(No Model.) 2 Sheets—Sheet 1.

E. F. BURRILL.

PROGRAM CLOCK.

No. 601,850. Patented Apr. 5, 1898.

Fig. 1.

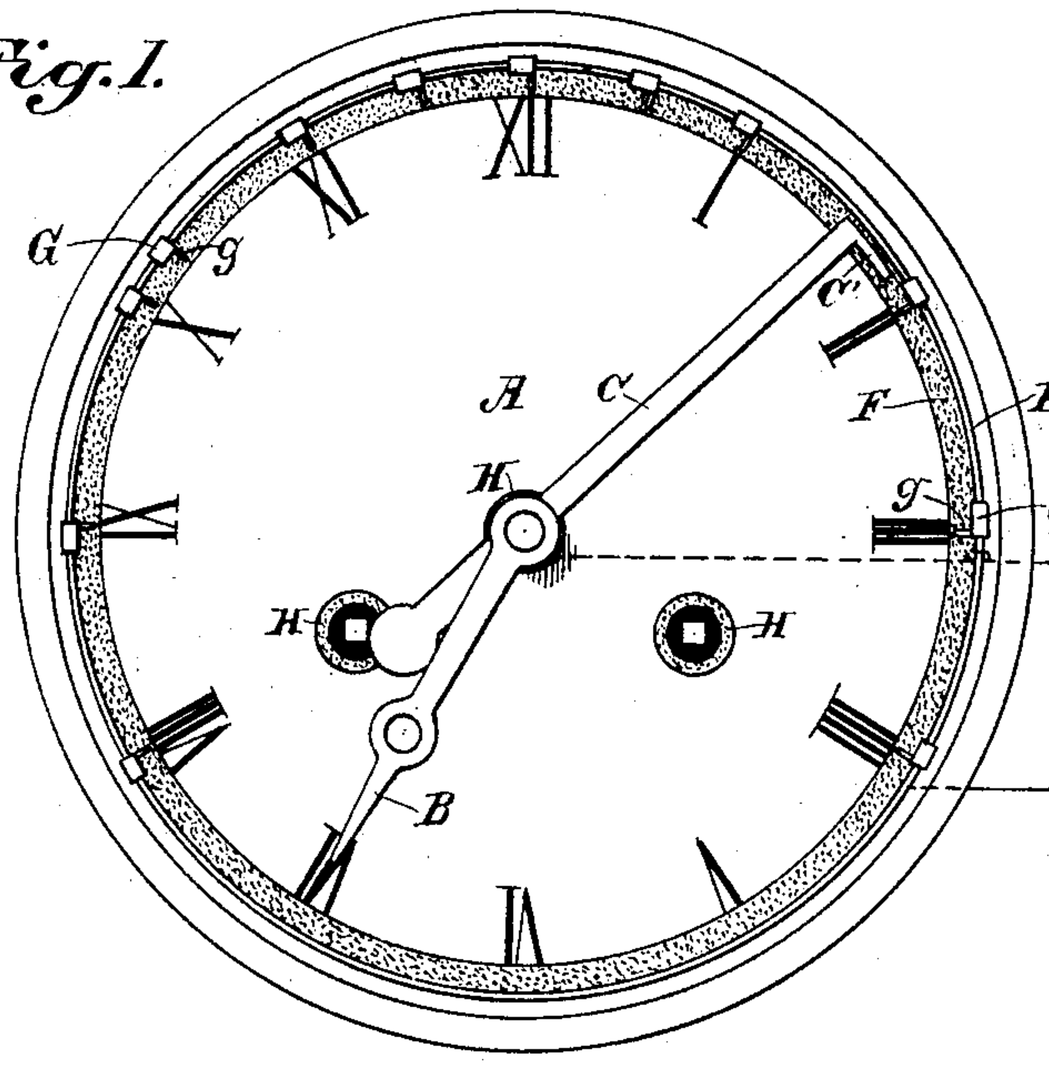
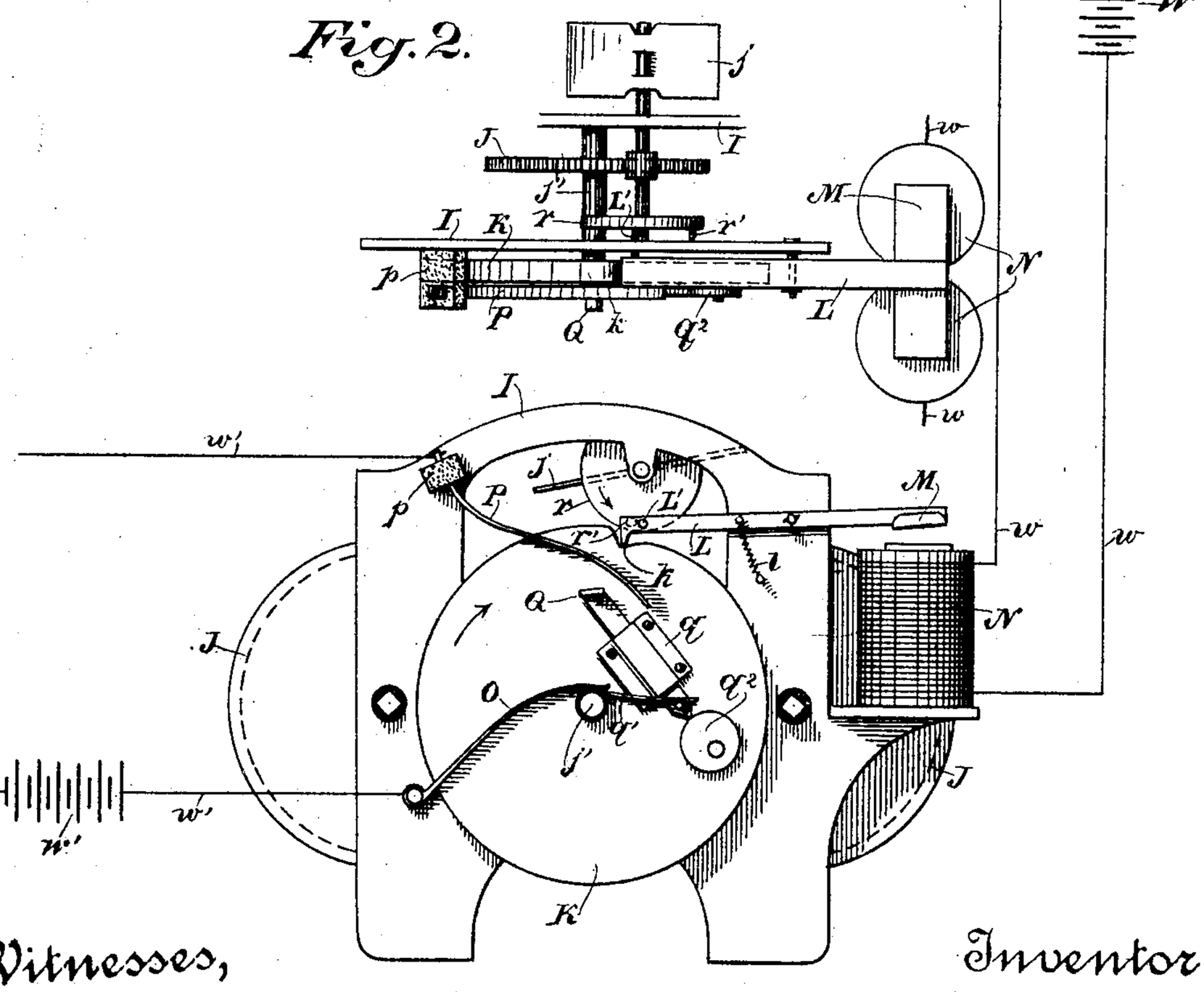


Fig. 2.



Witnesses,
J. H. Morse
H. F. Ascheck

Inventor,
Elwyn F. Burrill
By Dewey & Co.
Attys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

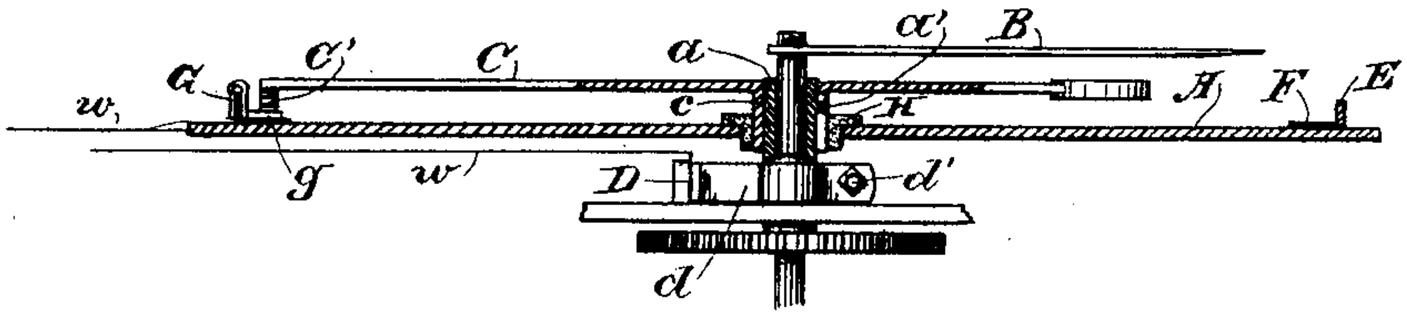


Fig. 4.

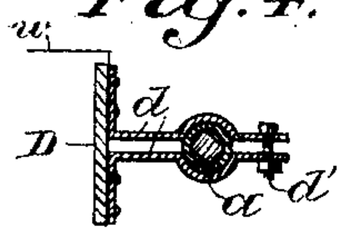


Fig. 5.

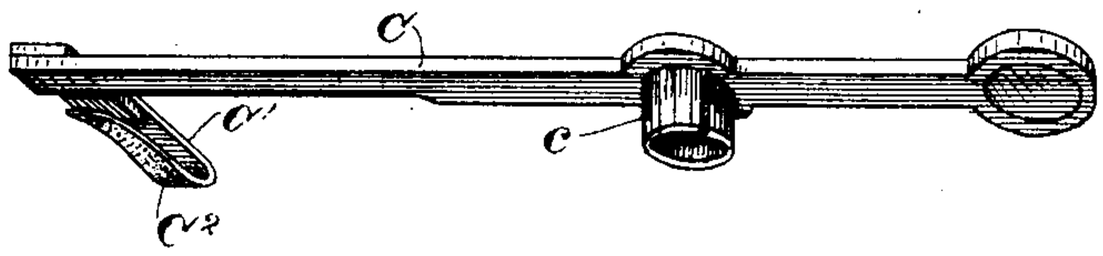
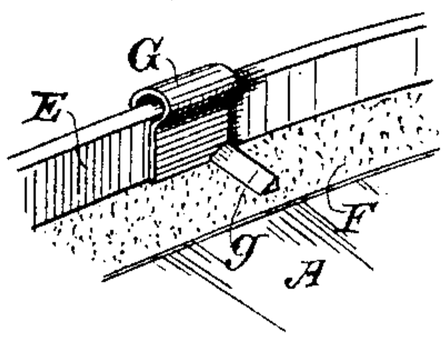


Fig. 6.



Witnesses,
H. A. Towle
H. F. Ascheck

Inventor
Elwyn F. Burrill
By Dewey & Co.
Attys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ELVYN FREMONT BURRILL, OF OAKLAND, CALIFORNIA.

PROGRAM-CLOCK.

SPECIFICATION forming part of Letters Patent No. 601,850, dated April 5, 1898.

Application filed September 4, 1896. Serial No. 604,827. (No model.)

To all whom it may concern:

Be it known that I, ELVYN FREMONT BURRILL, a citizen of the United States, residing at Oakland, county of Alameda, State of California, have invented an Improvement in Program-Clocks; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to that class of devices whereby electric gongs, buzzers, annunciators, relays, or other electrically or mechanically operated devices for signaling or other purposes are set in operation at prescribed times through the agency of a clock. The times at which these devices are set in operation refer usually to and indicate some kind of a program, from which this class of devices has received the general title of "program-clocks."

Though my invention is applicable to any kind of a program, for any purpose, it is especially intended for the exhibition or rendition of a program adapted for school purposes.

My invention consists in the novel construction, arrangement, and combination of parts, which I shall hereinafter fully describe and claim.

Figure 1 is an elevation of my device. Fig. 2 is a top view of the intermediate mechanism. Fig. 3 is a vertical section of the clock-dial. Fig. 4 is a detail showing the clamping of the hour-wheel sleeve. Fig. 5 is a perspective view of the hour-hand with its contact-lever. Fig. 6 is a perspective detail of one of the nodes in position.

I will first describe the parts connected with and immediately dependent upon the operation of the clock.

A represents the dial of an ordinary clock, of which it is unnecessary herein to illustrate the remaining parts.

B is the ordinary minute-hand of the clock, and C is the hour-hand.

In order to render the hour-hand, which alone is used for the electrical contacts, true and steady in its movement, there are secured upon a support D, fastened to the front movement-plate, two strips of thin spring metal *d*, mutually clasping the sleeve *a* of the hour-wheel, said strips being held together to their frictional contact with the sleeve by means of a binding-screw *d'*. These metallic strips also serve to conduct the current to the hour-hand, as is shown by the battery-wire *w*.

The hour-hand C is a heavy, rigid, balanced one, as shown. It is provided with a strong sleeve *c*, having a longitudinal slit in one side, which engages with a pin *a'*, projecting from the outer surface of the sleeve *a* of the hour-wheel. The purpose of this construction is to hold the hour-hand from turning upon the sleeve of the hour-wheel.

Around the periphery of the dial A and upon its face is secured a metallic circle E, made by bending a strip of sheet spring-brass or other suitable conducting material.

F is a ring cut from bristol-board or other non-conducting material and placed flat upon the surface of the dial and close against the base of the metallic circle E. This insulating-ring may be fitted to the dial either inside or outside of the metallic circle, but it is here shown as being just inside thereof.

G are substantially U-shaped metallic nodes or riders movable longitudinally upon the metallic circle E and frictionally held thereto by the elasticity of their legs or members. Each node is provided with a slender finger *g* at the lower end of one leg thereof (here shown as the inner leg) and at right angles to it, said finger lying upon the face of the insulating-ring F and radial to the dial. The shape of the finger in cross-section is that of a right-angled triangle, with one face lying upon the insulating-ring, another presenting an inclined plane to the approaching hour-hand, while the third is in a plane perpendicular to the plane of the dial. There are gutta-percha insulators H for the key-holes, and also for the center hole of the dial to insulate it from the movement and hour-hand.

The point of the hour-hand is provided with a downwardly and backwardly bent metallic spring-lever C', whose tip travels exactly under the point of the hand and in constant contact with the face of the insulating-ring F, and consequently trips over the metallic fingers *g* of the nodes G, which lie across its path.

One circuit-wire *w* of the light relay-battery W is led to the metallic circle E as one terminal, and said circuit includes the point

of the lever C′ upon the hour-hand as the other terminal, since the other circuit-wire *w* is led to the metallic strips, previously described, which conduct the current to the hour-hand. It now follows that while the tip of the lever upon the hour-hand is passing across the finger of a node the electrical circuit will be closed and any electrically-actuated apparatus within the circuit will be set in operation; but for many purposes—for example, ringing gongs in a school-building to announce the periods of a school-program—the duration of this contact would be too long on account of the slow movement of the hour-hand. To reduce the duration of this contact and closure of the circuit, I have provided the under side of the lever C′ with a guard C^2, consisting of a strip of some insulating or non-conducting material, which extends from very near the point or extremity of the lever upwardly a sufficient distance, leaving only the very tip of the lever exposed and so located relatively to the insulating-strip as to come in electrical contact with the node-finger only while crossing the very upper edge or ridge thereof, for said guard-strip protects it from contact while traveling up the slope of the finger, and only when passing across the top ridge thereof will the tip of the lever come into electrical contact with it.

It will be well at this point in order to make clear the improved character of the parts thus far described, as well as the utility of the parts to be described, to briefly set forth some difficulties to be met in order to secure the perfect operation of a device of this nature.

It is well known that an apparent mechanical contact of two pieces of metal which are terminals of an electric battery is not necessarily an electrical contact. This is especially true where a metallic point appears to touch a smooth metallic surface. I have found that it is possible for a metallic point or terminal to be carried by the movement of a clock-hand across a smooth metallic surface, the other terminal all the time apparently touching it, without making an electrical contact. If the contact-point on the hand travels constantly upon the surface of the insulating-ring between the contact-points on the dial, as it should do in order to secure the best results, it gathers minute particles of dust and carries them upon the surfaces of the nodes, and thus impairs the contact, rendering the action of the current spasmodic or causing it to fail altogether. Devices of this class at present in use employ a flat node with its surface parallel to the plane of the dial, and consequently fail for the reasons I have just given. They are, furthermore, liable to failure for the following reasons: The nodes controlled by the hour-hand are comparatively broad and the lever naked, thus requiring several minutes for its point to pass across the face of the node. This fact makes it impossible to control the closure of the circuit by means of the hour-hand alone, so the minute-hand is also employed, and the closure takes place only when both hands are simultaneously crossing nodes and continues only so long as the minute-hand lever is in contact with its node. Thus if either the hour-hand or minute-hand contact fails the result is a total failure.

The difficulties I have described could be overcome if sufficient pressure of the lever upon the node could be secured; but the minute-hand is incapable of imparting more than a very delicate pressure of the lever upon the nodes. Consequently the employment of the minute-hand to control the operation of the closure is an element of weakness and especially susceptible of failure.

Even employing the minute-hand, as described above, the node must be very narrow; otherwise the contact is too long; but if it is sufficiently narrow the hand, since it moves in impulses a considerable distance with each beat of the pendulum, is in danger of jumping the node without making contact.

It will be seen that my device dispenses with the minute-hand and its nodes as factors in the result at which I aim, thus getting rid of a fruitful source of failure. Furthermore, my hour-hand contacts are rendered sure by causing the point of the spring-lever to travel up an inclined plane, thus securing the maximum pressure at the moment of contact, and by causing the contact-point to travel across a sharp edge or ridge of metal, thus securing a scraping of the point, which removes any particles of dust that may be upon it.

Since the parts already described are for many purposes complete, I will show the manner of setting the nodes for ringing a program, which the device is capable of doing perfectly with a single-stroke gong, inasmuch as said gong would strike but once irrespective of the length of the contact. Suppose, for example, that it is desired to ring a gong or to set any electrically-actuated apparatus in operation by means of the clock at 9 a. m. and again at 2.15 p. m. every day. Turn the hands of the clock until they indicate one minute to nine. Then set a node upon the metallic circle so that its finger lies upon the insulating-ring close in front of the point of the lever upon the hour-hand. Then by gently sliding it upon the circle so adjust it that the contact-point on the lever arrives at the edge of the node-finger at exactly nine o'clock, which will be indicated by the striking of the gong. Now turn the hands until they indicate "2.14 p. m." and set a node in the same manner as before. Then set the clock to indicate the correct time of day. It will ring the program above indicated every twelve hours as long as the nodes remain in those positions.

Should it be desired to ring the program throughout one portion of twenty-four hours

and not to repeat it during the remaining portion, it is obvious that a switch (unnecessary herein to show) may be so arranged that it may, when desired, cut the clock out of the circuit or throw it in again.

Another important advantage in my device may be thus explained. The duration of the contacts in a model in operation is less than a one-half minute. It is evident, therefore, that gongs could be rung at any minute of any hour and at any intervals not less than one minute during a period of twelve hours, or on a twenty-four-hour dial during a period of twenty-four hours. In other devices, since it requires several minutes for the hour-hand lever to pass across a node, this result could not be obtained. Suppose, for example, it is desired to ring a gong at twelve m., and another at one minute past two p. m. It will be necessary, besides the hour-hand nodes, to set a minute-hand node at the figure "12" and another at one minute past the figure "12." Now the gong will ring at twelve m., because both hands are simultaneously crossing nodes; but the gong will also ring at one minute past twelve, because the hour-hand will not have passed off the node set for the gong at twelve and the minute-hand will have reached the node set at one minute past twelve. Consequently both hands will again be simultaneously on nodes. Then instead of there being one gong at one minute past two, as desired, there will also be a gong at two, because the hour-hand in order to be ready upon the node set for one minute past two will already have passed upon it when the minute-hand crosses the node set for twelve.

As far as I am aware the devices heretofore in use and those suggested are not intended to operate programs having minute-hand nodes nearer together than five minutes.

Before describing the construction of the intermediate devices which are included in my invention and by which, when set in operation by the clock, the program is rendered, I will explain that it is not well to allow the current from a heavy battery to pass through the clock, for the reason that the powerful spark at the moment of breaking contact burns the contact-points, even though platinized, and rapidly corrodes them, until the contact is impaired and ruined. There are also corrosive deposits from local action in the bearings of the movement. So it is customary to set a relay between the clock and the main battery. The clock then closes the circuit of a light relay-battery, which is herein represented by W, and which actuates the relay. The relay in turn closes the circuit of the main battery, which is here represented by W′.

As there are only two contact-points in a relay, the corrosive effects of the spark can be remedied in a moment by an occasional filling. Now an ordinary relay is powerless except when under the influence of a battery. When employed for the purpose above described, such a relay acts so long as the clock maintains its circuit closed and ceases to act the moment the clock breaks the contact. Now my relay or intermediate device differs in important particulars. I will now describe this intermediate relay or controlling device.

I represents a suitable frame which carries a power mechanism of any suitable character, here represented as consisting of spring-actuated clockwork, (represented generally by J.) Of this clockwork *j* is the ordinary fly or fan regulator, and *j′* is a driven shaft or arbor, conveniently the hour-shaft of an ordinary clock-train. Mounted upon this shaft or arbor and rotating with it is a cam K, disk-shaped, except that its periphery for a small portion of it falls gently toward the center into a depression *k* and then rises again from the deepest part of the depression *k* quite abruptly to the circumference. Near this cam and to one side of it is pivoted a lever L, the point of one arm of which is held by a delicate spring *l* against the periphery of the cam K. The lever L carries fixed to the end of its other arm an armature M of an electromagnet N, to which the circuit-wires *w* from the clock and relay battery extend. The cam-arm of the lever L is provided with a pin L′, extending inward to near the face of a small disk *r*, rotating on the fan-arbor or outer arbor of the train of gears. The small disk *r* also carries a pin *r′*, projecting from its face near its periphery outward toward the lever L. Now when the point of the lever L rests upon the circumference of the cam K the pin L′ is out of the path of the pin *r′* and the disk *r* is free to rotate; but when the cam K has made a complete revolution the point of the lever L drops gradually into the depression *k* and the pin L′ begins to interfere with the pin *r′*. When the point of the lever rests in the deepest part of the depression *k*, the pin L′ is exactly in the path of the pin *r′* and stops the rotation of the disk *r*, which stops the whole mechanism. Since the releasing and stopping force is exerted upon a disk and arbor so far removed from the driving power, this construction makes it possible with a delicate releasing force to control a powerfully-driven mechanism. If the stopping were effected by allowing the lever L to fall into a notch in the cam K, to act as a direct pawl, the cam would be driven so forcibly against the pawl that too great a force would be required to release it. The circuit from the main battery W′ is represented by the wires *w′*, and this circuit includes a suitable gong (unnecessary herein to show) or any other mechanism to be ultimately operated to exhibit or render the program. This circuit terminates at one end in a spring-contact O against the arbor *j′* and at the other end in the post *p* of a contact-spring P, adapted to bear against a contact-finger Q, carried by the cam K. This contact-finger Q is an adjustable one, being mounted and adapted to slide in a bearing *q* and being controlled by a spring *q′*, which said

spring holds the lower extremity of said contact-finger against an adjusting-cam q^2. By turning this cam the contact-finger may be set farther in or out, in order to increase or diminish the length of time which by the revolution of the cam K it remains in electrical connection with the contact-spring P. Now it will be seen that when the light relay-circuit *w* from the clock is closed by the hour-hand, as heretofore described, the electromagnet N will be energized and will attract its armature M, so that the lever L will be lifted out of the depression *k* in the cam K; also, the pin L′ will be lifted out of the path of the pin *r*′. The disk *r*, and consequently the cam K, will now rotate under the operation of the power mechanism, and the finger Q and spring P will be thrown into electrical contact and continue therein for any length of time desired, whereby the ultimate device, whether it be the gong or any other mechanism, will be operated. The cam K will make one rotation, when the lever L will fall into the depression and the mechanism will be stopped, as above described. It will therefore be seen that this controlling device is dependent upon the clock only for its release. It is therefore self-acting, self-timing, and self-stopping mechanically. As a self-acting relay for ringing a program it is more effective than the minute-hand of the clock in controlling the duration of contact, for by the rotation of the cam, which may have any suitable diameter, I cause the moving contact-finger Q to travel a long distance at each action and can cause the electrical contact to be made at any desired point in its revolution and continue any desired portion of it from an instantaneous one to one continuing throughout the entire rotation. Thus the duration of contact is put under perfect control; also, since the rotating cam is near the driving-power, it yields a strong pressure of the contact-points upon each other, securing never-failing contact.

The closer control of the duration of contact even than is yielded by my devices on the clock is highly desirable for several purposes—for example, in ringing a school-program with ordinary rapid-striking gongs. In this case the clock alone, or with an ordinary relay, would make too long a contact. With this intermediate device all that is necessary in the clock is that the lever pass over the node-finger in a less time than is required for one rotation of the cam K—say one minute, which for a school-program apparatus adapted to ring one-minute intervals is a convenient time. The function of this intermediate apparatus need not be electrical. It may be mechanical. For instance, it could be used to set off the heavy striking machinery of a tower-clock, making it possible to detach the striking machinery from the clock, or for other mechanical purposes.

In practice, if found desirable, a second metallic circle and relay may be employed to ring two or more independent programs conjointly.

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

1. In a program-clock, the combination of a dial having an annular flange or circle, a node consisting of a substantially U-shaped plate having resilient side arms or members adapted to straddle said flange or circle and to be adjusted to different points thereon, a finger projecting transversely and directly from the lower extremity of one of the legs of the node and being of a substantially right-angled-triangular shape in cross-section, an electrically-operated clock-hand having an underbent lever on its outer end, adapted to extend in the direction of the movement of the hand and to travel up the slope of the finger and an insulating-strip on the under side of the lever and covering the major portion and exposing the point thereof whereby the lever travels up the slope and makes contact with the ridge or edge of the finger.

2. In a program-clock, the combination of a dial having an annular flange or circle, set on edge, a substantially U-shaped plate or node having its side legs or members to embrace and frictionally engage said flange or circle, one of said legs having rigid with and projecting directly from its lower extremity a contact-finger triangular in cross-section, an electrically-connected hour-hand of a clock mechanism, a ring of insulating material fitted to the dial at one side of the circle or flange, and upon which the broad flat base of the finger lies, an underbent lever carried by the hand and having on its under surface an insulating-strip which exposes only the extremity of the lever to electrical contact with the upper edge or ridge of the contact-finger, and the minute-hand of the clock mechanism independent of the electric circuit.

3. In a program-clock and in combination with a timepiece, an electric circuit and connections by which a hand of the timepiece is adapted to close said circuit at prescribed times, an intermediate device set in operation by the closing of said circuit and adapted to actuate the ultimate mechanism for rendering the program, said device consisting of a power mechanism, a cam rotated thereby, a lever for releasing and stopping said cam, an electromagnet and armature operated by the timepiece-circuit to actuate the lever, a fixed electrical contact-piece, and a contact-finger carried by the cam and adapted to make and break electrical contact with said piece.

4. In a program-clock and in combination with a timepiece, an electric circuit and connections by which a hand of the timepiece is adapted to close said circuit at prescribed times, an intermediate device set in operation by the closing of said circuit and adapted to actuate the ultimate mechanism for rendering the program, said device consisting of a power mechanism, a cam rotated thereby, a

lever and means controlled thereby and operating through the fly or fan regulating device of the power mechanism for releasing and stopping said cam, an electromagnet and armature operated by the timepiece-circuit to actuate the lever, a fixed electrical contact-piece, and a contact-finger carried by the cam and adapted to make and break electrical contact with said piece.

5. In a program-clock, and in combination with a timepiece, an electric circuit and connections by which a hand of the timepiece is adapted to close said circuit at prescribed times, an intermediate device set in operation by the closing of said circuit and adapted to actuate the ultimate mechanism for rendering the program, said device consisting of a power mechanism, a cam rotated thereby, a lever for releasing and stopping said cam, an electromagnet and armature operated by the timepiece-circuit to actuate the lever, a fixed electrical contact-piece and a contact-finger carried by the cam and adapted to make and break electrical contact with said piece, said finger being adjustable to increase or diminish the length of its contact.

In witness whereof I have hereunto set my hand.

ELVYN FREMONT BURRILL.

Witnesses:

S. P. MEADS,

S. A. CHAMBERS.