

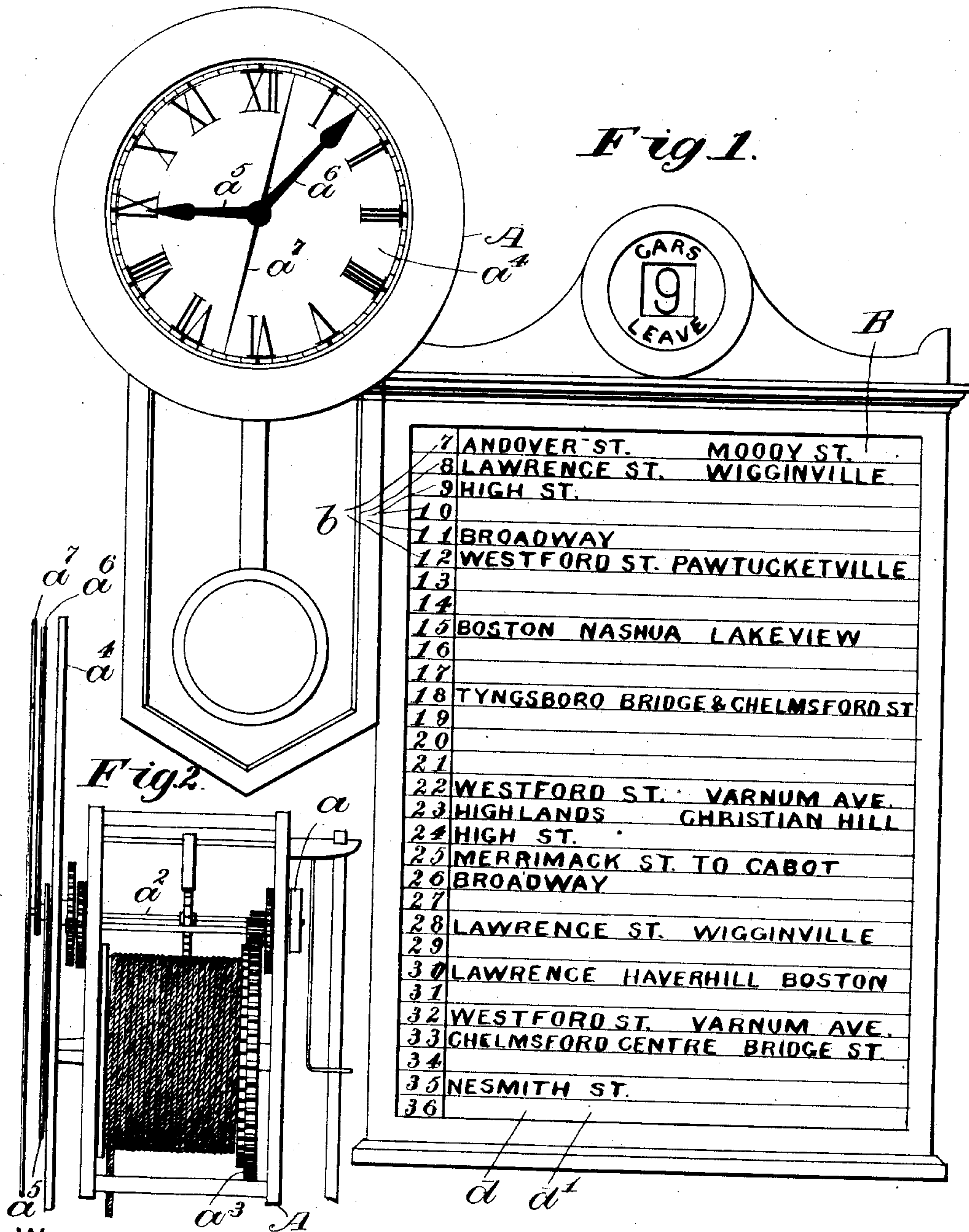
No. 832,018.

PATENTED SEPT. 25, 1906.

D. G. HURD.  
TIME OPERATED TIME TABLE.

APPLICATION FILED JUNE 25, 1904.

5 SHEETS--SHEET 1.



WITNESSES.

*Kirkley Hyde.*  
*Grace Crowley.*

INVENTOR  
*Delmar G. Hurd.*  
By *Albert M. Moore,*  
His ATTORNEY.

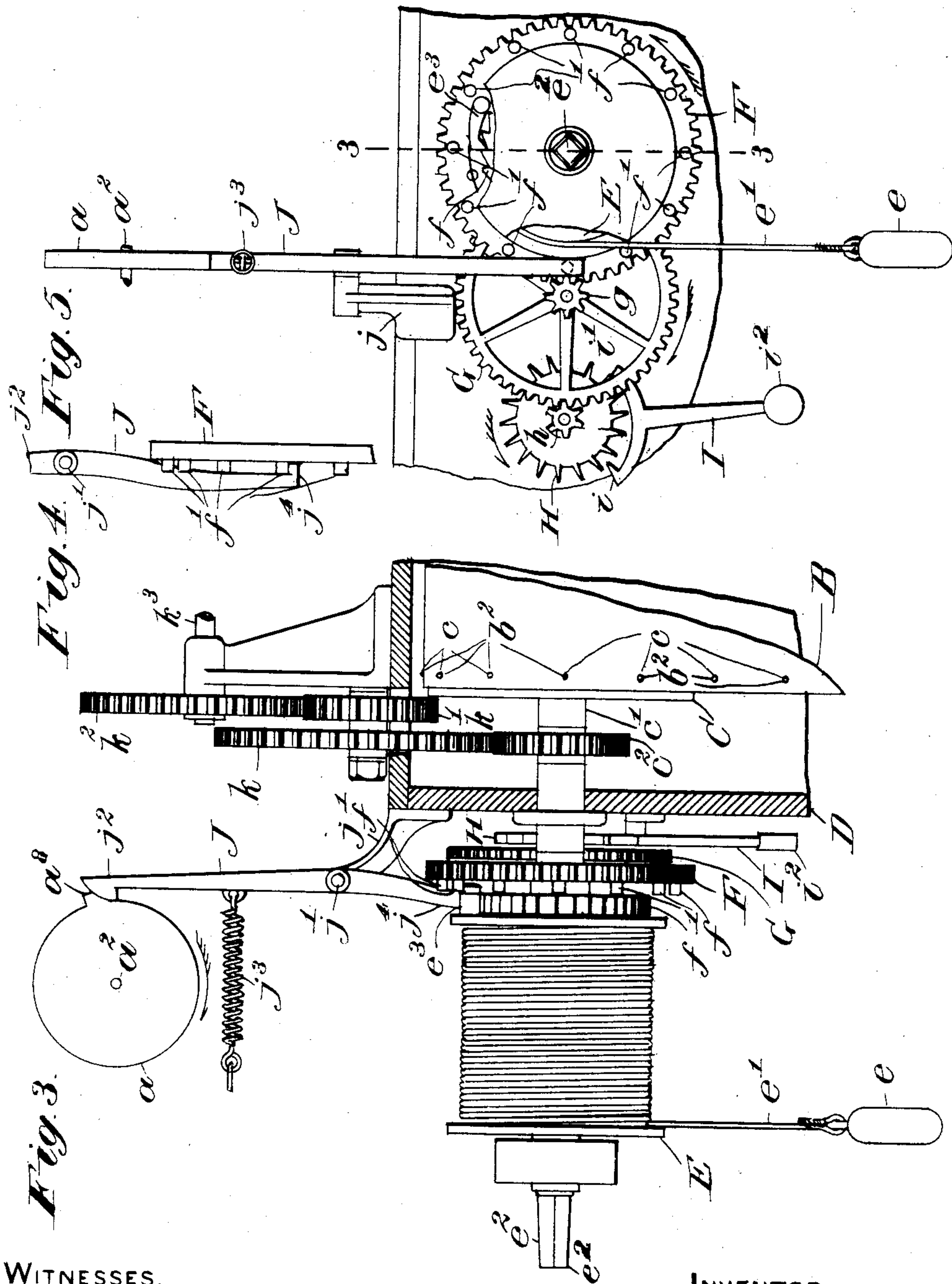
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5 SHEETS—SHEET 2.



WITNESSES.

*Kirkley Hyde.*  
*Grace Crowley.*

INVENTOR

*Delmar G. Hurd,*

By *Albert M. Moore,*

*His* ATTORNEY.

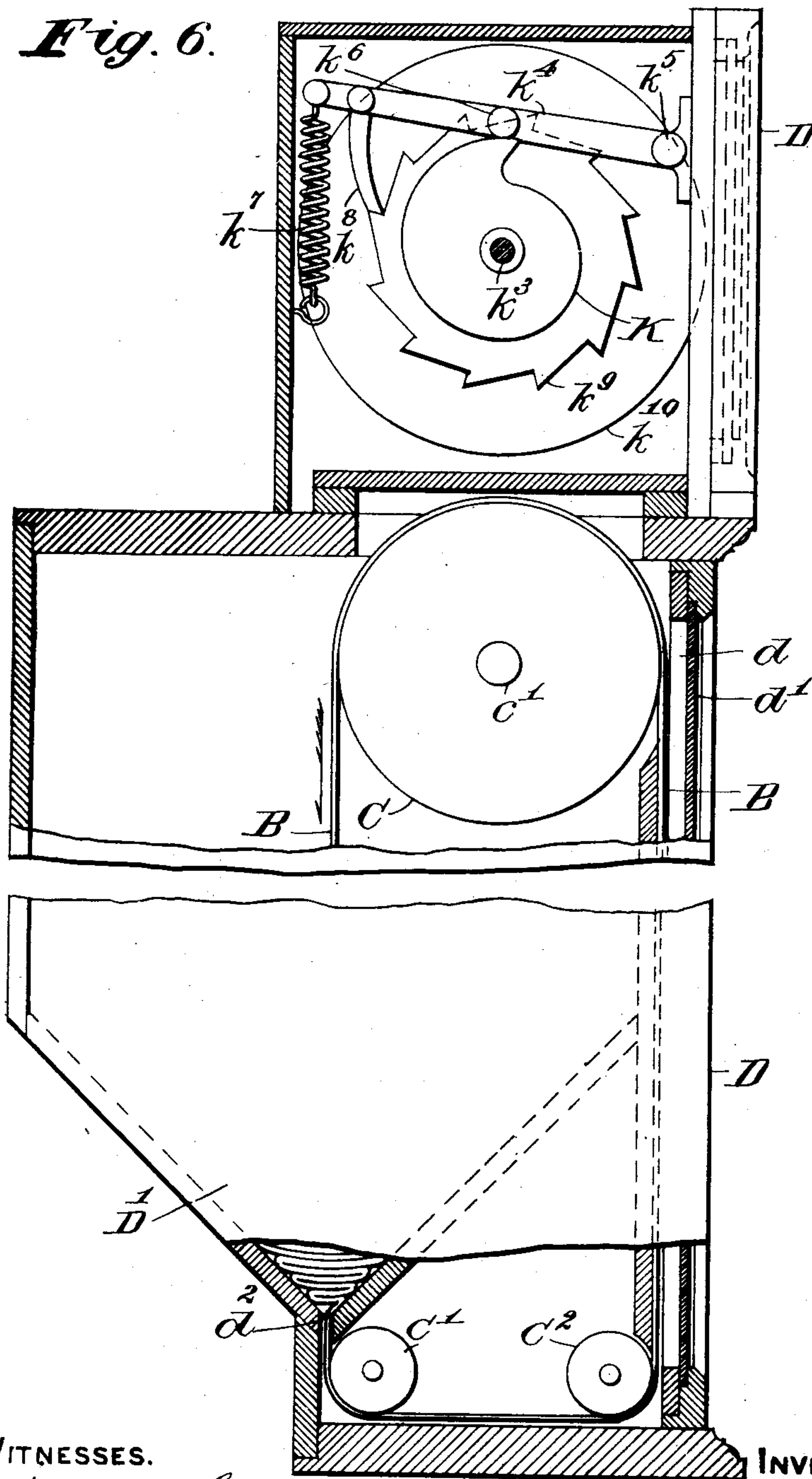
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5 SHEETS—SHEET 3.

*Fig. 6.*



WITNESSES.

*Kirkley Heyde.*  
*Isaac Crowley.*

INVENTOR

*Delmar G. Hurd,*  
By *Albert M. Moore,*  
His ATTORNEY.



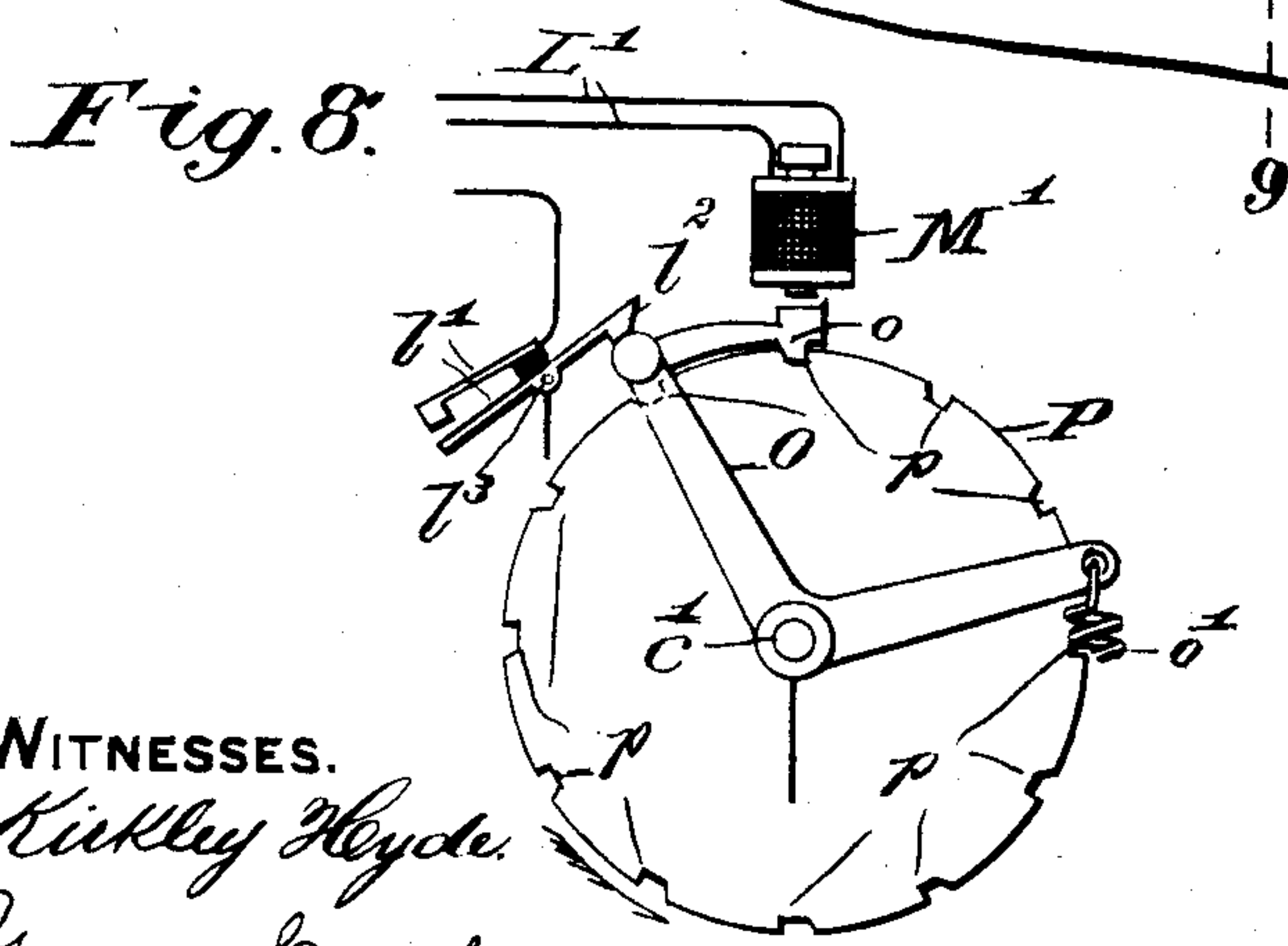
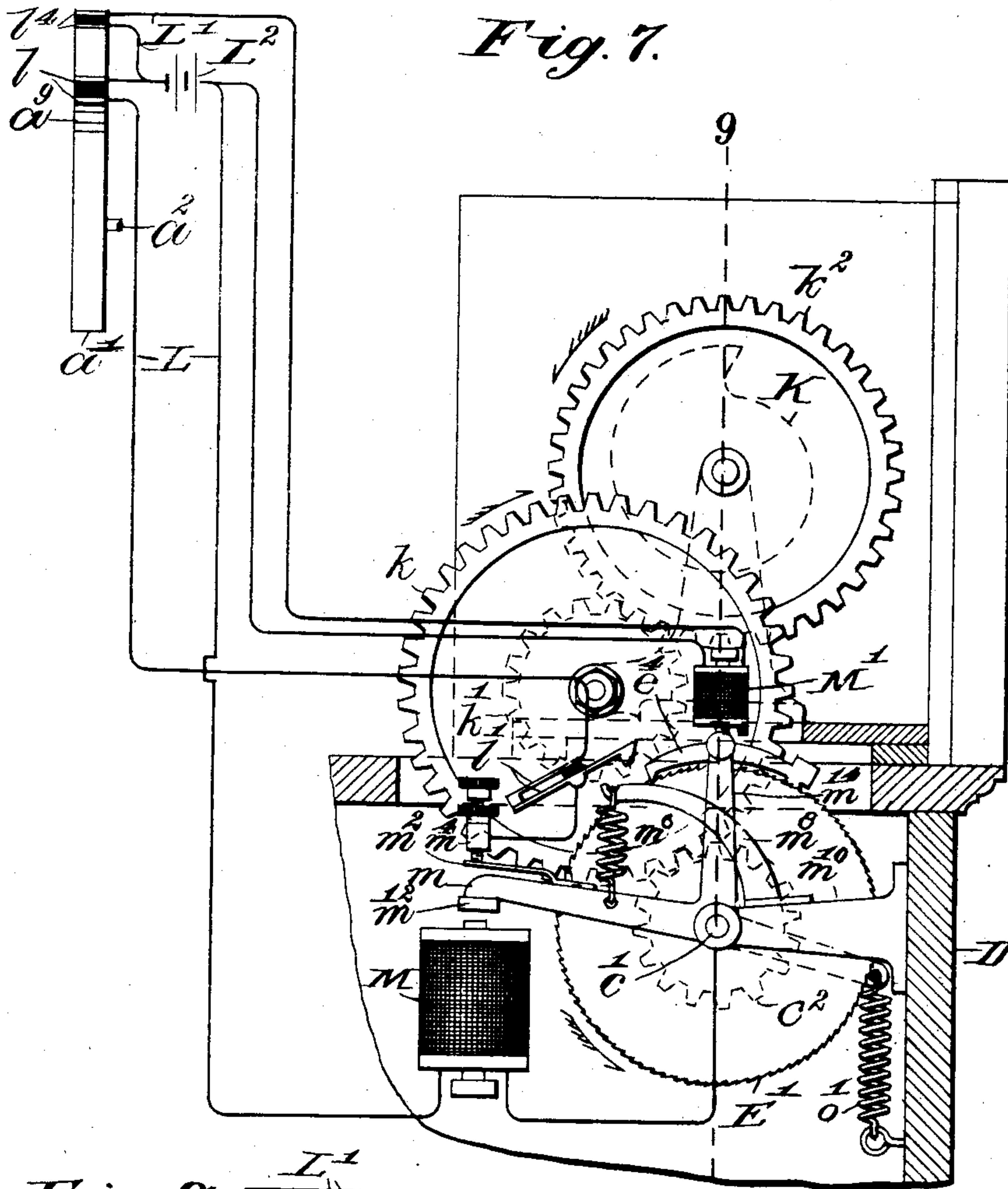
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5 SHEETS—SHEET 4.



WITNESSES.  
*Kirkley Heyde.*  
*Grace Browley.*

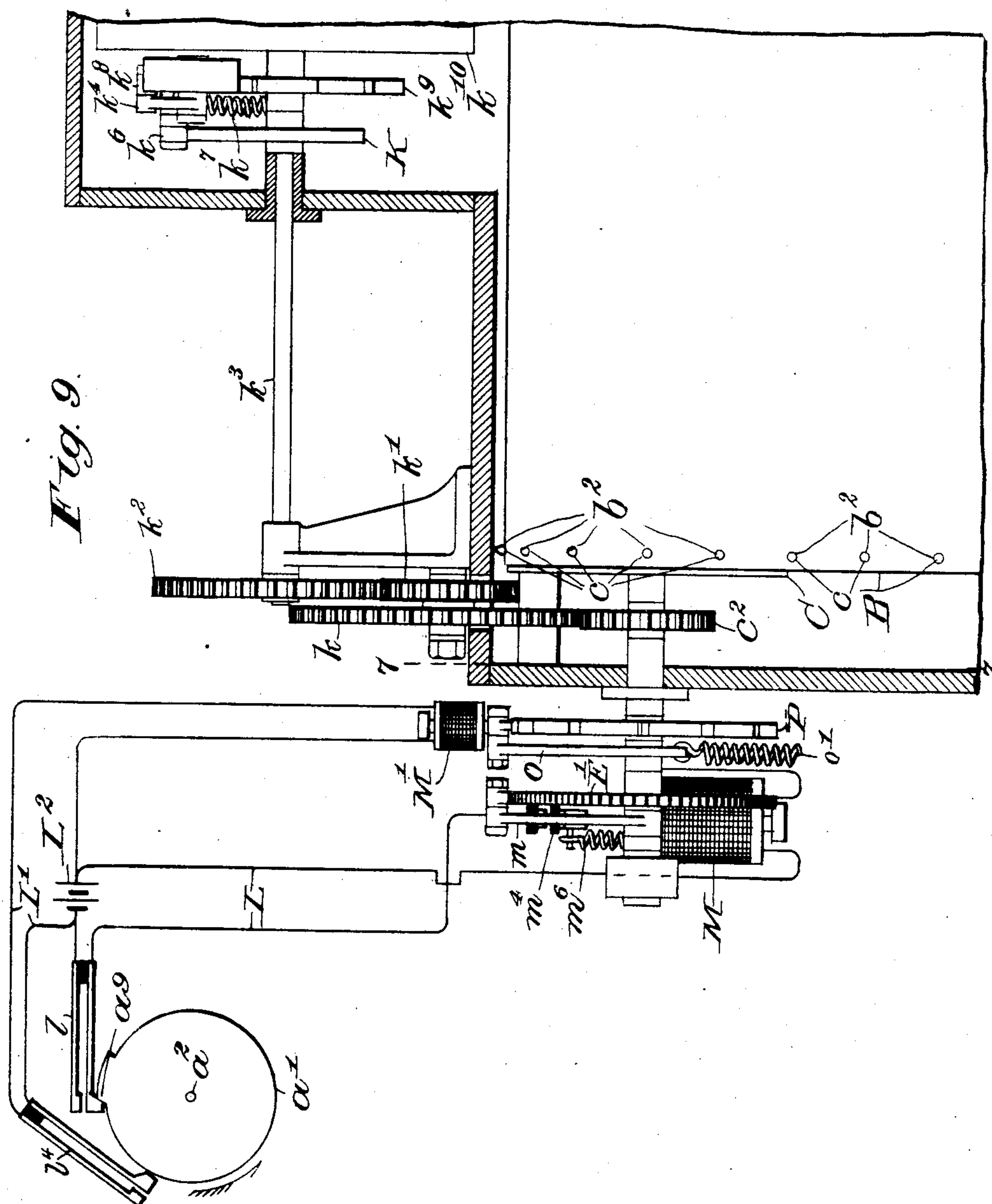
INVENTOR.  
*Delmar G. Hurd.*  
By *Albert M. Moore,*  
*His* ATTORNEY.

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D. G. HURD.  
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5 SHEETS—SHEET 5.



**WITNESSES.**

Kirkley Hyde  
Essex Browley.

INVENTOR  
Delmar G. Hurd,  
By Albert M. Moore,  
His ATTORNEY.



# UNITED STATES PATENT OFFICE.

DELMAR G. HURD, OF LOWELL, MASSACHUSETTS, ASSIGNOR OF  
ONE-THIRD TO AUGUST FELS AND ONE-THIRD TO MAX W.  
FELS, OF LOWELL, MASSACHUSETTS.

## TIME-OPERATED TIME-TABLE.

No. 832,018.

Specification of Letters Patent.

Patented Sept. 25, 1906.

Application filed June 25, 1904. Serial No. 214,177.

*To all whom it may concern:*

Be it known that I, DELMAR G. HURD, a citizen of the United States, residing in Lowell, in the county of Middlesex and Commonwealth of Massachusetts, have invented certain new and useful Improvements in Time-Operated Time-Tables, of which the following is a specification.

This invention relates to time-operated time-tables; and its object is to indicate automatically at equal intervals of time a series of recurring events and the times of their expected or predetermined occurrence—as, for instance, the arrival or departure of cars or trains on railways—sufficiently in advance of the taking place of such events to admit of preparation therefor.

In practice the device will comprise a suitable case, and arranged in said case an endless sheet on which are indicated by printing or equivalent means successive intervals of time, as minutes, and opposite the designation of the minute or other intervals the event or events which will occur during such interval, the case being provided with a sight-opening through which a desired number of such indications may be read—as, for instance, all the indications of the entire series—means of moving said sheet at each interval, and accurate clock mechanism for controlling such movement and adapted, preferably, to indicate correct time.

Said invention consists in the devices and combinations hereinafter described and claimed.

In the accompanying drawings, on five sheets, Figure 1 is a front elevation of the improved time-table; Fig. 2, a left side elevation of the clock shown in Fig. 1, omitting the case, the lower part of the pendulum-rod, and the pendulum; Fig. 3, a front elevation of the time-sheet-feeding mechanism, the lever which stops the same, the cam which operates said lever to release said feeding mechanism, a part of the hour-indicating mechanism, also a part of the time-sheet and a part of the case in vertical section on the line 3 3 in Fig. 5; Fig. 4, a side elevation of the lower part of said stop-lever and the upper part of the stop-wheel; Fig. 5, a left side elevation of

the sheet feeding and releasing mechanism and a part of the case in which the time-sheet moves; Fig. 6, an enlarged left side elevation of said case, partly in vertical section, showing the hour-indicating wheel, the endless time-sheet, and its rolls. In the three remaining figures, which show a modification of my invention, electrical circuits are diagrammatically represented and electrical devices for stopping and moving the time-sheet are shown, Fig. 7 being a left side elevation of the circuit-closing cam and of the wheel-train which moves the time-sheet and a vertical section of the case on the line 7 7 in Fig. 9; Fig. 8, a side elevation of the circuit-breaking wheel and lever; Fig. 9, a front elevation of the parts shown in Fig. 7, the case being in section on the line 9 9 in Fig. 8.

In Fig. 1 of the drawings, the time-table is represented as adapted to indicate the times of the next departures of cars on a street-railway and as adapted to move the time-sheet at intervals of one minute, and the description will assume that length of interval, though obviously any other convenient interval may be used. A indicates a clock, which may be of any usual construction, but must be accurate. The clock is provided with a cam  $a$ , which revolves once a minute, being secured on the shaft  $a^2$  of the seconds-hand  $a^7$ , as represented in Figs. 2 and 3. The shaft  $a^2$  is driven by a train of gears from the great wheel  $a^3$  by well-understood means, and the clock will preferably be provided with a dial  $a^4$ , hour-hand  $a^5$ , minute-hand  $a^6$ , and seconds-hand  $a^7$ , all of any usual construction, but without these parts the time would be indicated to within a minute by the parts of the time-table hereinafter described. The time-sheet B, or time-table proper, is an endless belt or sheet of flexible material, as cloth, on which are written, printed, or formed by equivalent means figures  $b$ , indicating the successive minutes (or other adopted intervals of time) and opposite each interval number the names of the places for which cars are to leave at that interval. The sheet B is supported upon a drum C, journaled in the case D, and by the intermittent rotation of said drum (by means hereinafter



described) is carried upward by each movement of said drum an amount measured by one of the intervals indicated by a figure  $b$ . The case D is provided in front with a sight-opening  $d$ , preferably glazed at  $d'$ , through which the desired number of announcements may be seen—that is, at least one announcement of each occurrence in the series. The sheet B may be long enough to contain the car or train announcements for twenty-four hours and is therefore too long to be conveniently stretched out to its full length. I therefore provide the case D with a hopper-like compartment D' in the rear of the exposed vertical part of the sheet B, Fig. 6, into which the sheet falls in folds as it comes from the top of the drum C, and I draw said sheet through a narrow slit  $d^2$  in the lower end of the compartment D' out under the rolls C' C<sup>2</sup>, then forward and up in front of the sight-opening or window  $d$ , the parts of said sheet within the hopper rolling and sliding on each other toward the center of the hopper, as shown in Fig. 6, into shorter folds as they near the bottom of the hopper. The drum C is provided with means for securing the accurate registration of the sheet on said drum, which is represented as being provided at regular intervals with pins  $c$ , projecting from its periphery and adapted to enter holes  $b^2$  in said sheet, as shown in Figs. 3 and 6.

The drum C is represented in Figs. 3 and 5 as driven by a weight  $e$ , hung on a cord  $e'$ , wound on a barrel E, which is loose on the arbor or shaft  $c'$ , on which said drum and the toothed wheel F are both fast. The barrel E is provided with a many-sided hub  $e^2$  to be engaged by a crank or wrench for the purpose of winding up the cord  $e'$  and is prevented from turning back on the shaft  $c'$  by a detent  $e^3$ , carried by said barrel and engaging a ratchet-wheel  $f$ , fast on said shaft  $c'$ . To prevent the drum C being driven too rapidly by the falling of the weight  $e$ , the teeth of the wheel F engage a pinion  $g$ , which is secured to the toothed wheel G, the latter engaging another pinion  $h$ , concentric with and rotary with a scape-wheel H, and said scape-wheel engaging the pallets  $i$  of an escapement-lever I or short pendulum, which is weighted at  $i^2$ , so that said drum is caused to turn with comparative slowness. The drum C is normally prevented from turning by a stop-lever J, pivoted on a stationary bracket  $j$  at  $j'$ , the upper end  $j^2$  of said lever being held by a spring  $j^3$  against the cam  $a$  and the lower end  $j^4$  normally engaging some one of a series of pins  $f'$ , which project from the face of the wheel F, said pins  $f'$  being arranged in a circle concentric with the arbor or shaft  $c'$  and at angular intervals from each other, corresponding to the spaces occupied by the successive announcements on the drum C. The cam  $a$  is a

disk having a projection  $a^8$ , which, crowding the upper end of the stop-lever J away, causes the lower end of said lever to be unhooked or disengaged from a pin  $f'$  and allows the drum C and time-sheet B to be wound by the descent of the weight  $e$ . The cam projection  $a^8$  is of so short angular measurement as to release in a small fraction of a minute said lever J, which is then moved by the spring  $j^3$  into a position to engage the following pin of the series  $f'$  and again stop the movement of the sheet. At each revolution of the cam  $a$  the announcement at the top of the visible part of the time-sheet disappears upward into the case and another announcement comes into view at the bottom of the window.

The arbor or shaft  $c'$  is represented in Fig. 3 as provided with a fast pinion  $c^2$ , which engages a gear  $k$ , and a pinion  $k'$ , rotary with said last-named gear, engages another gear  $k^2$ , fast on the shaft  $k^3$ , and causes said shaft  $k^3$  to make a complete revolution once in an hour. A cam K, fast on the shaft  $k^3$ , raises a lever  $k^4$ , pivoted at one end at  $k^5$  in the upper part of the case D, a projection  $k^6$  from said lever being held down by a spring  $k^7$  on the periphery of said cam. When the greatest projection of the cam K passes the projection  $k^6$ , the lever is thrown down by the spring  $k^7$ , and a pawl  $k^8$ , carried by said lever, turns a twelve-toothed ratchet  $k^9$  a distance measured by one tooth thereof and causes a wheel  $k^{10}$ , which carries on its periphery numbers from "1" to "12," to display the number of the completed hour, as represented in Fig. 1.

In the modified form of my invention shown in Figs. 7, 8, and 9 the parts already described are indicated by the same letters of reference as in the other figures. The same clock may be used and may have a cam  $a'$ , similar to the cam  $a$ , on the shaft  $a^2$  of the seconds-hand  $a^7$ —that is, a cam which makes a complete revolution every minute. Two normally open electric circuits L L', which may have a common generator or battery L<sup>2</sup>, are represented. In the circuit L is included a circuit-closer  $l$ , which, being operated by the cam projection  $a^9$ , closes the circuit from the generator L<sup>2</sup> through the electromagnet M, the vibrator or bent lever  $m$ , its spring  $m^2$ , the contact  $m^4$  and normally closed circuit-breaker  $l'$  back to said generator, said vibrator-spring  $m^2$  being drawn away from the magnet M and against the contact  $m^4$  by a spring  $m^6$ , which is stretched between an arm  $m^8$ , which extends from the bracket  $m^{10}$ , secured to the inside of the front of the case D. When the circuit L is closed by action of the cam  $a'$ , the armature  $m^{12}$  on the lever  $m$  is drawn by the magnet M until the spring  $m^2$  is drawn away from the contact  $m^4$  and breaks said circuit L, which is immediately closed by the contraction of the



spring *m*, and this vibration of the lever *m* will continue until the cam projection has passed by the circuit-closer *l* or the circuit is otherwise broken. Each movement of the lever *m* toward the magnet turns the ratchet-wheel *E'*, which is fast on the shaft *c'* of the drum *C*, by means of a pawl *e<sup>4</sup>*, pivoted on an arm *m<sup>14</sup>* of the vibrator and engaging said ratchet-wheel. The shaft *c'*, drum *C*, the fast pinion *c<sup>2</sup>* and other parts between said pinion *c<sup>2</sup>* and the hour-indicating wheel *k<sup>10</sup>*, including the last named, are all as hereinbefore described: These time-sheet-shifting and hour-indicating devices are prevented from being turned too far by a controlling-lever *O* and wheel *P*, the latter being fast on the shaft *c'* and having a number of notches *p*, the common interval between which measures the angular space devoted on the drum *C* to a single announcement, and said lever *O*, carrying a detent *o*, which engages said notches *p*, one at a time. A spring *o'*, represented as a helical wire spring stretched between said lever and a part of the case, resists the movement of said lever *O*, wheel *P*, and drum-shaft *c'*, but is not of sufficient strength to overcome the inertia of these parts and of the parts driven from said shaft *c'*, and thus reverse their movement. The circuit-closer *l'* is opened by the lever *O*, running under an incline *l<sup>2</sup>* on the weighted front end of the lower part of said circuit-closer, (the parts of said closer being represented as pivoted to each other at *l<sup>3</sup>*), when the drum is turned the proper distance. This allows the vibrator *m* and the drum *C* to come to rest at a time when the free end of the detent *o* is directly under another electromagnet *M'*, arranged in the circuit *L'*, which also includes a circuit-closer *l<sup>4</sup>* similar to the circuit-closer *l* and like that operated by the cam projection *a<sup>9</sup>*. When the circuit *L'* is closed, the detent *o* is lifted out of its notch in the wheel *P*, an armature *o'*, secured on the top of the free end of said detent, being attracted by the magnet *M'*, and thereupon the lever *O*, being drawn by the spring *o'*, carries said detent *o* forward into engagement with the next notch *p'*.

The time-sheet *B*, as above intimated, is too long to be drawn taut over two drums or rolls, because said length, if the space occupied by each announcement were one inch, in the direction of the length of the sheet, would be, before the ends of the sheet were joined, one hundred and twenty feet, to which must be added about four feet for the total space occupied by all the space-separating lines which are desirable as direction-lines for the eye of the observer. The length of the doubled sheet when stretched on two drums would therefore be about sixty feet and would prevent the use of the sheet in that form. By allowing the time-sheet as it

leaves the drum *C* to fall without any folding devices it assumes the form of superimposed folds in the compartment *D'* and may be drawn without much friction from the slit or space *d<sup>2</sup>*.

I claim as my invention—

1. The combination of an endless time-sheet having figures to indicate equal intervals of time, signs to indicate events arranged opposite the figures which indicate the times, at which such events are next first to occur, a case for said time-sheet having a sight-opening adapted to display sufficient of said time-sheet to inform the observer of the time of occurrence next after the time of observation of all such events, and time-controlled means for moving said time-sheet a corresponding amount at the expiration of the interval denoted by the first figure displayed.

2. The combination of an endless time-sheet having figures to indicate equal intervals of time, signs to indicate events arranged opposite the figures which indicate the times, at which such events are next first to occur, a case for said time-sheet having a sight-opening adapted to display sufficient of said time-sheet to inform the observer of the time of occurrence next after the time of observation of all such events, time-controlled means for moving said time-sheet a corresponding amount at the expiration of the interval denoted by the first figure displayed, and a time-indicator.

3. The combination of an endless time-sheet having figures to indicate minutes, signs to indicate events arranged opposite the figures which indicate the minutes, at which such events are next first to occur, a case for said time-sheet having a sight-opening adapted to display sufficient of said time-sheet to inform the observer of the minute of occurrence next after the time of observation of all such events, and time-controlled means for moving said time-sheet a corresponding amount at the expiration of the minute denoted by the first figure displayed.

4. The combination of a clock having a cam, a shaft, a drum fast thereon, means for rotating said shaft and drum, a time-sheet, carried by said drum and having thereon numbers indicating intervals of time less than an hour and announcing events predetermined to occur at said intervals, hour-indicating devices, connecting means between said shaft and said devices to operate the latter, and stop devices normally preventing the rotation of said shaft but controlled by said cam to permit the rotation of said shaft at intervals indicated on said sheet.

5. The combination of an endless time-sheet divided transversely into equal spaces which are numbered to indicate successive equal intervals of time and having noted in



said spaces events predetermined to occur in the indicated intervals, a drum carrying said sheet, means for partially rotating said drum at each interval, a receptacle into which said sheet is delivered from said drum in superimposed folds, said receptacle having a front and a back inclined downward toward each other and separated at their lower edges by a narrow slit through which said sheet may be

drawn by the movement of said drum, allowing said folds to slide on each other and grow smaller as they settle in said receptacle.

In testimony whereof I have affixed my signature in presence of two witnesses.

DELMAR G. HURD.

Witnesses:

ALBERT M. MOORE,  
CHARLES F. McFARLAND.