(No Model.) 2 Sheets—Sheet 1.

C. E. EMERY.

REWINDING CLOCK.

No. 391,886. Patented Oct. 30, 1888.

Fig. 1.

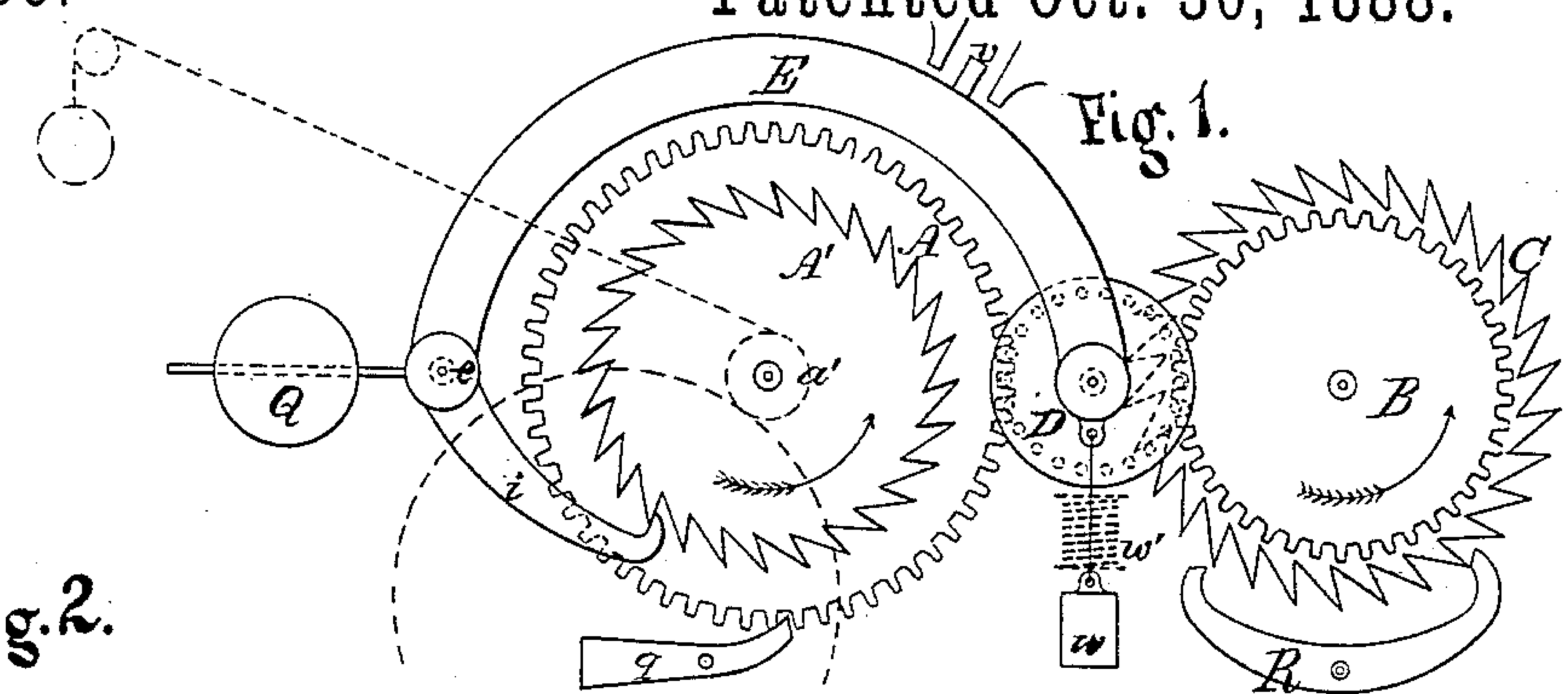
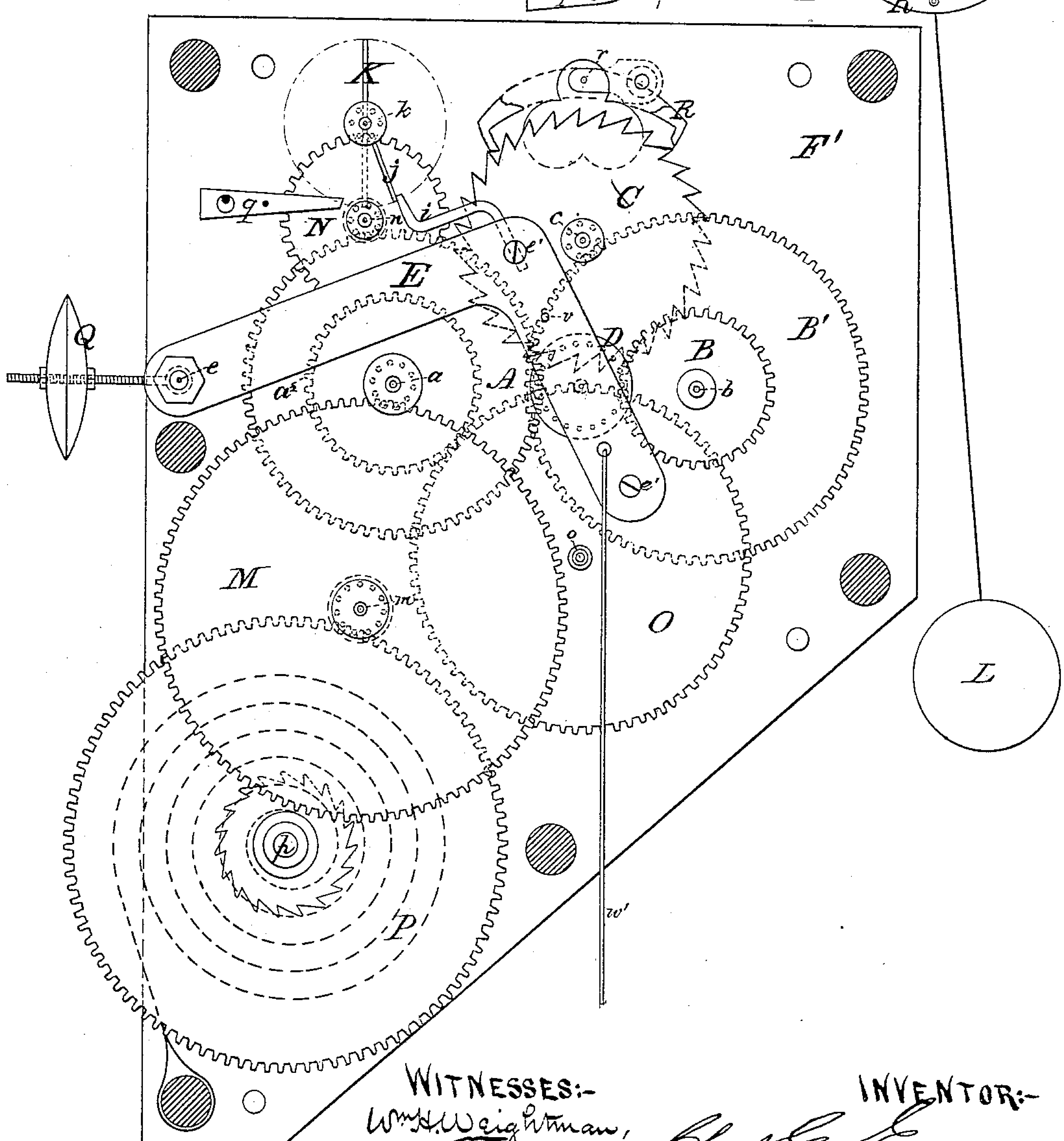


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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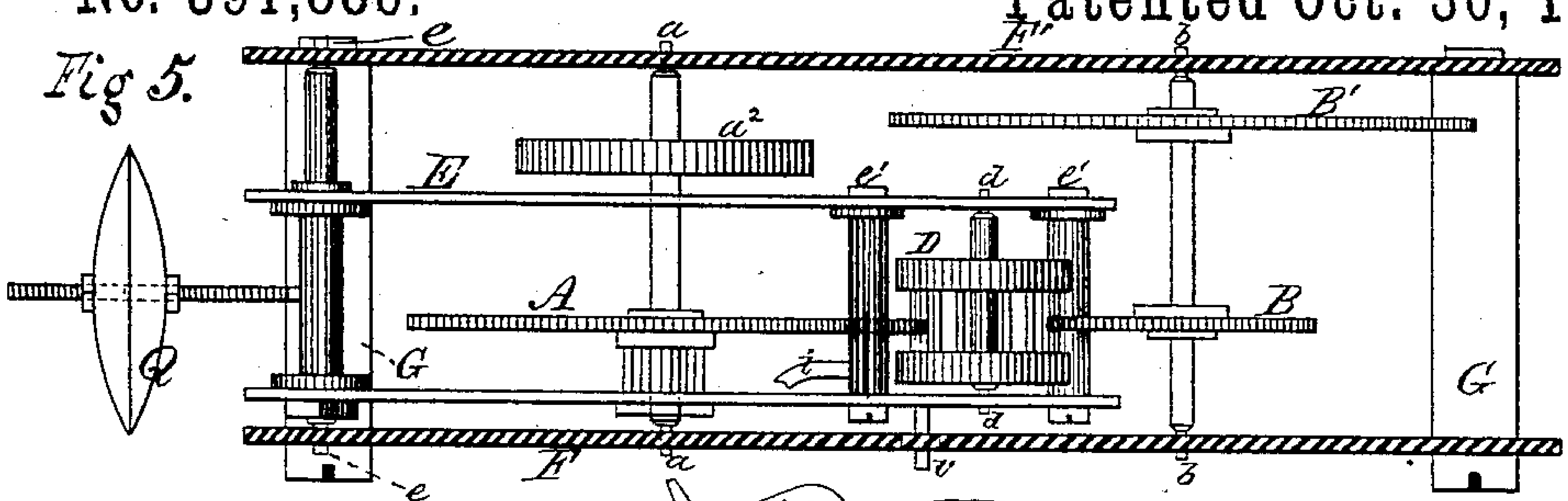
Fig 5.



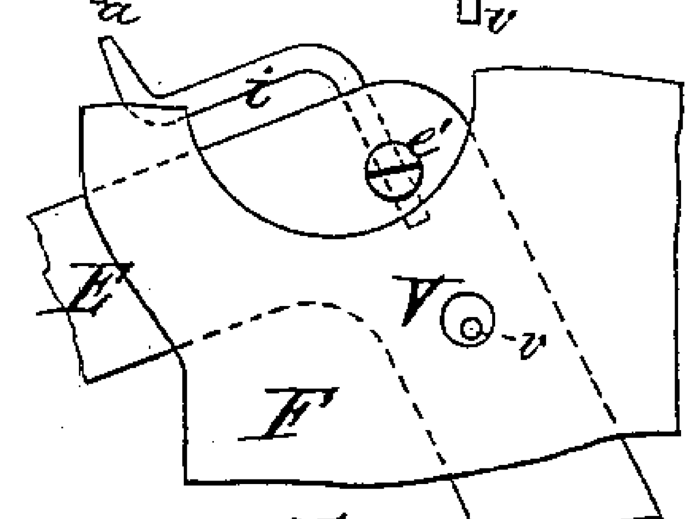


Fig. 6

Fig. 4.

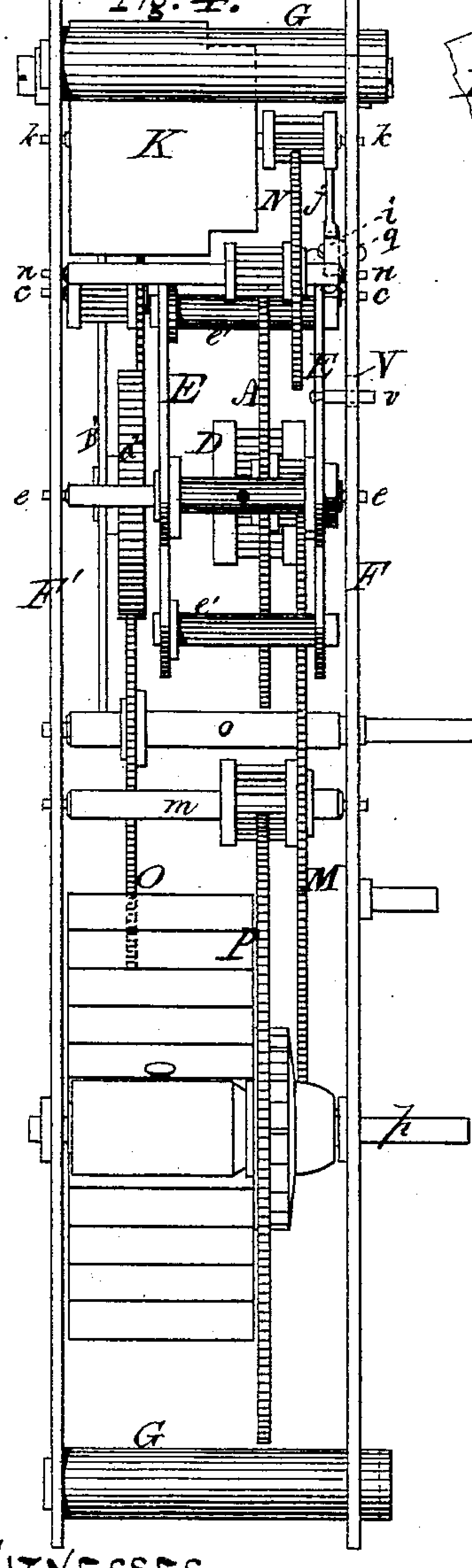
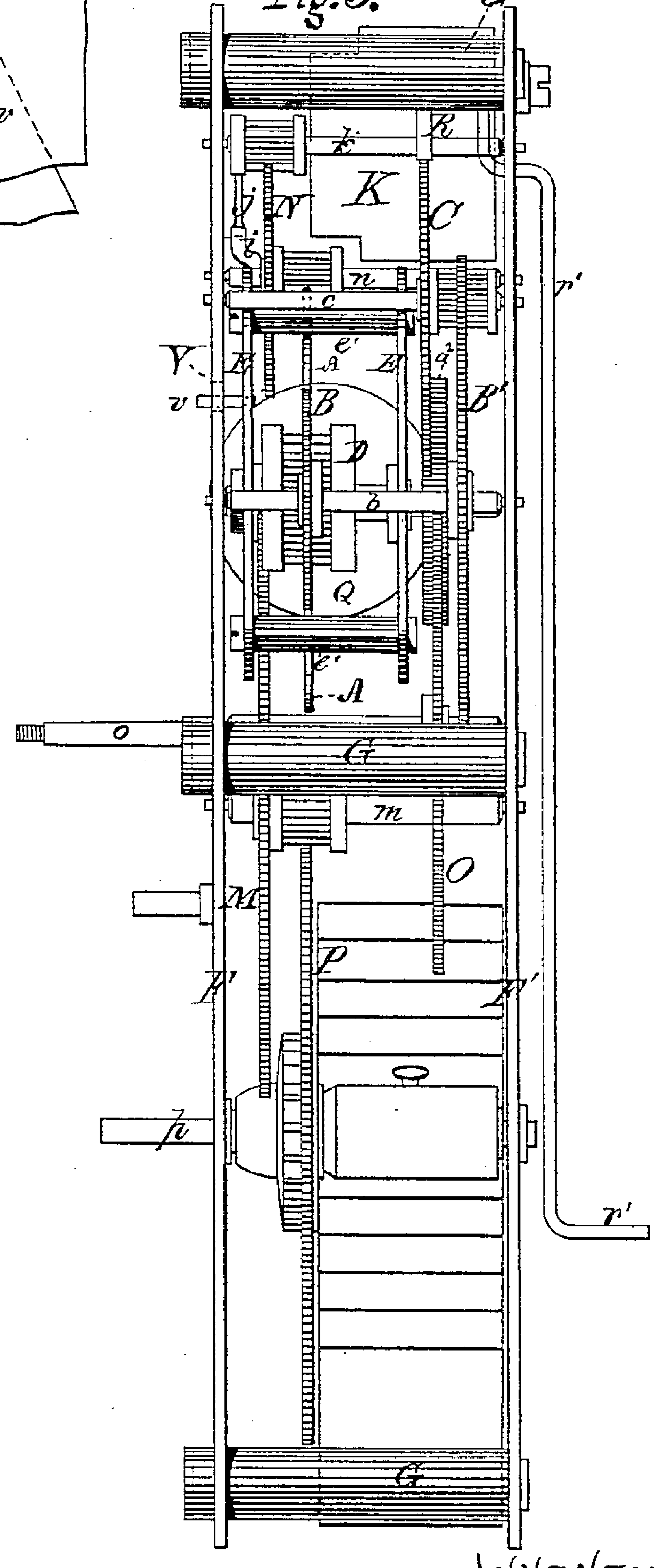


Fig. 3.



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UNITED STATES PATENT OFFICE.

CHARLES E. EMERY, OF BROOKLYN, NEW YORK.

REWINDING-CLOCK.

SPECIFICATION forming part of Letters Patent No. 391,886, dated October 30, 1888.

Application filed December 3, 1887. Serial No. 256,860. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. EMERY, of Brooklyn, Kings county, New York, (office New York city,) have invented a new and Improved Rewinding-Clock; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, making a part of this specification.

This improvement relates to the class of clocks known as "Remontoir" or "rewinding," in which the main weight "charges" or rewinds at intervals a small weight or spring arranged near the escapement, thus causing the impulses of the latter to be of nearly equal force. Devices of this character were used sparingly many years ago when machinery was less available and the trains of tower and other clocks were not made as accurately as at present. Gravity-escapements producing similar results are used in some expensive clocks, and in some tower-clocks the heavier machinery necessary to drive the hands on very large dials is separated from and yet by a tripping device is caused to act in conjunction with the time mechanism. Electric devices are now used to rewind a spring operating the escapement-wheel; but as the spring is affected by temperature it induces complications of its own independent of the difficulties the arrangement is designed to overcome. The isochronism of accurately-constructed and highly-finished clocks may be closely approximated even when operated by a spring of varying force; but neither weight nor spring clocks of ordinary type with cheaply-constructed trains can be depended upon when accuracy to seconds is required.

The object of this invention is to provide mechanism for regularly rewinding a small weight to operate the escapement-wheel of a clock, which mechanism can be constructed in the same manner as the parts of an ordinary brass clock, and therefore be readily duplicated with facility and cheapness, the result being that the irregularities caused by the variation in force of the mainspring and imperfections in the gearing of ordinary clocks may be entirely eliminated or their influence confined to a few speed-wheels in the train in which the errors are repeated so often as not to affect the result. It is found possible in this way to obtain practically as good time with a brass clock of ordinary cheap construction, if compensated for temperature, as can be obtained with excellent regulators of expensive construction. There is also secured all the advantages of a clock continuously operated by a weight arranged in a case with its height too limited to permit the proper applicating of an operating-weight in the ordinary way.

In the drawings, Figure 1 represents an illustrative sketch of the principal details necessary to perform the rewinding. Fig. 2 is an elevation of a clock containing the improvement with front plate removed. Fig. 3 is a side view of the same movement, looking from the right, with mainspring in section. Fig. 4 is a side view of the same movement, looking from the left, with mainspring in section. Fig. 5 is a top view of the rewinding mechanism, showing parts on the line of centers *a* and *b*, Fig. 2, with the other wheels omitted to avoid confusion. Fig. 6 is a front view of a portion of the front plate of the clock to show the operation of a stop, as hereinafter described.

The operation of rewinding will be understood from the illustrative sketch, Fig. 1, in which let A represent a wheel which is given a tendency to move in the direction of the arrow by a weight or connection through a pinion, *a'*, with a wheel (both shown in outline in dotted lines) to a mainspring or weight, and let B represent a driven wheel operating a scape-wheel, C, on the same axis, as shown, or through gearing. The connection between the wheels A and B is to be made by a large pinion, D, gearing into each, but mounted in a swinging frame, E, with the rear of same at *e* pivoted in the frame of the clock, the same as the staffs of the wheels A and B. With the parts in the position shown, if the wheel A be held stationary by any means—as, for instance, by a hook, *i*, attached to the frame E, engaging with a tooth of a wheel A', secured to A—the pinion D, engaging on the left with the teeth of the wheel A, would by its weight and that of its frame E exert a force downward on the adjacent side of the wheel B and tend to turn such wheel, and thereby give force to the escapement R and keep the pendulum L in operation. If, when the wheel

B has descended a short distance, the hook i release the wheel A through A′ it will be moved in the direction of the arrow by its connection with the mainspring. The pinion D and the frame E will be lifted until the hook i catches the next tooth of the wheel A′, and the operation be repeated; but even during the lifting operation the force exerted upon the teeth of the wheel B will be practically the same as when the wheel A was stationary. This arrangement will be recognized as an application of the mechanical device known as a "weighted transmitting dynamometer." The pinion D in the swinging frame E acts to transmit force from the driving-wheel A to a follower or driven wheel, B, and at the same time measure the force transmitted, the same as the similar parts of a transmitting-dynamometer act; but as in this case the weight of the dynamometer-pinion D, with its frame and attachments, is constant the force transmitted is constant so long as the driving-wheel is controlled substantially as described.

In Fig. 2, showing the distinguishing features of Fig. 1 arranged in a clock-movement, the corresponding wheels A and B will be found with similar letters of reference, also the large pinion D, and the frame E, carrying the same and pivoted in the frame on a staff, e; but for convenience the scape-wheel C, instead of being on the same staff as B, is placed above and to the left of the same on the center line of the clock and its staff operated through a pinion by an intermediate gear-wheel, B′, on the staff with B. The frame E, through a stop, i, releases the arm j on a fly-staff, k, the pinion of which is operated by an intermediate wheel, N, on a staff, n, the pinion on such staff receiving motion directly from the large wheel A, the effect of which is that when the fly-arm j is released by the sinking of the frame E the wheel A revolves and lifts the pinion D and frame E until the stop i on the frame E engages again with the fly-arm j, after the latter has made a complete revolution.

In Figs. 2 to 6 F represents the front plate of the clock, and F′ the rear plate. P is the great wheel, with the mainspring S mounted on its arbor in the customary way. M is the second wheel, deriving motion through a pinion on its staff m from the great wheel and operating directly a pinion on the staff a of the third wheel, A, which we will call the "rewinding-wheel." The first, second, and third wheels, P, M, and A, with corresponding pinions, form the rewinding-train, and with the intermediate wheel, N, and the plate of thin metal, K, on staff k, called the "fly," form the "fly-train," N being called the "fourth wheel" of fly-train, and the fly K is the fifth in order. Whenever it is possible by the proportions of the parts, the wheel D will be constructed as a spur-wheel instead of a lantern-pinion, and receive motion from a pinion corresponding to wheel A on the staff a, and transmit the same to a pinion corresponding to wheel B on the staff b. The pinion or wheel D will therefore be called the "weight-wheel" in the descriptions, and numbered in order the sixth wheel. The wheel B, driven by the pinion D, corresponds to the pinion of staff b, and is called the "following-wheel." The intermediate wheel, B′, on same staff, is called the "seventh wheel," and in this case the eighth wheel is the escape-wheel C. The weight-wheel D, with the following-wheel B, and intermediate wheel, B′, on staff b, with the escape-wheel C and pinion on same staff, form properly the time-train. In this movement the main center is at o on the center line of the clock below the scape-wheel center c, and is provided with large wheel O, engaging with a large pinion, a^2, called the "thick pinion," secured on the staff a of the rewinding-wheel A. The large wheel O is numbered 9, for distinction, and by this arrangement may be made so large as to reduce to a minimum the slack-motion incident to locating the main center out of the train, while saving the friction due to driving through the center, which necessarily has very large pivots. The clearances and relations of the several wheels may be readily observed from the side views, Figs. 3 and 4, mentioned.

As is shown in the sectional plan view, Fig. 5, the weight wheel or pinion D is mounted on a staff pivoted in the two plates of the small frame E, the plates being secured by studs or pillars e' e', in the customary way of making a clock-frame, and the rear staff, e, is pivoted in the main plates of the clock-movement. It will really be possible to reduce the weight of the frame E and weight-pinion D sufficiently to give the proper impulse, so a counterbalance, Q, is provided on an arm projecting from the staff e of the frame E, adjustable to reduce the available weight at D as desired. In some cases a small weight, w, is hung by a wire, w', from the frame E, for appearance and to permit of varying the impulse after the clock-face is in position.

R, Fig. 3, represents the anchor carrying the pallets; r, the pallet-staff, and r' the pallet-rod connecting the pallet-staff with the pendulum, which latter is to be suspended from the frame or case behind the movement in a customary way.

The operation will be readily understood from the description given of the illustrative sketch. With the spring on the great-wheel staff P wound, the frame E will be raised and the fly j detained by the stop i, so that the whole rewinding-train at the left of the movement will be stopped. If, however, the pendulum be set in motion, the escapement will receive impulse from the weight-wheel D, and as the latter, with frame E, sinks the stop-arm i, attached to the frame, will release the fly j, when frame E will be raised a distance corresponding to one turn of the fly-arm and the motion of the fly-train, including the mainspring, be again stopped and the weight-wheel D keep up the impulse on the time-train during the operation of rewinding, as well as the intervals of rewinding. A small pawl, q, Fig. 2, is pivoted to the frame in such position as to prevent the fly-arm j from turning backward against the direction of the arrow. With this provision the mainspring on arbor p may be made with a going-arbor instead of a going-barrel, if the spring be wound with a thumb-key, thereby saving the extra expense of a going-barrel, as the wheel D will keep up the impulse of the pendulum and act as a retaining power, at least during the time required to make one motion of the thumb-key. This would not be the case if the equivalent of the pawl q were not provided, as in such case releasing the strain on the going-arbor spring would allow the weight D to run down, carrying back the rewinding-train. The pawl q may, however, be applied to any one of the wheels of the rewinding or fly train to accomplish the same purpose, as illustrated by a pawl similarly lettered in Fig. 1.

It will be observed that only the escapement-wheel and the intermediate wheels, B and B′, of the time-train are driven by the weight-wheel D. The scape-wheel staff c may carry a seconds-hand when the parts are properly proportioned. The main center, as may be observed, is driven by the fly-train, and the friction caused by the weight of the hands, or the variations in force caused by defects in the train up to the wheel D, do not affect the time-keeping properties of the clock. Evidently a staff of the fly-train may be arranged to turn once a minute and carry a hand corresponding to the seconds-hand of a clock, which would move only when the time-train was rewound. In order to keep the minute-hand approximately in position with the seconds-hand, it is preferred to proportion the fly-train so that the fly-arm j will be released every fourth of a minute, though evidently there may be two or more arms j on the fly-staff and the proportion of the teeth made to release more or less times in a minute. The stoppage and release of the fly-train by the motion of frame E through a stop, i, may be made to any one of the wheels of the fly-train, instead of to the fly itself, as illustrated by a stop-hook, i, in Fig. 1.

The frame E at some point away from the center e is to be provided with a stop, v, arranged to engage between two stationary limiting-points, such as are formed in the drawings, by the top and bottom of the hole V in the frame of a clock, as shown in the detached view, Fig. 6. The stops in either direction are to be arranged so as to prevent the frame E from moving sufficiently in either direction to throw the weight-wheel D out of engagement with the teeth of the wheels A and B. (Note an equivalent stop, v, in Fig. 1.) The stop v also answers the further purpose that when the mainspring is nearly run down, so that the operating force is too weak to lift the frame E, the remaining force will still be transmitted through the wheel D to the intermediate wheel, B, and scape-wheel C and keep the clock in motion. This method of operation is made possible only by the fact that the time-train is being continuously impulsed by the weight-wheel D, and that the rewinding or fly train is tripped by the motion of the frame of weight-wheel D, instead of by an escapement not especially designed to secure the same mode of operation. Evidently arms on a staff of the fly-train may be allowed to escape through notches in a staff of the time-train, or an escapement operated by the pendulum or time-train may act to release the rewinding-train; but a special design is necessary to permit the clock to keep in motion after the mainspring weakens, so as not to lift the weight and so that the parts will not be thrown an impulse or more out of time and adjustment if the action of rewinding be suspended momentarily by turning the hands or winding the mainspring and the fly does not escape at the proper moment. By unlocking the fly-train by the movement of the frame of the weight-wheel D and providing the stop v the parts can never get out of adjustment. The weight-wheel and frame will act as a retaining power until the stop v bottoms, and even then the clock will be kept in motion directly by the mainspring for a considerable period. On rewinding the mainspring after it has fully run down, the fly-train will lift the weight D and keep in motion until the stop i reaches the fly f, when all parts will be in adjustment for regular working, making it possible to handle this clock as freely as any pendulum-clock.

The particular movement shown in the drawings is designed for the use of lantern-pinions, though of course others may be employed. The wheel or pinion D is preferably made a lantern-pinion, when both the driving-wheel A and driven wheel B may be spur-wheels. The wire leaves of the pinion permit the slight change of angle necessary in the contacts between the teeth of the wheels A and B, and obviate the necessity of very careful depthing.

While any arrangement or proportion of wheels may be used in connection with the rewinding feature, the movement shown is specially designed for its use in an eight-day clock. The number of teeth and leaves shown in drawings are merely illustrative. A convenient number will be found as follows: Great wheel P, ninety-six teeth, gearing into pinion of ten leaves; second wheel, M, ninety teeth, gearing into pinion of nine leaves; rewinding-wheel A, seventy teeth; weight-wheel D, twenty leaves; wheel B, thirty-five teeth; B′, eighty teeth; escape-wheel pinion, eight leaves; teeth of escape-wheel to suit length of pendulum fly-train; intermediate wheel, N, forty-eight teeth, operating six-leaved pinion on staff of fly K, and operated by seven-leaved pinion on its staff n engaging with wheel A, the pinion a^2 and center-wheel O to be connected by teeth, of which there are to be three times as many in the latter as in the former. The hour-hand in this particular movement is to be operated by gearing on the outer plate of the clock in a customary way. The above proportions secure a relation between the revolutions of great wheel and center of one to thirty-two; center to escape wheel of one to sixty, making the latter turn once a minute and adapted for a seconds-hand and center-wheel to fly of one to two hundred and forty, causing the rewinding to take place four times in a minute.

The operation of disengaging the fly or rewinding train by the sinking of the weight-wheel D is equally applicable if the power be derived from any known source, or if the weight-wheel D or frame E be modeled after any other form of dynamometer than that shown. For instance, if the weight-wheel D were a bevel-gear and the rewinding-wheel A and following-wheel B also bevel-gears of equal size engaging with weight-wheel D, the axes of the wheels A and B would be in line, and if weight-wheel D were swung in a frame pivoted on the line of such axes, as in the dynamometer of corresponding construction, the operation of releasing the fly-train for rewinding by the sinking of the weight-wheel frame E would be precisely the same as described with relation to the similarly-lettered wheels, as shown; but this complicated construction would increase the cost of the clock compared with the plan shown. So, also, the construction of the parts may be modeled after those of any other form of transmitting-dynamometer in which a weight-wheel, D, is operated by gears or cords from a wheel corresponding to the rewinding-wheel A, and transmits motion to a following-wheel corresponding to B, and the sinking of the wheel corresponding to the weight-wheel D can be arranged to release the winding-train and wheel A precisely as hereinbefore described. Evidently, also, the method of operation would be the same if instead of weight-wheel D gearing directly to a following-wheel, B, there were another wheel (which could be made larger than D, if desirable) on the same staff *b*, and such wheel operated a following pinion or wheel, B. So, also, the sinking of the weight-wheel D or its frame E may be employed to release power from any source to perform the rewinding. For instance, to open the valve of an engine operated by a fluid or to close the circuit of a magnetic engine; also, to shut the valve or open the circuit when the rewinding is performed.

The frame E, instead of being pivoted at *e*, may evidently be carried in guides and still trip the fly-train by its movement. It will be observed that, in fact, the pivots *e* simply act as guides to the frame E, and that the latter in turn simply guides the pinion D in a substantially vertical direction between the rewinding-wheel A and following-wheel B; hence the frame E is in respect to its mode of operation a guide-frame, and may be so termed. It is not absolutely essential that the wheels A, D, and B be in a horizontal line. They may be placed at any angle with the horizontal—for instance, in a vertical line—providing the preponderating weight of frame E and counter-balance Q be sufficient in relation to the horizontal to cause the wheel D to operate to impulse the wheel B in the same manner as before. The preponderance may be caused by a horizontal weighted arm. Evidently, too, the dynamometer-arm E may be exactly balanced and given a tendency in one direction by a spring instead of a weight, so that the force transmitted by the dynamometer-wheel B would be measured by the tension of a spring instead of by a weight. The dotted lines surrounding the weight-wire *w'* in Fig. 1 may represent such a spring adapted to press in the same direction as the weight and to be substituted for the same, in which case the counter-balance could be adjusted to exactly balance the frame E independent of the force of the spring and the arrangement be adapted for use in any position—for instance, in a watch or marine clock.

Evidently the fly-arm *j* may be detained by a pawl pivoted to the frame like the pawl *q*, instead of by a stop, *i*, providing the pawl be moved out of engagement with the fly by the frame E, so as to operate in an equivalent manner to the stop *i*.

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

1. In combination, in a rewinding clock, a guided weight wheel arranged to continuously give force to a time-train, a mainspring arranged to furnish the force transmitted through said guided weight-wheel, and devices for controlling the action of the mainspring, thereby enabling a time-movement to be continuously operated by a weight to secure accurate time in a case of insufficient height to permit the use of an operating-weight in the ordinary manner.

2. In a rewinding-clock provided with a guided weight-wheel continuously impulsing a time-train, a stop or detent, *i*, operated by the weight-wheel or its frame, combined with a tooth or equivalent on one of the wheels of the rewinding-train, so as to release the rewinding-train at intervals, substantially as and for the purposes described.

3. In combination with the guide-frame of a weighted wheel continuously connecting a rewinding and a time train, a stop, *v*, adjusted and operating to support the guide-frame and permit the rewinding-train to operate the time-train directly when the rewinding force is insufficient to perform the rewinding.

4. The guide-frame E, the fly *j*, the detent *i*, and limiting-stop *v* of guide-frame, combined and operating together to keep the winding and time trains in adjustment, substantially as and for the purposes specified.

5. In combination with the fly-train of a clock rewound through a guided weight-wheel, a detent, *q*, or equivalent, operating to prevent the running backward of the rewinding-train, substantially as and for the purposes described.

6. In combination with the frame of a weight-

wheel continuously impulsing a time-train, an exposed weight, W, as and for the purposes specified.

7. The supporting-pivots *e* of the frame E of a weight-wheel continuously connecting a rewinding and a time train, combined with the plates of the main frame, substantially as described.

8. In a rewinding-clock, a guided weight-wheel continuously connecting spur gears or pinons in a rewinding and a time-train, combined with devices for controlling the rewinding-train by connection with the time-train.

9. In combination, in a rewinding-clock, a rewinding driving spur-wheel, A, of a rewinding-train, a following time-wheel, B, of a time-train, a guided weight-transmitting wheel, D, connecting the wheels A and B, pivoted in a guide-frame, E, and devices for controlling the rewinding-train by connection with the time-train.

10. In combination, in a rewinding-clock, a rewinding driving spur-wheel, A, of a rewinding-train, a following time-wheel, B, of a time-train, a guided weight-wheel, D, connecting the wheels A and B, pivoted in a guide-frame, E, steadied on pivots running in stationary bearings, and devices for controlling the rewinding-train by connection with the time-train.

11. In combination, in a rewinding-clock, a guided weight-wheel continuously connecting spur-gears in a rewinding and a time-train, a rewinding-train driving directly the main hands, and a time-train operated through the guided weight-wheel.

12. In a rewinding-clock, the combination and connection of a gear-wheel on the main center and a guided weight-wheel operating a time-train through and by means of wheels and pinions on a staff of the rewinding-train.

13. In a rewinding-clock in which a time-train is continuously operated by a guided weight-wheel impulsed from a rewinding-train, a detent operated by a weight-wheel or its guide-frame, arranged to regulate and control the action of the rewinding devices.

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