signal is thus prevented by opening the circuit upon the failure of unison between the clock and transmitter.

The position of drum *D* may be set or changed with respect to the rotating circuit-breaker by means of the devices shown in Fig. 1.

A spring, *v*, is fixed to drum *D* and carries upon its free end a pin, *u*, which takes into a series of equidistant holes in the next wheel *W'* of the motor train. By depressing this spring, which withdraws the pin *u*, the drum *D* may be rotated into any desired position.

In Fig. 1 two spring-motors, *M M*, are shown, both co-operating to the same end; but an electric or other motor of sufficient power may be substituted.

What I claim, and desire to secure by Letters Patent, is—

1. The combination, in a time-signal, of a variable signal-transmitter permanently geared to a motor and an electro-magnet for controlling the motor operated by a clock or time-piece through the medium of an electric circuit.

2. In a time-signal, the combination of a variable signal-transmitter permanently geared to a suitable motor, a manually-operated locking device for changing the relative position of the design-lines and circuit-breaker, an electro-magnet for controlling the operation of the motor, and a clock or time-piece for governing the operation of the magnet.

3. A variable signal-transmitter, consisting of the combination of two or more drums having concave surfaces upon which are located one or more design-lines and a rotating circuit-



closer located at the center of the circle of which the concave surfaces of the drums form arcs.

4. The combination, in a variable signal-transmitter, of two or more drums having concave surfaces upon which are located one or more design-lines, a rotating circuit-closer located at the center of the circle of which the concave drum-surfaces form arcs, and a motor geared to the said drum.

5. The combination, in a variable signal-transmitter, of two or more drums having concave surfaces upon which are located one or more design-lines, a rotating circuit-closer located at the center of the circle of which the concave drum-surfaces form arcs, and a motor geared to the said drums and to the rotating circuit-closer.

6. The combination, in a time-signal transmitter, of two or more drums having concave surfaces upon which are located one or more design-lines, a rotating circuit-closer located at the center of the circle of which the concave drum-surfaces form arcs, and a motor geared to the said drums and to the rotating circuit-closer held in check by the armature of an electro-magnet controlled by a clock or time-piece.

7. The combination, in a time-signal transmitter, of two or more drums having concave surfaces upon which are located one or more design-lines, a rotating circuit-closer located at the center of the circle of which the concave drum-surfaces form arcs, a motor geared to the said drums and to the rotating circuit-closer held in check by the armature of an electro-magnet controlled by a clock or time-piece, an electro-magnet in a local circuit operated by the said circuit-closer, and a main line operated by the last-named electro-magnet.

8. The unison alarm for a time-signal trans-

mitter, consisting of the combination of an electro-magnet operated by a local circuit having a circuit-closer controlled by the clock and a circuit-closer controlled by the signal-transmitter, the two being so arranged that a failure of unison will operate the circuit to sound an alarm.

9. The hereinbefore-described means for preventing erroneous signals in a time-signal transmitter, which consists in the combination of a switch or circuit-closer in the main circuit controlled by an electro-magnet located in a local circuit containing a circuit-closing point operated by the clock and a circuit-breaking point operated by the transmitter.

10. In a time system, an electro-magnetic circuit-closer, consisting of the combination of an electro-magnet having upon its armature-bar a spring, at the free extremity of which is located a weighted contact-point operating upon a fixed contact-point, and a limiting-stop in the path of the armature-bar operating to bring the armature to rest before contact is made between the weighted contact and the fixed contact.

11. The combination, in a variable signal-transmitter, of the drums  $D D'$  with the circuit-closer  $c c'$ .

12. In a time-signal, the combination of a motor-driven variable transmitter controlled by an electro-magnet, the arm  $y$ , attached to the motor-train, the arm  $x$ , attached to the armature of the electro-magnet, and a clock or time-piece for operating the electro-magnet.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 2d day of June, 1885.

JOHN M. ORAM.

Witnesses:

FRED J. F. SCHWARTZ,  
GEO. WILLIS PIERCE.