(No Model.) 6 Sheets—Sheet 1.

N. M. SAATI.

WATCH.

No. 512,328. Patented Jan. 9, 1894.

Fig. 1.

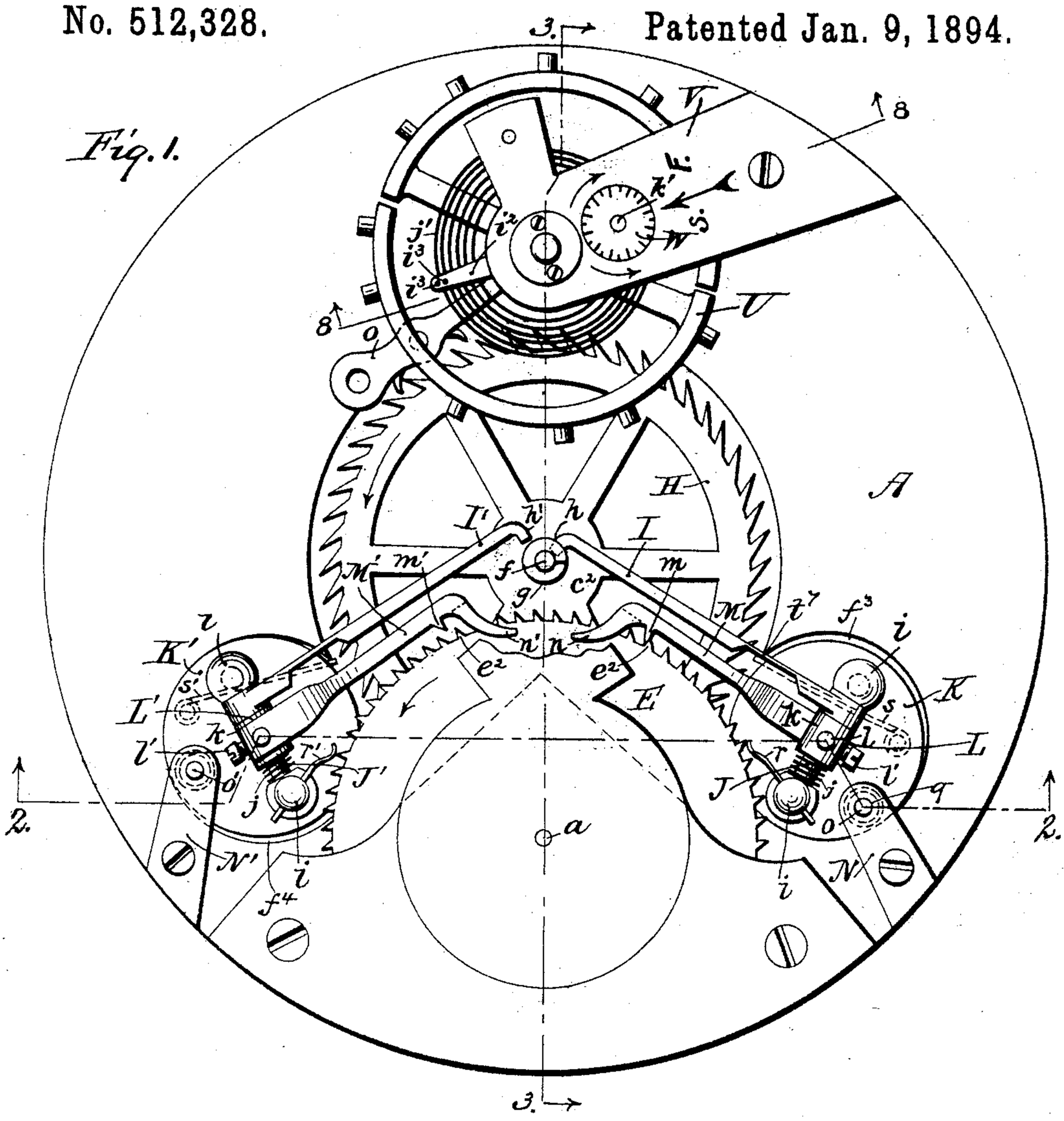
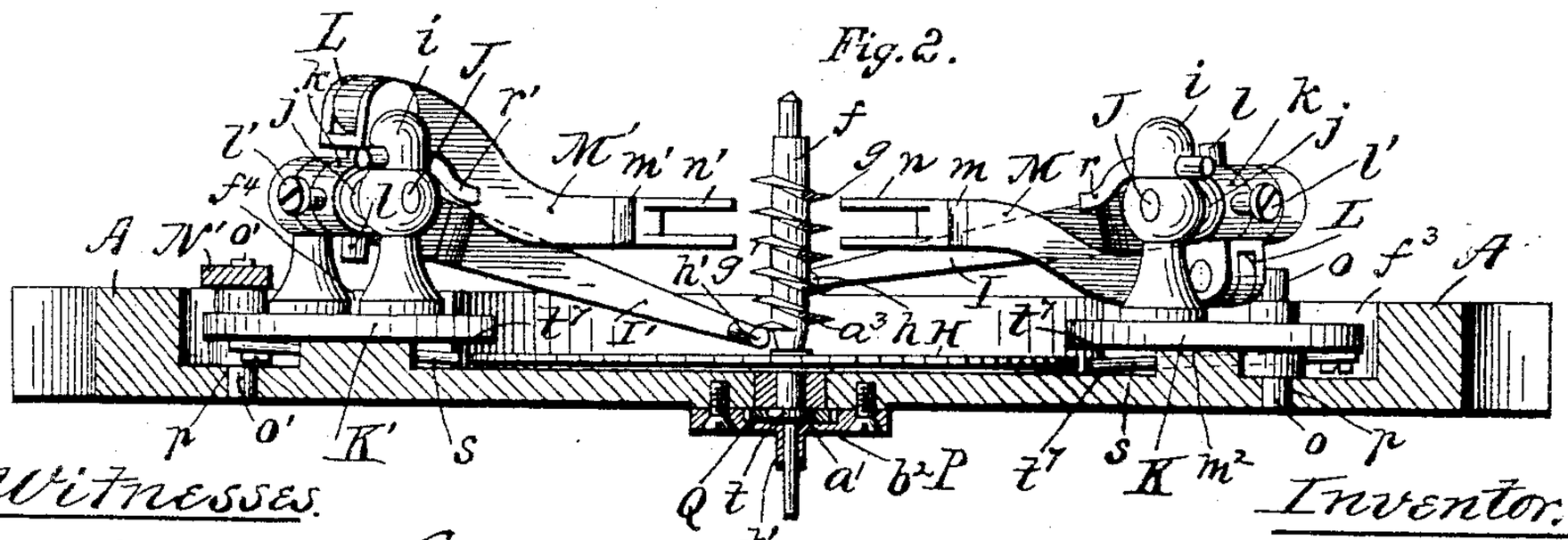


Fig. 2.



Witnesses.

Charles J. Lannigan.

James C. W. Brumm.

Inventor.

Norman M. Saati.

by L. Scholfield Atty.

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(No Model.) 6 Sheets—Sheet 2.

N. M. SAATI.

WATCH.

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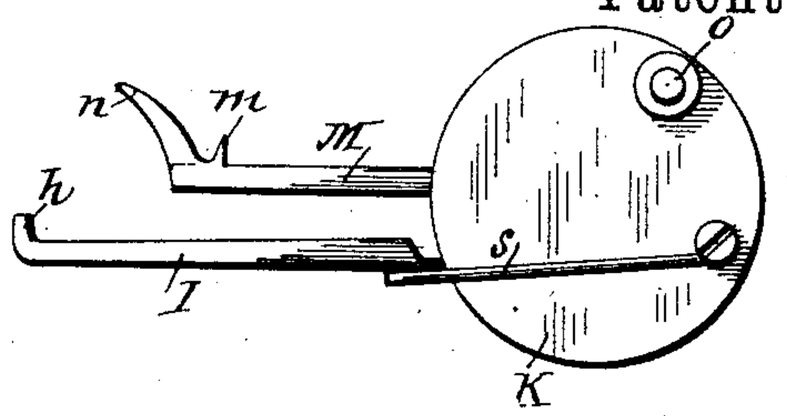


Fig. 6.

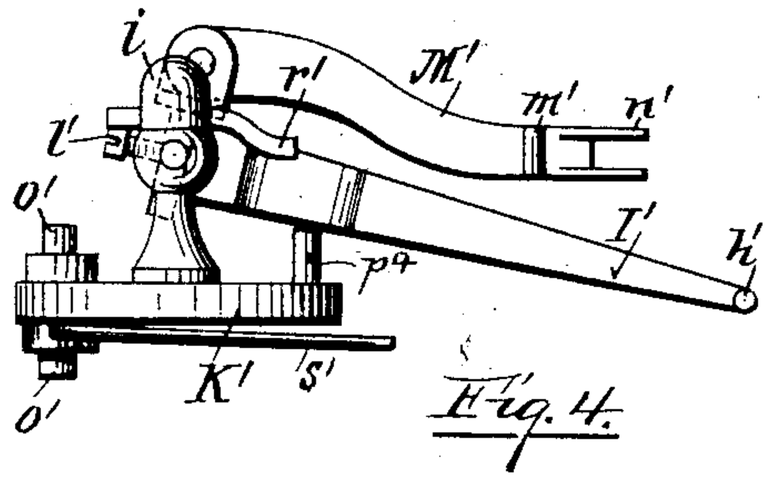


Fig. 4.

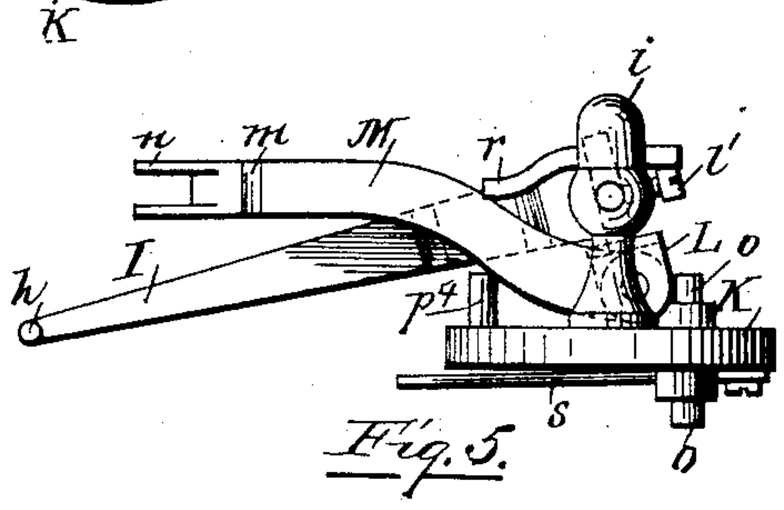
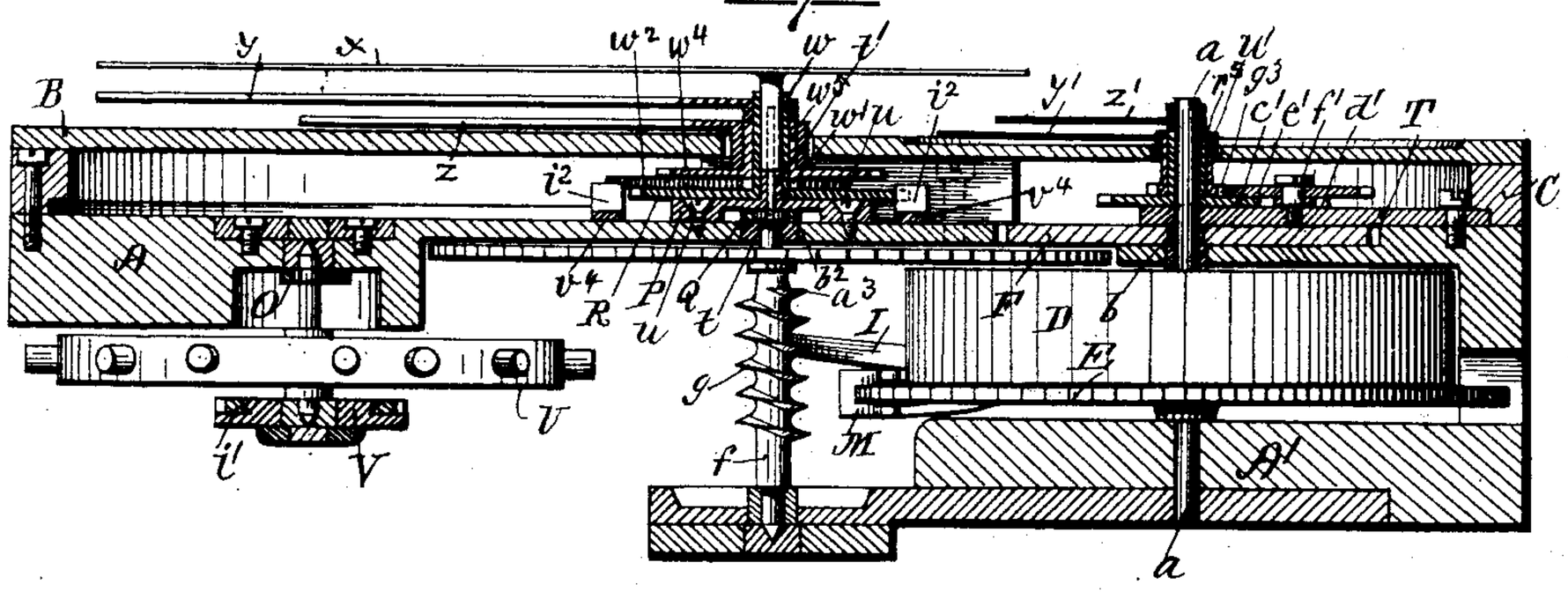


Fig. 5.

Fig. 3.



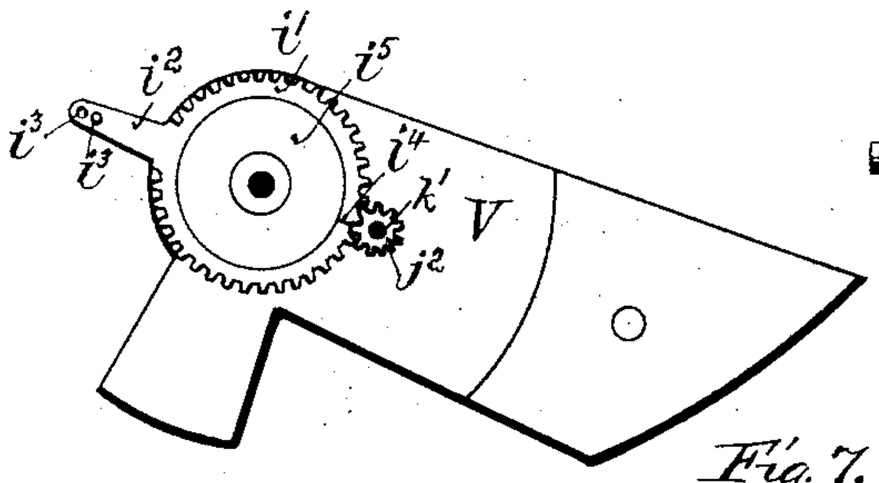


Fig. 7.

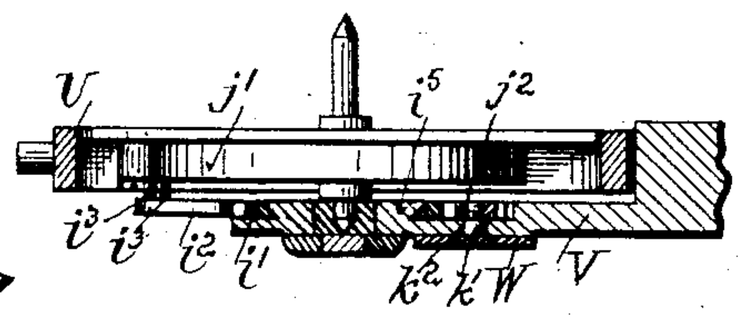


Fig. 8.

Witnesses.

Charles Hannigan.

James W Beaumun

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N. M. SAATI.

WATCH.

No. 512,328. Patented Jan. 9, 1894.

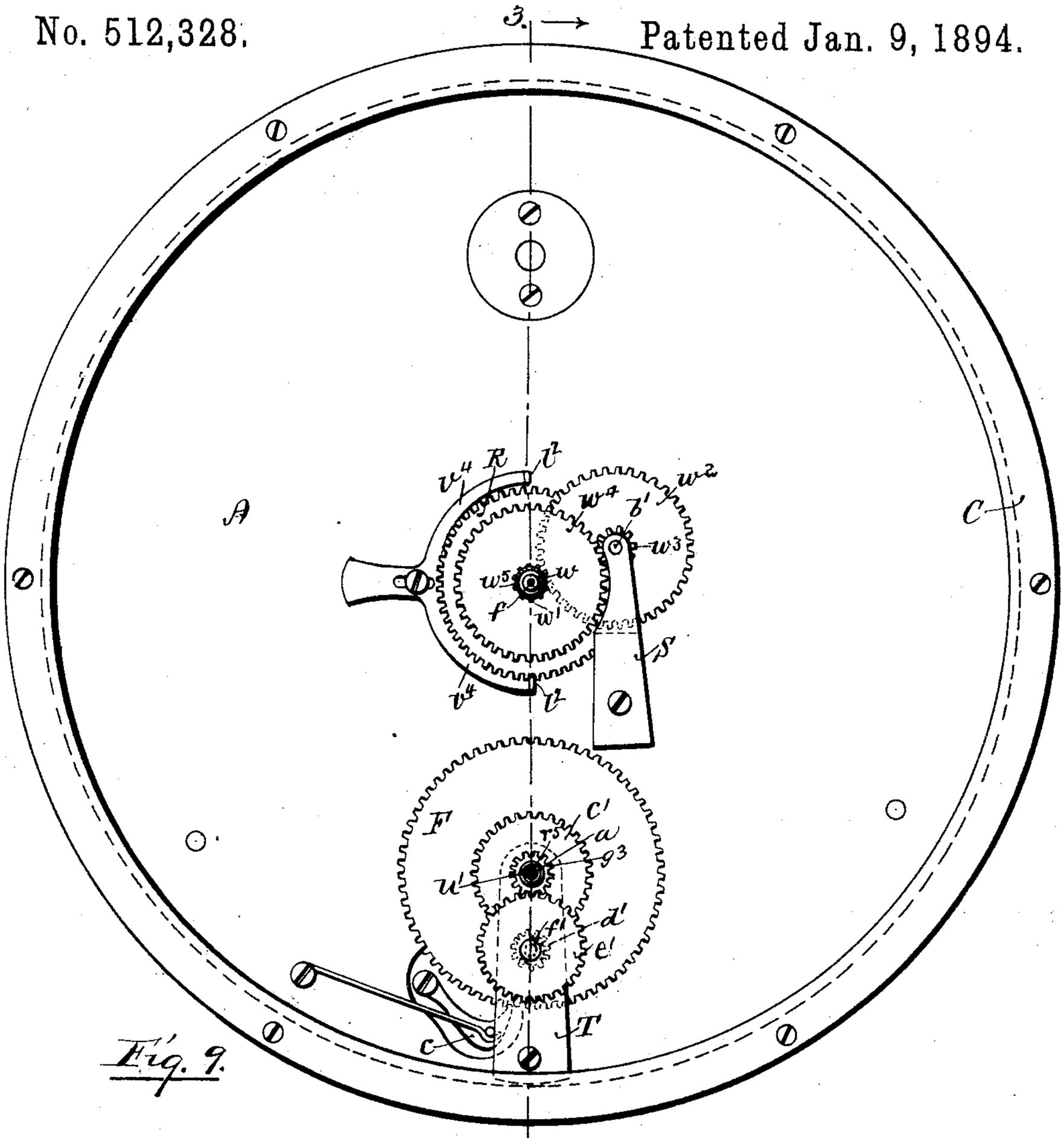

Fig. 9.

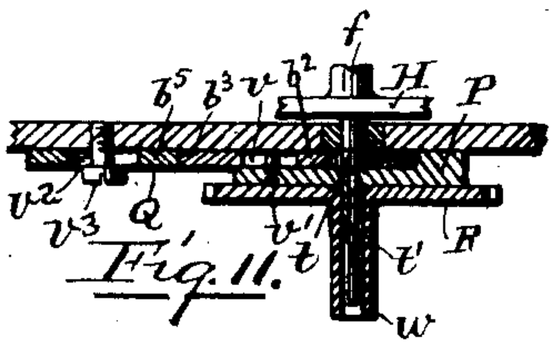

Fig. 11.

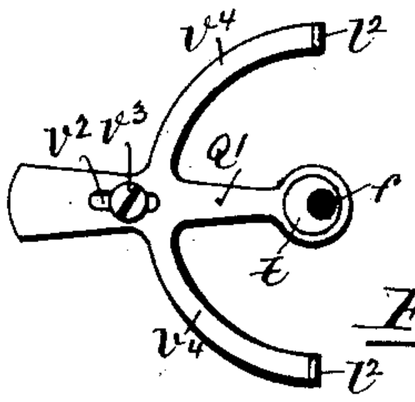

Fig. 12.

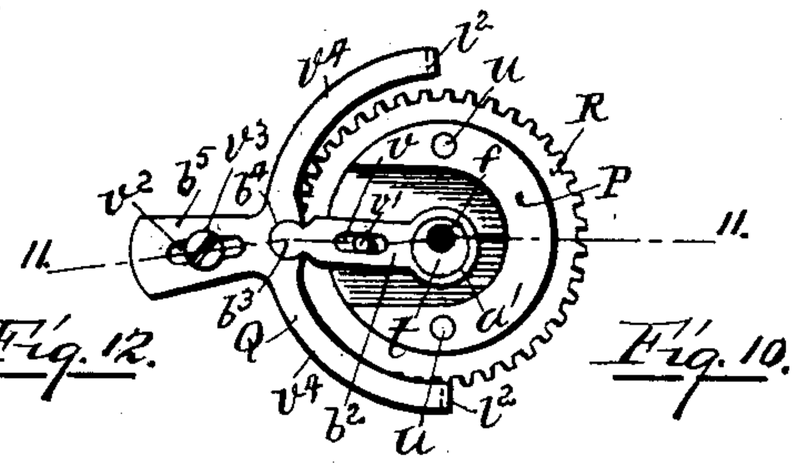

Fig. 10.

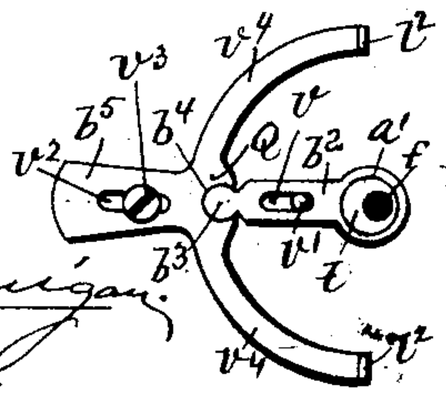

Fig. 13.

Witnesses.

Charles Hannigan.

James W. Beaman.

Inventor.

Norman M. Saati.

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N. M. SAATI.

WATCH.

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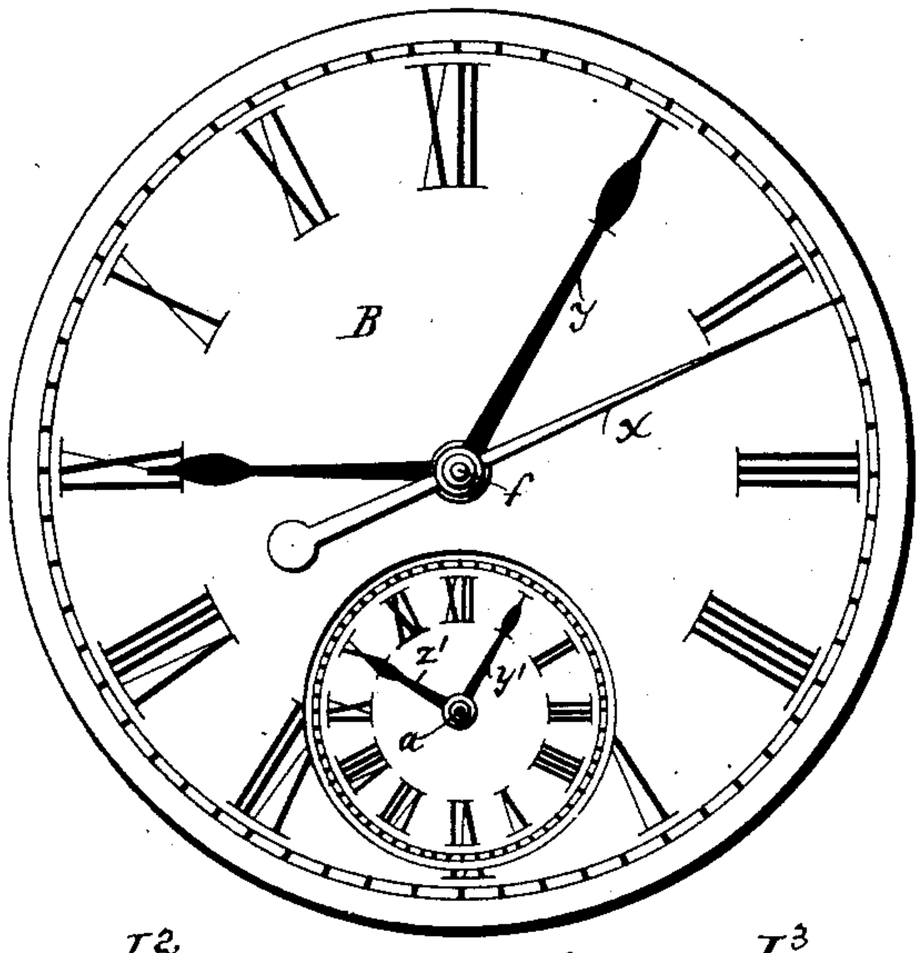

Fig. 14.

Fig. 16.

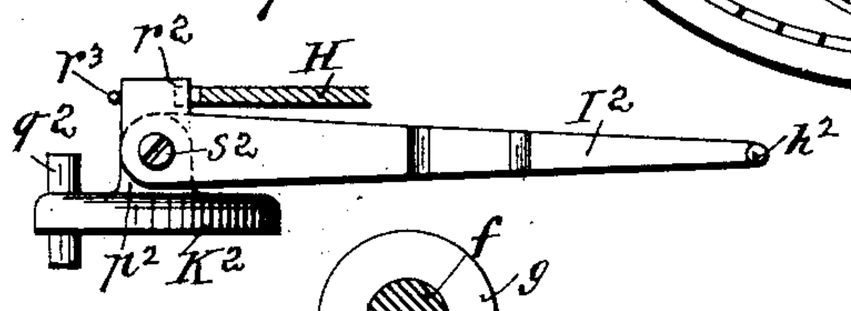

Fig. 17.

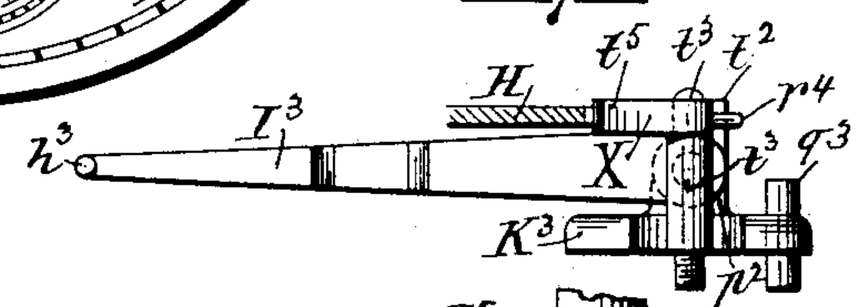

Fig. 18.

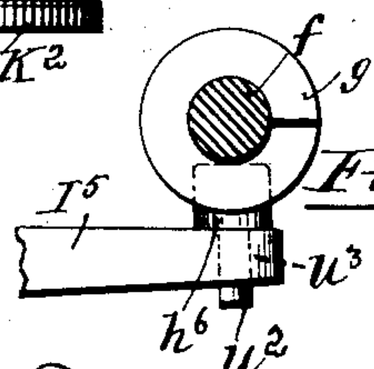

Fig. 19.

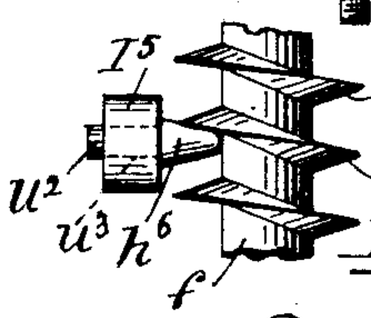

Fig. 15.

Witnesses.

Charles Hannigan.

James W Burman

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WATCH.

No. 512,328. Patented Jan. 9, 1894.

Fig. 20.

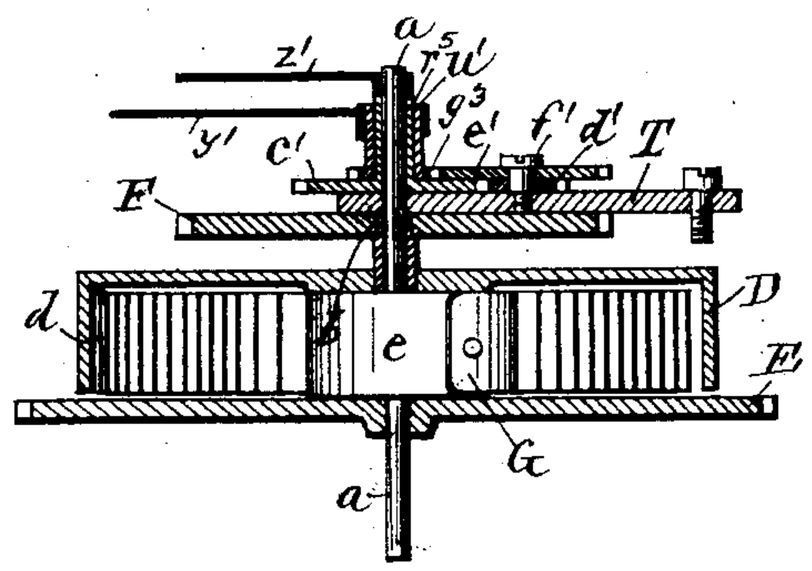

Fig. 21.

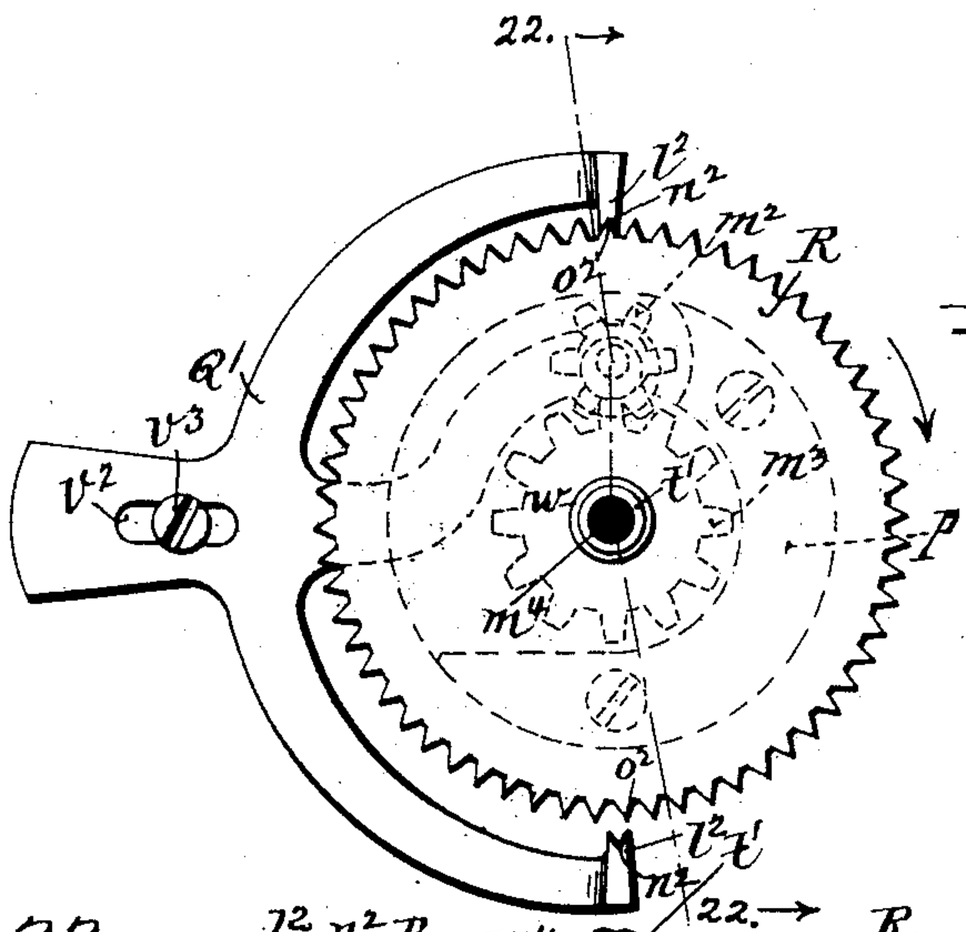

Fig. 22.

Witnesses.

Charles Hannigan.

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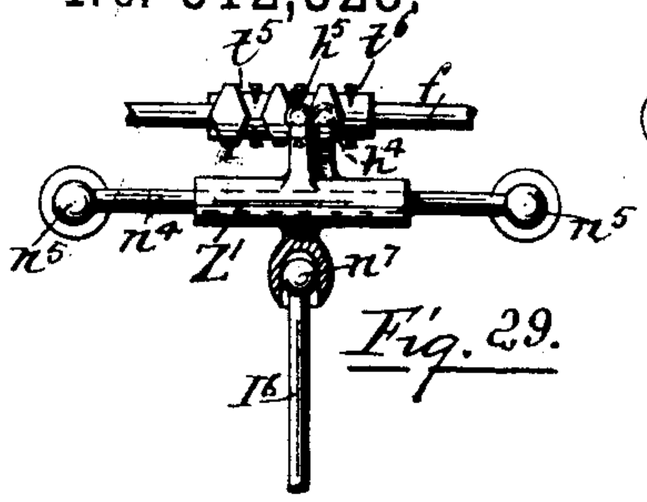

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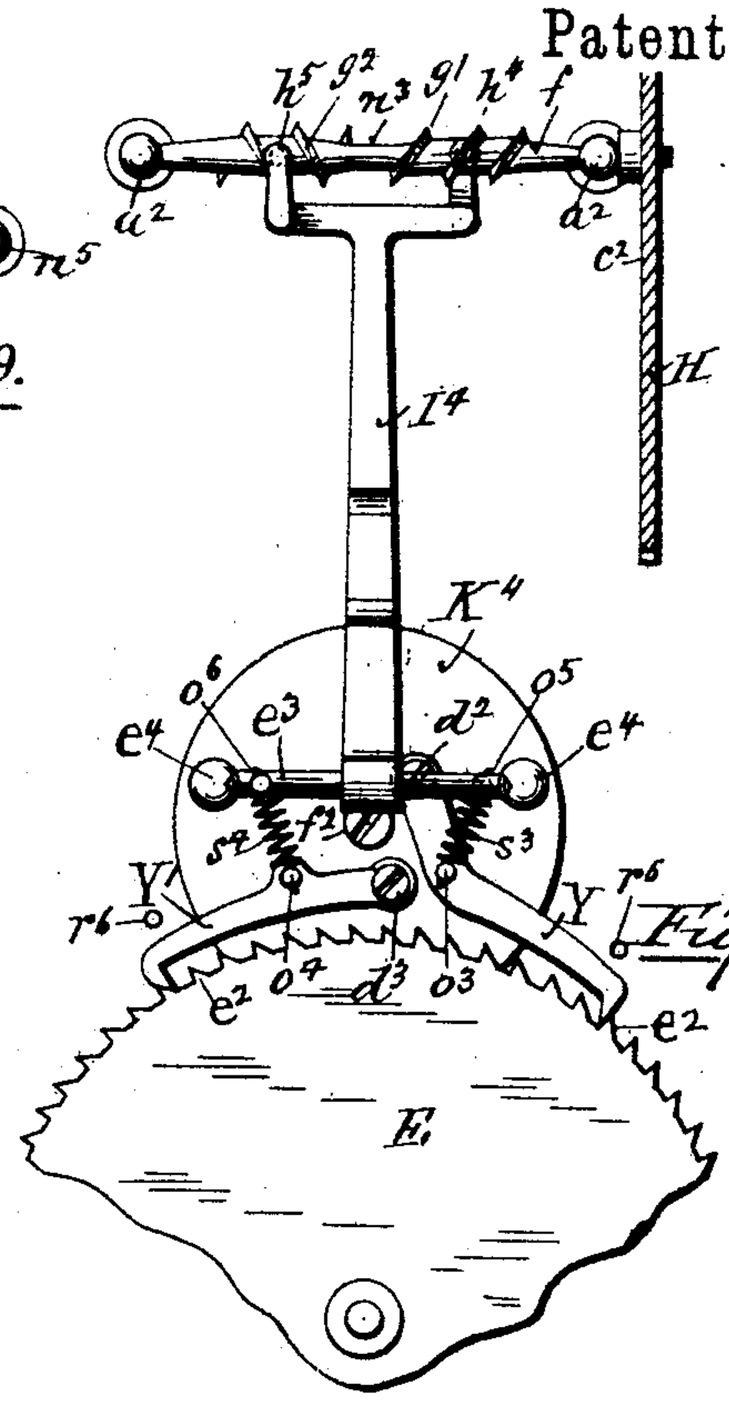
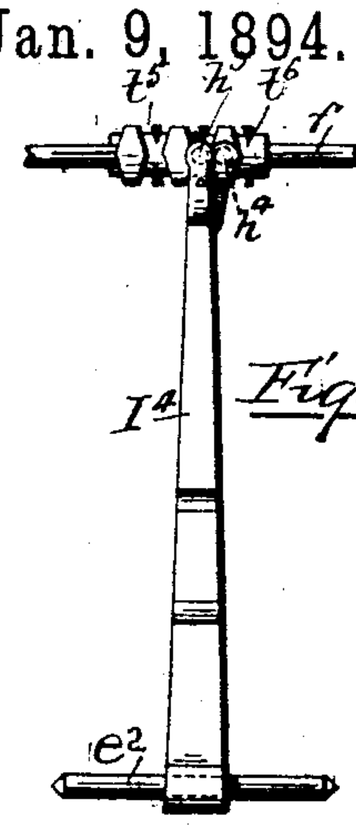


Fig. 23.



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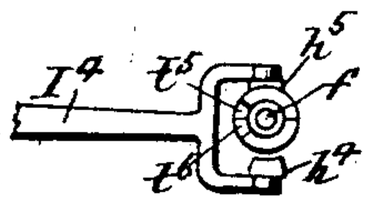
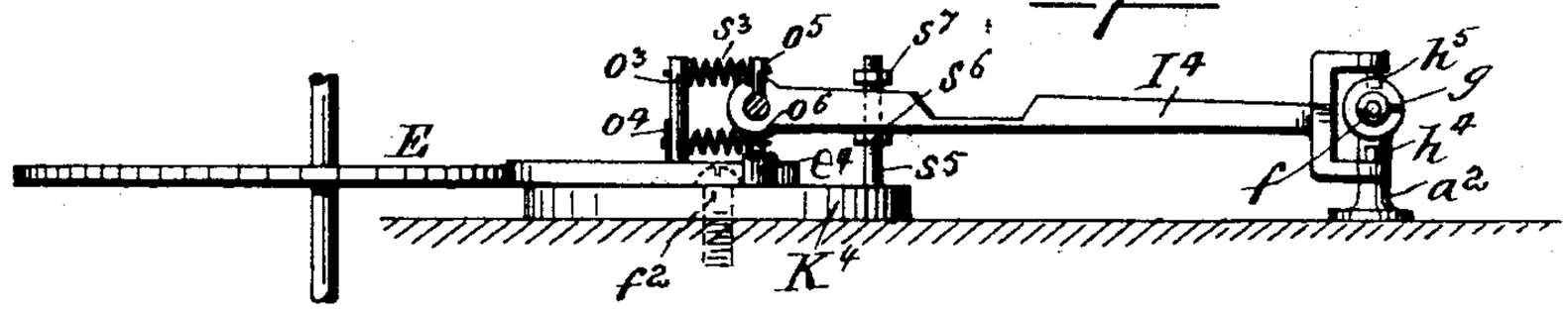


Fig. 28.



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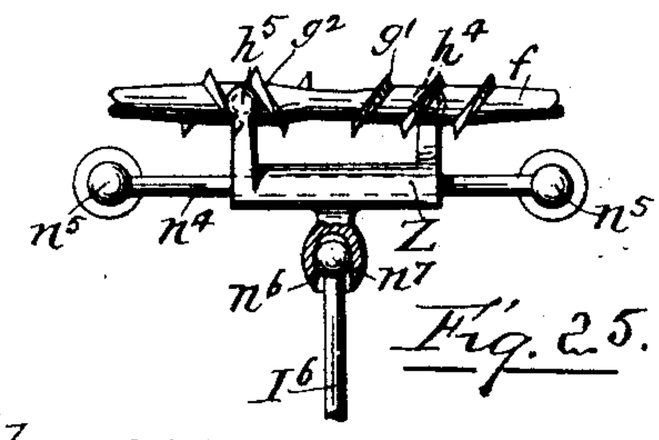

Fig. 25.

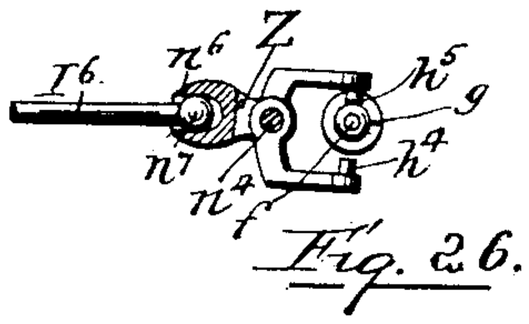

Fig. 26.

Witnesses.

Charles Hannigan.

James W Beaman

Inventor.

Newman M Saati.

by S. Schofield.

Atty.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

NOWMAN M. SAATI, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO HIMSELF AND WILLIAM A. WALTON, OF SAME PLACE.

WATCH.

SPECIFICATION forming part of Letters Patent No. 512,328, dated January 9, 1894.

Application filed September 21, 1892. Serial No. 446,490. (No model.)

To all whom it may concern:

Be it known that I, NOWMAN M. SAATI, a subject of the Sultan of Turkey, residing at Providence, in the State of Rhode Island, have invented a new and useful Improvement in Time-Keeping Mechanisms, of which the following is a specification.

The object of my invention is to dispense with the ordinary train of gearing between the actuating spring or weight, and the escapement wheel, and to simplify and cheapen the construction of the operating mechanism of a watch or clock, and my invention consists in the employment of a spiral groove, or worm, and suitable engaging members, for imparting the desired rotary movement to the escapement wheel.

It also consists in the combination with the escapement wheel, of an improved device for reducing the rate of movement between the axle of the escapement wheel, and the minute or hour hands.

It also consists in an improved combination of time indicating hands, with the winding barrel and axle for the main spring or weight.

In the accompanying drawings: Figure 1, represents a back view of the movements of a watch embodying my invention. Fig. 2, represents a section taken in the line 2, 2, of Fig. 1. Fig. 3, represents a section taken in the line 3, 3, of Fig. 9. Fig. 4, represents a detail view, showing the lever for one of the engaging members, and its connected catch, from the engaging side. Fig. 5, represents a detail view, showing the lever for the opposite engaging member, and its connected catch, from the engaging side. Fig. 6, represents an edge view of the lever and catch, shown in Fig. 5, and a face view of the supporting disk from the side of the attaching plate. Fig. 7, is a detail view showing a portion of a regulator for the balance wheel. Fig. 8, represents a detail section, taken in the line 8, 8, of Fig. 1, showing the regulating mechanism. Fig. 9, represents a view of the front side of the watch movement, showing the gears for operating the minute and hour hands. Fig. 10, represents an under view of the device for operating the minute hand by means of an eccentric upon the axle of the escapement wheel. Fig. 11, represents a section taken in the line 11, 11, of Fig. 10, showing also a detail section of the attaching plate of the watch. Figs. 12 and 13 represent different forms of the engaging lever, for operating the minute hand, from the eccentric according as the movement of the escapement wheel is in one direction, or the other. Fig. 14, represents a view of the face of the watch, showing two sets of hands; one upon the axis of the escapement wheel, and the other upon the axle of the driving wheel. Fig. 15, represents a plan view, showing a modification in the mechanism for imparting motion to the escapement wheel. Fig. 16, represents an inside view of the lever for one of the engaging members, and its pivoting disk, at one side of the toothed driving wheel. Fig. 17, represents an inside view of the lever for the engaging member at the opposite side of the toothed wheel. Fig. 18, represents an enlarged end view of the operating worm, and an edge view of the engaging end of the lever, provided with a flattened loosely held engaging member. Fig. 19, represents an enlarged side view of a portion of the operating worm, showing an end view of the lever and an edge view of the flattened engaging member. Fig. 20, represents a section taken through the main-spring barrel in the line 3, 3, of Fig. 2. Fig. 21, represents a modification of the device for operating the minute hand, from an eccentric upon the axle of the escapement wheel. Fig. 22, represents a section of the same taken in the line 22, 22, of Fig. 21. Fig. 23, represents a detail plan view showing a modification, adapted for a clock movement, in which a single lever is employed for both engaging members. Fig. 24, represents a detail side view of the same. Figs. 25 and 26, are views representing a sliding carriage for the engaging members. Figs. 27, 28 and 29, are detail views, showing a modification in the worm of the escapement wheel.

In the accompanying drawings, A represents the supporting plate of a watch movement, and B the dial, which is supported by the rim C. The barrel D is held loosely upon the axle *a*, of the toothed wheel E, which is supported by the bridge A′ and provided with a squared hub *b*, upon which is placed the ratchet wheel F, the said ratchet wheel being

held in its set position, by means of the spring actuated click *c*. The main spring G is secured at its outer end to the wall *d* of the barrel D, and at its inner end to the arbor *e* which is attached to the axle *a* of the wheel E, so that when the barrel is held in a fixed position by means of the ratchet wheel and click, rotary motion will be imparted to the wheel E by the resilience of the spring G. The axle *f*, of the escapement wheel H, is provided with a screw thread or worm *g*, adapted to receive the engaging members *h*, *h'*, of the levers I, I', which levers are firmly attached to their pivot axles J, J', supported in the bearing standards *i*, *i*, which project from the side of the pivoted disks K, K'. Upon the pivot axle J, is placed the spiral spring *j*, one end of which is fastened to the pivot axle, and the other end to the adjacent standard *i*, so that the torsion of the said spring will tend to throw the lever I toward the side c^2 of the escapement wheel H. The cylindrical enlargement *k* of the pivot axle J, is bored transversely of the axis of the axle, to receive the shank *l*, of the adjustable arm L, which projects from the side of the axle toward the disk K, the said arm being held in position by means of the set screw *l'*; and to the arm L, is jointed the catch M, which engages with the teeth of the wheel E, the said catch being forked at its outer end *n*, so as to embrace the edge of the wheel E, and be supported thereby, at any position in which the said catch may be placed, whether in, or out of engagement with the teeth of the wheel E, the engaging spur *m*, of the catch M, being adapted at its inner side for engagement with the radially directed front side of the teeth e^2 of the wheel E. The disk K is pivoted by means of a stud *o*, which projects from both sides of the disk and extends into the perforation *p* in the plate A, and also into the perforation *q* in the bridge N, and to the bearing standard *i*, is attached the flat disengaging sprlng *r*, the forward end of which is adapted to enter the space between the teeth of the wheel E. To the side m^2 of the disk K, adjacent to the plate A, is attached the wire spring *s*, which bears against the corner t^7 of the plate A and operates to slightly turn the disk K, and throw the engaging member *h* of the lever I, toward the side of the axle *f* for engagement with the worm *g*, the spring *s* being in all cases made weaker than the opposite disengaging spring *r*. The disk K', arranged at the opposite side of the wheel E, carries the lever I', having a pivot axle J', which is provided with the adjustable arm L', projecting from the side of the axle J', opposite to that of the arm L upon the axle J, the said axle J and lever I', being actuated by means of the torsion spring *j'*, to throw the engaging member *h'* of the lever I', toward the side c^2 of the escapement wheel H, as above described for the lever I, attached to the disk K.

To the arm L', is jointed the catch M' which is also forked at its outer end *n'*, as in the case of the catch M, and the spur *m'* is arranged to engage at its outer side with the teeth of the wheel E, and to the standard *i* of the plate K', is attached the flat disengaging spring *r'*, the curved end of which is adapted to enter the space between the teeth of the gear E, the said disengaging spring *r'*, being made stronger than the wire spring *s'*, which is arranged at the opposite side of the disk K' to turn the said disk and lever I' upon the pivot stud *o'* so that the engaging member *h'* of the lever I', will be carried toward the side of the axle *f*, for engagement with the worm *g*, the pivot stud *o'* being held by the plate A, and a bridge N', as in the case of the disk K before described, the pivots *o* and *o'* being preferably so arranged, relatively to the point of action of the catches M and M', upon the teeth of the wheel E, that the natural tendency will be to preserve the engagement of the said catches with the teeth, rather than to cause their disengagement, and the pivotal movement of the disks K, K', will be limited by the opposite sides of the recesses f^3, f^4, of the plate A, in which the said disks are placed, so that the engaging members *h*, *h'*, will not bear against the side of the axle *f*, to cause friction upon the same, and also that the said engaging members will not be carried outward to an undesirable distance from the side of the worm, and the stop pins p^4, p^4, will serve to prevent the contact of the members *h*, *h'*, with the wheel H.

When the balance U, is set in motion, the consequent movement of the escapement lever P will allow the escapement wheel H of sixty teeth, to revolve tooth by tooth, the power of the main spring G, being transmitted to the escapement wheel H by means of the engaging members *h*, *h'*, of the levers I, I', and the worm *g*, the operation of the said engaging members being as follows: When the main-spring G has been wound up, by turning the barrel D in the proper direction, the resilience of the spring will tend to cause the movement of the wheel E in the same direction; as shown by the arrow in Fig. 1, and the engagement of the teeth of the gear E, with the side of the spur *m*, of the catch M, will cause a pull upon the arm L, tending to turn the pivot axle J and thus cause the pressure of the engaging member *h* of the lever I, against the coils of the worm *g*, to produce a rotary movement of the escapement wheel in the direction of the arrow in Fig. 1, and, since there are five full turns in the worm *g*, upon the full completion of the movement of the lever I, by the pressure of the tooth of the gear E, against the spur *m*, of the catch M, the escapement wheel H will have been turned five times, subject to the regulating action of the escapement lever O, and prior to the disengagement of the engaging member *h* of the lever I, with the coils of the worm *g*, the engaging member *h'* of the lever

I′ will have been brought into engagement therewith; with the spur m' of the catch M′, in engagement with a tooth of the driving wheel E, whereupon the pressure of the tooth of the wheel E, upon the spur m' will cause a push upon the arm L′, tending to turn the pivot axle J′, and thus cause a pressure of the engaging member h' of the lever L′, against the coils of the worm g, to continue the movement of the escapement wheel H, after the disengagement of the engaging member h of the lever I, from the said worm, such disengagement being effected by the action of a moving tooth of the wheel E, upon the disengaging spring r, to cause the turning of the disk K, and its attached mechanism, upon the pivot o, against the weaker action of the spring s, so that, the spur m will be thrown back out of engagement with the tooth e^2 of the wheel E, and the engaging member h of the lever I, will be thrown back from the axle f of the escapement wheel, and as soon as the spur m, is released from its engagement with the tooth of the wheel E, the resilience of the torsion spring j, will cause the movement of the engaging member h of the lever I, back toward the side c^2 of the escapement wheel, preparatory to re-engagement with the inner end a^3 of the worm g, and as the movement of the escapement wheel H is being continued by the pressure exerted by the tooth of the wheel E, against the spur m' of the catch M′, which causes the outward movement of the lever I′, in engagement with the worm g, the disengaging spring r, will become released from engagement with the tooth e^2 of the wheel E, so that the opposing spring s, can act to turn the disk K, back to its former position, in which the spur m is again in engagement with a tooth of the wheel E, whereupon, the movement of the wheel E, will cause the outward movement of the engaging member h of the lever I, from the side c^2 of the escapement wheel, into engagement with the coils of the worm g, as before; and as the movement of the wheel E continues, and the engaging member h' of the lever I′, completes its traverse through the coils of the worm g, a tooth of the wheel E, will come into engagement with the end of the disengaging spring r' and cause the turning of the disk K′ and its attached mechanism, upon the pivot o', against the weaker action of the spring s', so that, the spur m', will be thrown back out of engagement with the tooth e^2 of the wheel E, and the engaging member h' of the lever I′, will be thrown back from the axle f of the escapement wheel; and, as soon as the spur m', is released from its engagement with the tooth of the wheel E, the resilience of the torsion spring j', will cause the movement of the engaging member h' of the lever I′, back, toward the side c^2 of the escapement wheel, preparatory to re-engagement with the inner end of the worm g; and as the movement of the escapement wheel H is being continued, by the pressure exerted by a tooth of the wheel E, against the spur m of the catch M, which causes the outward movement of the lever I, in operative engagement with the worm g, the disengaging spring r', will become released from engagement with the tooth of the wheel E, so that the opposing spring s', can act to turn the disk K′, back to the position in which the spur m' is again in engagement with a tooth of the wheel E, whereupon the movement of the wheel E will cause the outward movement of the engaging member h' of the lever I′, from the side c^2 of the escapement wheel, into engagement with the coils of the worm g, as before; and this operation will be continuously repeated, so that, upon the movement of the wheel E for the space of a single tooth with the engaging members h and h' operating in the coils of a worm g of five turns, ten entire revolutions will be imparted to the escapement wheel, and a time piece constructed upon the principle of the engaging members and worm, instead of the ordinary train of gearing, will operate with a greatly reduced expenditure of power, a much weaker main-spring being amply sufficient for the purpose.

The driving wheel E is represented in the drawings as having seventy-two teeth, and the escapement wheel H sixty teeth, with a worm g of five turns; and the gearing to operate the hands of the time piece, may be driven, either by the axle f, of the escapement wheel, or by the axle a of the wheel E, or by both, as shown in Figs. 3 and 9, and when both are employed, the true time at two different places may be kept by the same watch, or the watch may be set, for both the standard, and the true time, at any given place. As the escapement wheel H of sixty teeth will make one revolution in a minute, the seconds hand x, may be attached to the axle f of the said wheel, and in order to reduce the movement, for the purpose of driving the minute hand y, the eccentric t, is attached to the axle f, and covered by the circular bridge P, which is secured to the plate A by means of the screws u, u, and over the eccentric t, is placed the eye a', of the lever arm b^2, of the compound engaging lever Q, the said lever arm being provided with the slot v adapted to receive the fulcrum pin v' attached to the plate A, and also with a circular head b^3, adapted to enter the circular socket b^4, of the lever arm b^5, the said arm being provided with the slot v^2, adapted to receive the fulcrum screw v^3, and with the curved arms v^4, v^4, having at their outer ends the engaging spurs l^2, l^2, adapted to engage with the teeth of the minute wheel R of sixty teeth, which wheel is placed loosely upon the stationary hub t' at the outer side of the bridge P, the said wheel being provided with the elongated hub w, upon the upper end of which is placed the minute hand y; and when the escapement wheel H is in motion, the engaging spurs l^2, l^2, of the compound lever Q, will engage alternately with the teeth at op-

posite edges of the minute wheel, to cause a single revolution of the same, when the escapement wheel has made sixty revolutions; the eccentric t which fits the eye a' of the compound lever Q, serving to cause the engaging spurs l^2, l^2, to impart the required rotary movement to the wheel R, by their alternate engagement and disengagement with the teeth of the same; the compound lever Q in this case serving to cause the rotation of the wheel R, in the proper direction for the minute hand of the watch. But in case it is not desired to employ a second hand x, then the escapement wheel H, and its eccentric t, may be caused to revolve in the opposite direction, so that a single engaging lever Q shown in Fig. 12, may be employed, the operation of the eccentric t, in that case serving to rotate the wheel R in the proper direction; and in order to apply the minute wheel R of sixty teeth to a watch the balance of which is arranged to beat quarter seconds, the eccentric t is placed upon the axle f of the escapement wheel, as shown in Figs. 21 and 22, and a pinion m^2 of six teeth secured to the hub of the eccentric, under the bridge P, the said pinion being made to engage with a gear m^3 upon the axle m^4, to which axle the second hand is to be attached, the minute wheel R being held loose upon the stationary hub t', at the outer side of the bridge P; and in order to provide for the action of the single lever Q', which performs one hundred and twenty vibrations per minute upon the minute wheel of sixty teeth, the engaging spurs l^2, l^2, of the lever Q', are provided with the notches n^2, which are adapted to receive the pointed ends of the teeth o^2, of the minute wheel, the said engaging members being also adapted to enter the spaces between the said teeth, and in this case, the eccentric t which fits the eye a', is made with a throw adapted to cause the movement of the wheel R, for the space of one half a tooth, at each revolution of the eccentric t, the spurs l^2, l^2, first engaging with the tooth, and then entering the space, and so on, alternately, so as to impart a rotary movement to the wheel R, in which two revolutions of the eccentric t, will serve to impart a movement of one tooth to the wheel R, and in this case, the escapement wheel, upon the axle of which the eccentric t is placed, is to be driven in a direction contrary to that shown in Fig. 1, the reversal of movement to accommodate the second hand x being effected by the action of the pinion m^2 and gear m^2.

The hub w of the minute wheel R, is provided with the pinion w' of ten teeth, which engages with the gear w^2 of forty teeth, and to the side of the gear w^2, is attached to the pinion w^3, of twelve teeth, the said gear w^2 and pinion w^3, being held upon a stud b', which is supported by the bridge S, and the pinion w^3 of twelve teeth engages with the gear w^4, of thirty-six teeth, the said gear being provided with the hub w^5, upon which is placed the hour hand z.

The supplementary hour hand z' is arranged upon the axle a of the driving wheel E, and upon the axle $\bar{a}$ at the outer side of the bridge T, is placed the cannon gear c' of forty-eight teeth, the said gear being frictionally held upon the said axle, and the frictionally held gear c' engages with the pinion d' of twelve teeth, which is attached to the side of the gear e', of forty-eight teeth, the said gear and pinion being held to revolve upon the screw stud f', held in the bridge T, and the gear e' engages with the pinion g^3 of twelve teeth, revolving upon the hub r^5 of the gear c', the said pinion being provided with an elongated hub u' upon which is placed the minute hand y', thus readily providing two sets of time keeping hands, in the same watch or clock.

The parts of the watch movement may be differently arranged, that is, the axle a, of the driving wheel E, may occupy the central position upon the dial B, which is occupied by the axle f of the escapement wheel E, the minute and hour hands being placed upon the axle a of the wheel E, as described.

The regulator for the balance U, is formed of a split toothed ring i', which is provided at one side with the arm i^2, having the downwardly projecting pins i^3, i^3, adapted to engage with the hair spring j'. The ring i' is split at the line i^4, so that the ring can be readily sprung into the under cut circular groove i^5, of the bridge V, which supports the axle of the balance U, and the teeth of the ring i' engage with the pinion j^2, attached to the axle k', which passes through a perforation k^2 in the bridge V, and upon the outer end of which is placed the graduated disk W, provided with a milled edge, and by turning the disk W in either direction, the arm i^2 will be moved in the opposite direction to effect a change in the vibration of the regulating spring, and the resilience of the split ring in the groove i^5, forms a friction bearing which holds the arm i^2 steady, and prevents injurious back lash when the movement of the watch is being regulated.

A modification of my improved time keeping mechanism is shown in Fig. 15, in which the engaging levers I^2, I^3, are pivoted to the lugs p^2, upon the pivoted supporting disk K^2, K^3, by means of the screws s^2. The lever I^2 is provided with catch r^2, which is integral with said lever, the said catch being adapted for engagement with the teeth of the wheel E, and at the rear of the catch r^2, is placed the light spring r^3, which tends to throw the lever I^2 toward the side c^2 of the escapement wheel, and also to turn the disk K^2, slightly upon its pivot q^2, to throw the engaging member h^2 of the lever I^2, away from the axle f, so as not to engage with the worm g, upon the subsequent movement of the said engaging member toward the side c^2 of the said wheel. The engaging lever I^3 at the op-

posite side of the wheel E, is provided with the short stud t^2, at the back of which is arranged the light spring r^4, which serves to move the lever I^3, toward the side c^2 of the escapement wheel, and also to turn the disk K^3 slightly, upon its pivot q^3, to throw the engaging member h^3 of the lever I^3, away from the axle f, thus preventing engagement with the worm g, upon the subsequent movement of the engaging member toward the said side c^2. The catch lever X is interposed between the stud t^2 of the lever I^3, and the teeth of the wheel E, in order to provide for the reverse direction of the movement of the teeth, at the side of the wheel adjacent to the disk K^3, from that of the same teeth at the side adjacent to the disk K^2, so that the engaging member h^3 of the lever I^3, will be operated to engagement with the worm g and disengagement therefrom, in the same manner, as in the case of the engaging member h^2 of the lever I^2, the catch lever X being pivoted to the post t^3, the arm t^4 of the said lever resting in front of the stud t^2, and bearing against the same, and the arm t^5, engaging with the teeth e^2 of the wheel E, to produce the required movement of the catch lever to cause the proper movement of the disk K^3, and the engaging lever I^3. When the tooth e^2 is in engagement with the catch r^2, of the lever I^2, as shown in Fig. 15, the disk K^2 will be first turned so as to carry the engaging member h^3 of the lever I^2 toward the axle f of the worm g, and the continued movement of the tooth e^2 will cause the engaging member h^2 to move along the coils of the worm, and impart the required movement to the escapement wheel, until finally the engaging member h^2 will be brought clear of the worm at its opposite end, so as to cease its action thereon, and the tooth e^2 will pass clear of the catch r^2. Then the action of the spring r^3, will serve to turn back the disk K^2 on its pivot q^2, and to throw back the engaging member h^2 of the lever I^2 to a point beyond the line of the coils of the worm, and back toward the side c^2 of the wheel H, preparatory to re-engagement with the worm, and in the mean time the action of the tooth e^2, upon the arm t^5 of the catch lever X will serve to carry the said arm forward, and throw the arm t^4 backward, so as to press against the stud t^2, to first cause a slight movement of the disk K^3 upon its pivot q^3, and an inward movement of the engaging member h^3 of the lever I^3, toward the axle f of the worm g, and then, the continued movement of the tooth e^2, will cause the engaging member h^3 to move along the coils of the worm, and thus impart the required movement to the escapement wheel, until the said engaging member passes out of the coils, at the opposite end of the worm, so as to cease its action thereon, and the tooth e^2 will pass clear of the arm t^5 of the catch lever X. Then the action of the spring r^4, will serve to turn back the disk K^3 on its pivot q^3, and to throw back the engaging member h^3 of the lever I^3, to a point beyond the line of the coils of the worm, and back toward the side c^2 of the wheel H, preparatory to re-engagement with the worm upon the subsequent engagement, of a tooth of the wheel E with the arm t^5, and the engaging members of the levers I^2, I^3, will be operated alternately into engagement with the worm g, to produce a continuous movement of the escapement wheel H. The pivotal movement of the disks K^2, K^3, may be properly limited, so that the engaging members h^2, h^3, will not bear against the side of the axle f, to cause friction upon the same, and also that the said engaging members will not be carried outward to an undesirable distance from the side of the worm, by means of the stop pins f^5, f^6, secured to the plate A, near the opposite edges of the disks.

The engaging members may be held loosely at the end of the engaging lever I^5, as shown in Figs. 18 and 19, in which the engaging member h^6 is made of flattened construction, and provided with a shank u^2, which is held loosely in the perforation u^3 in the end of the lever I^5 thus allowing the engaging member to fit fairly against the coils p^3 notwithstanding the varying inclination of the lever I^5 with respect to the axis of the worm.

Another modification of my invention adapted for a clock movement is shown in Figs. 23 and 24, in which a single engagement lever I^4, is employed, the said lever being provided with the two opposite engaging members h^4, h^5, arranged at opposite sides of the axle f of the escapement wheel H, for action upon the right and left hand worms g', g^2, arranged upon the said axle, which may be supported in the fixed bearings a^2, a^2, connected to any suitable support. The lever I^4 is provided with the pivot axle e^3, which is supported in the bearing standards e^4, e^4, upon the disk K^4, the said disk being pivoted upon the screw f^2. To the disk K^4, at the points d^2, d^3, are pivoted the catch levers Y, Y', extending in opposite directions from their pivoting points, for engagement with the teeth e^2 of the wheel E. The catch levers Y, Y', are each provided with a stud o^3, o^4, which is connected with one of the oppositely projecting arms o^5, o^6, upon the pivot axle e^3, and the studs o^3, o^5, are connected by means of the spiral spring s^3, and the studs o^4, o^6, are connected by means of the spiral spring s^4, and the movement of the engaging members h^4, h^5, of the lever I^4, toward and from the axle f of the escapement wheel H, is limited by means of the screw stud s^5, and the nuts s^6, s^7; the said screw stud being secured to the disk K^4, and passing through a perforation in the lever I^4, and by this means the said engaging members may be so adjusted that they will not bear against the said axle, to prevent the ready rotation of the same, and the outward movement of the catch levers Y, Y' is limited by the stop pins r^6, r^6.

The operation of the device will be as follows: When the catch lever Y is in engagement with the tooth e^2 of the wheel E, as shown in Fig. 23, and the engaging member h^4, is in engagement with the coils p^3 of the worm, then upon the continued forward movement of the tooth e^2, the disk K^4 will be turned upon its pivot screw f^2, causing the movement of the lever I^4, and the engaging members h^4, h^5, in the direction away from the side c^2 of the escapement wheel, the engaging member h^4 being in engagement with the coils of the worm g', and the opposite engaging member h^5, out of engagement with its worm g^2, and upon the continued movement of the engaged tooth e^2, the disk K^4, will be turned, so as to draw upon the spring s^3, until the engaging member h^4 passes out of engagement with the worm g', into the space n^3, between the worms g', g^2, and thereupon the lever I^4 being relieved from pressure, the accumulated resilience of the spring s^3, will instantly cause the outward movement of the engaging member h^4 from the axle f, and the inward movement of the opposite engaging member h^5, to the position shown in Fig. 24, and the instant outward movement of the catch lever Y, from engagement with the tooth e^2; whereupon, the opposite tooth e^2, will become engaged with the catch lever Y', to reverse the motion of the disk K^4, and lever I^4, so that the movement of the engaging member h^5 along the worm g^2, which is cut reversely to the worm g', will cause the escapement wheel H to be turned in the same direction as before; the movement of the disk K^4, upon its pivot, causing a pull upon the spring s^4, so that when the engaging member h^5 passes out of the worm g^2, into the space n^3, the accumulated resilience of the spring s^4, will cause the instant outward movement of the engaging member h^5, from the axle f, and the inward movement of the opposite engaging member h^4, and the instant outward movement of the catch lever Y', from engagement with the tooth e^2; whereupon, the opposite tooth e^2 will become engaged with the catch lever Y, to again reverse the motion of the disk K^4, and lever I^4; and this operation continuously repeated, will serve to impart continuous rotation to the escapement wheel H.

In order to impart a movement to the engaging members h^4, h^5, parallel to the axis of the axle f, instead of causing the same to be moved in the arc of a circle, the said engaging members may be held upon a carriage Z, adapted to slide upon the cylindrical rod n^4, supported by the standards n^5, the said sliding carriage being provided with the socket n^6, adapted to receive the spherical end n^7, of the operating lever I^6, which takes the place of the lever I^4, shown in Figs. 23 and 24, and in this case, the engagement and disengagement of the engaging members with their respective worms, will be as before, except that the engaging movement of the carriage by rocking on the rod n^4, will be the reverse of that of the lever I^4.

Instead of the two worms g' and g^2, a worm formed with the right and left hand spiral grooves t^5 and t^6, as shown in Figs. 27 and 28, may be employed, and in that case, the engaging members h^4, h^5, of elongated form are set for engagement with their respective grooves, at opposite sides of the axis of the axle f, and the application of a sliding carriage Z', provided with engaging members adapted for engagement with the reverse spiral grooves t^5 and t^6, is shown in Fig. 29, the lever I^6, being employed to operate the carriage, as in Fig. 25.

It is to be understood that I do not limit myself to the particular mode of operating the engaging members in their alternate engagement and re-engagement with the spiral groove of the worm, as there are various methods for effecting the required movement of the same from the movement of the wheel E, the examples given being deemed a sufficient exemplification of the principle involved.

I do not in this application claim broadly, the combination with the toothed wheel, and the worm, of a reciprocatory engaging-member adapted to traverse the coils of the worm in one direction, and to pass outside of the said coils in the opposite direction, and an engaging catch connected with the engaging member, and bearing against the tooth of the wheel, the same having been claimed by me as a mechanical movement, in my pending application Serial No. 493,278; my present invention being limited to the combination of the same with an escapement mechanism.

I claim as my invention—

1. In a time piece, the combination with an escapement mechanism, the worm, and the toothed driving wheel, of an intermediate reciprocatory engaging member, adapted to traverse the coils of the worm in one direction, and to pass outside of the said coils in the opposite direction, and the catch engaging with the teeth of the driving wheel to impart the traversing movement to the engaging member, substantially as described.

2. In a time piece, the combination with an escapement mechanism, the worm, and the toothed driving wheel, of an intermediate engaging member adapted to traverse the coils of the worm, an engaging catch adapted to bear against a tooth of the wheel to operate the engaging member, and a spring adapted to cause the disengagement of the engaging member, and the operating catch, upon the completion of the traversing movement of the engaging member, through the coils of the worm, substantially as described.

3. In a time piece, the combination with an escapement mechanism, the worm, and the toothed driving wheel, of an intermediate engaging member adapted to traverse the coils of the worm, an engaging catch adapted to

bear against a tooth of the wheel to operate the engaging member, a spring adapted to cause the disengagement of the engaging member and the operating catch, upon the completion of the traversing movement of the engaging member, and means for carrying the engaging member back to its starting point for re-engagement, substantially as described.

4. In a time piece, the combination with an escapement mechanism, the worm, and the driving wheel, of the opposite engaging members, and suitable connections with the driving wheel, for operating the engaging members alternately through the coils of the worm, substantially as described.

5. In a time piece, the combination with an escapement mechanism, the worm, and the toothed driving wheel, of the opposite alternately engaging members, and the catches adapted for alternate engagement with the teeth of the driving wheel, to cause the traverse of the engaging members through the coils of the worm, substantially as described.

6. In a time piece, the combination with an escapement mechanism, the worm, and the toothed driving wheel, of the pivoted disks at opposite sides of the driving wheel, the opposite engaging members, supported upon the pivot axles, the loosely held catches for engagement with the teeth of the driving wheel, the springs for swinging the engaging members toward the axle of the worm and the engaging catches, toward the teeth of the driving wheel, the springs for swinging the engaging members away from the axle of the worm, and the catches away from the teeth of the driving wheel, and the springs for turning the pivot axles, to carry back the engaging members for re-engagement with the worm, substantially as described.

7. In a time piece, the combination with the escapement mechanism and the eccentric, of the toothed minute wheel, and the engaging lever having an eye fitting the eccentric, and the spurs, adapted to engage alternately with the teeth at the opposite edges of the minute wheel, substantially as described.

8. In a time piece, the combination with the escapement mechanism, and the eccentric, of the toothed minute wheel, and the compound engaging lever, having an eye fitting the eccentric, and the spurs adapted to engage alternately with the teeth at the opposite edges of the minute wheel, substantially as described.

9. In a time piece, the combination with the axle of the escapement wheel, the eccentric and the minute wheel, of the engaging lever, fitting the eccentric and having forked engaging spurs, adapted to engage alternately with the points and sides of the teeth at the opposite edges of the wheel, substantially as described.

10. In a time piece, the combination with the axle of the escapement wheel, the eccentric, and the minute wheel, of the pinion upon the axle of the escapement wheel, the two-fold gear provided with an axle passing through the hub of the minute wheel, and the engaging lever fitting the eccentric, and having forked spurs adapted to engage alternately with the points and sides of the teeth, at opposite edges of the wheel, substantially as described.

11. In a time piece, the combination with the axle of the escapement wheel, of the minute wheel, the lever provided with opposite spurs adapted to engage with the teeth of the minute wheel, means for operating the said lever from the axle of the escapement wheel, the minute hand upon the hub of the minute wheel, the hour gear and hour hand, upon the hub of the minute wheel, and the intermediate gears for connecting the gears of the minute and hour hands, substantially as described.

12. In a time piece, the combination with the driving axle, the spring arbor attached to the axle, the mainspring attached to the spring arbor, the winding barrel loose upon the driving axle, and the ratchet wheel and click, of the hour hand attached to the driving axle, the common gear frictionally held upon the driving axle, the loose pinion, the minute hand attached to the hub of the loose pinion under the hour hand, and the intermediate gear and pinion which serves to transmit motion from the frictionally held common gear upon the driving shaft, to the loose pinion carrying the minute hand, substantially as described.

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