Sept. 20, 1949. A. B. POOLE 2,482,434

ROTARY MOTION-TRANSLATING DEVICE

Filed April 22, 1948 2 Sheets-Sheet 1

Fig. 1.

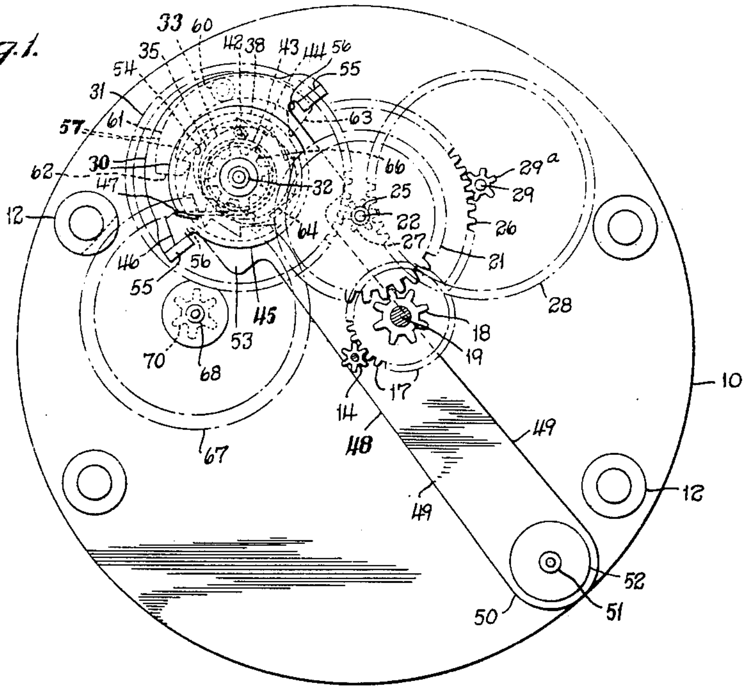
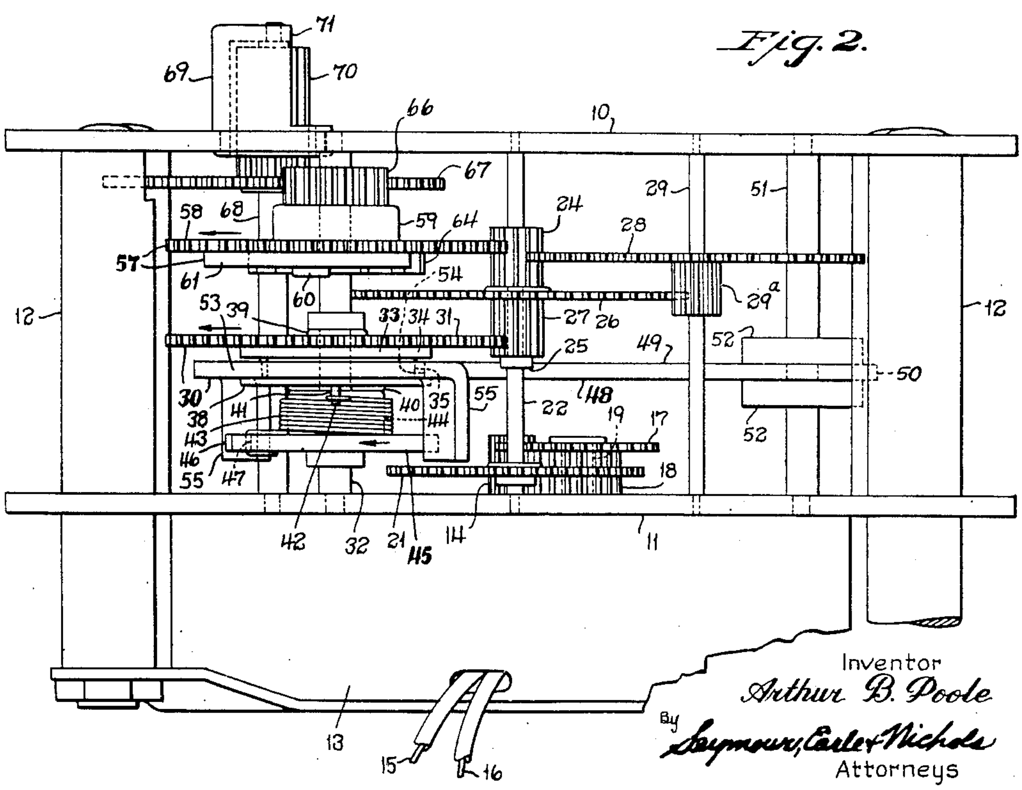


Fig. 2.



Inventor
Arthur B. Poole
By Seymour, Earle & Nichols
Attorneys

Sept. 20, 1949. A. B. POOLE 2,482,434

ROTARY MOTION-TRANSLATING DEVICE

Filed April 22, 1948 2 Sheets-Sheet 2

Fig. 3.

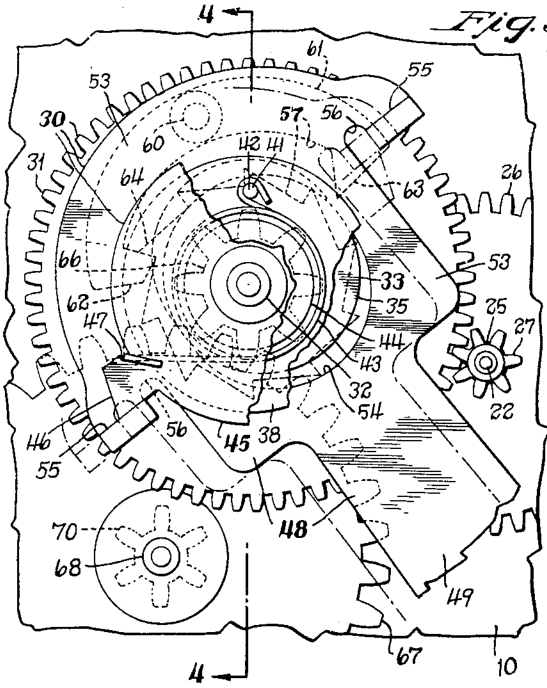


Fig. 5.

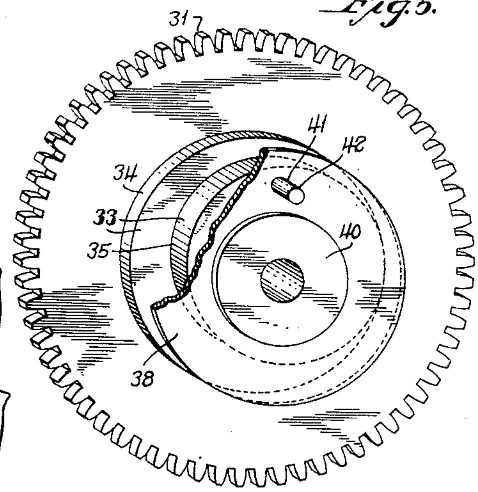


Fig. 6.

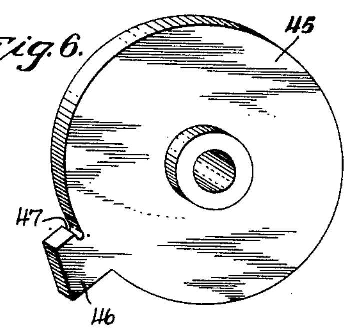


Fig. 4.

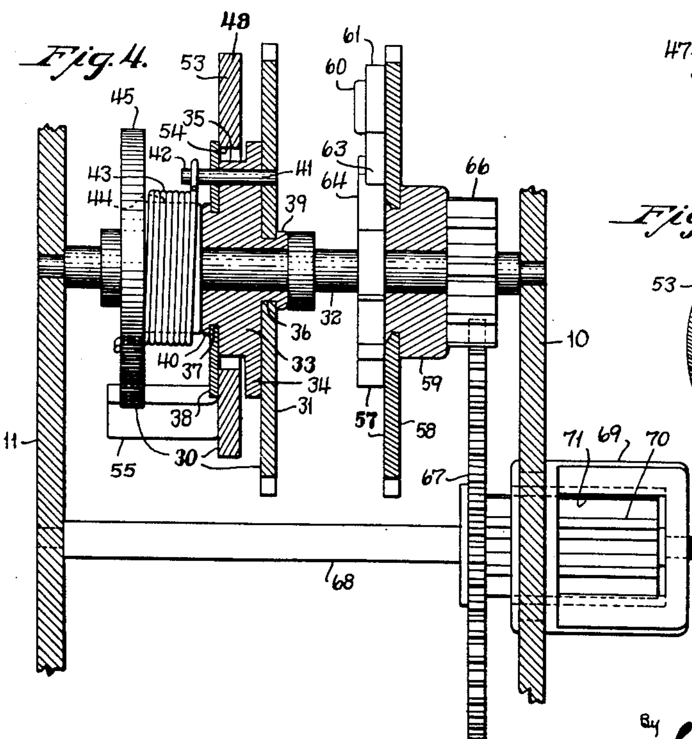
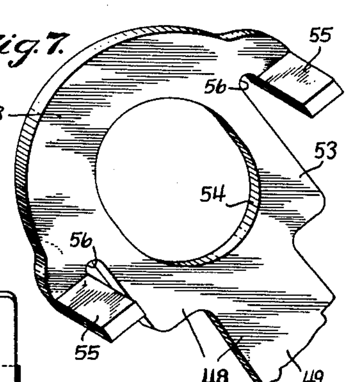


Fig. 7.



Inventor
Arthur B. Poole
By Seymour, Earle & Nichols
Attorneys

Patented Sept. 20, 1949 2,482,434

UNITED STATES PATENT OFFICE

2,482,434

ROTARY MOTION-TRANSLATING DEVICE

Arthur B. Poole, Harwinton, Conn.

Application April 22, 1948, Serial No. 22,600

2 Claims. (Cl. 74—84)

1

The present invention relates generally to a motion-translating device and more especially to a device for translating substantially-continuous rotary motion into intermittent or step-by-step motion, the device of the present invention being applicable to a wide variety of uses such as, for example, the periodic actuation of an electric switch.

An object of the present invention is to provide a superior rotary motion-translating device which is reliable and economical to manufacture, and adapted to translate or convert a relatively-slow substantially-continuous rotary motion into a relatively-rapid intermittent or step-by-step motion.

A further object of the present invention is to provide a superior device of the character referred to embodying governor-mechanism for connecting the motion-converting mechanism of the device to the driving-mechanism, whereby the motion-converting mechanism is restrained to operate at a speed comparable to the speed of the driving-mechanism.

A still further object of the invention is to provide a superior rotary motion-translating device with motion-converting mechanism embodying an oscillatable cam-actuated latch-arm for effecting step-by-step movement of a driven member.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art.

In the accompanying drawings, in which certain modes of carrying out the present invention are shown for illustrative purposes:

Fig. 1 is a rear elevation of one form of a rotary motion-translating device embodying the present invention, the rear plate of the device being removed for clarity of illustration;

Fig. 2 is an enlarged plan view of the motion-translating device of Fig. 1;

Fig. 3 is an enlarged fragmentary rear elevation of the motion-translating device showing details of the motion-converting mechanism and governor thereof;

Fig. 4 is a side elevation in section on line 4—4 of Fig. 3 showing details of the motion-converting mechanism including the oscillatable latch-arm, the cam-operating means thereof, and the governor therefor;

Fig. 5 is a perspective view of the gear-and-cam assembly for operating the oscillatable latch-arm;

2

Fig. 6 is a perspective view of the motion-converting rotor; and

Fig. 7 is a broken perspective view of the head of the oscillatable latch-arm having latching-lugs at diametrically-opposite sides thereof and an elliptical cam-aperture intermediate the latching-lugs.

The particular rotary motion-translating device herein chosen for the purpose of illustrating an embodiment of the present invention, comprises an electric timer which includes a front plate 10 and a back plate 11 held parallel with each other and in spaced relationship by a plurality of pillars 12.

Secured against the rear face of the back plate 11 is a synchronous electric motor structure indicated generally at 13 which requires no detailed description herein other than to point out that, as shown, the said motor structure is provided with a power-output pinion 14 which is supported within the movement of the timer adjacent the rear plate 11 thereof; and with lead-wires 15 and 16 which are adapted to be connected with any suitable source of alternating current in the usual manner of synchronous electric motors. The said motor structure 13, when energized, imparts an accurately timed rotational movement to the power-output pinion 14 and therefore serves, in effect, as timing-means which obviously may be replaced if desired by an ordinary spring-operated time-movement or any other suitably-timed driving-mechanism.

The aforesaid power-output pinion 14, hereinafter referred to as the "driving-pinion," is adapted to mesh with and to continuously drive a rotatable gear-wheel 17 formed preferably of an insulating material and secured to the front face of a pinion 18 which, in turn, is rotatably mounted upon a stud 19 rigidly secured to and projecting forwardly from the rear plate 11. The pinion 18 is adapted to mesh with and to drive a gear-wheel 21 which is secured on the rear end of a shaft 22 journaled at its opposite ends respectively in bearing-apertures of the front and rear plates 10 and 11. A pinion 24 is fastened to the shaft 22 adjacent the forward end thereof. Between the pinion 24 and a collar 25 of the shaft 22 is a gear-wheel 26 having a pinion 27 staked or otherwise fastened securely on the rear face thereof, both the gear 26 and the pinion 27 being rotatable freely on the shaft 22 and held from moving longitudinally thereon by the aforementioned pinion 24 and collar 25 thereof. The pinion 24 is adapted to mesh with and to drive a gear-wheel 28 which is fastened securely on a shaft 29 rotatably supported at its forward and rearward ends in suitable bearing-apertures of the front and rear plates 10 and 11 respectively of the motion-translating device. Staked or otherwise secured to the gear-wheel 28 against the rear face thereof, is a pinion 29*a* which is adapted to mesh with and to drive the aforementioned gear-wheel 26 and its pinion 27.

The above-described gear-train of the timing-device constitutes the "driving-train" or "driving-mechanism" and is adapted to drive the motion-translating or converting mechanism, indicated generally at 30. The latter comprises a gear-wheel 31 which is adapted to mesh with and to be driven by the pinion 27 of the drive-train, the gear-wheel 31 being carried on a shaft 32 journaled at its opposite ends in bearing-apertures of the front and rear plates 10 and 11 respectively. Referring more especially to Figs. 4 and 5, the gear-wheel 31 is seen to be supported on the shaft 32 for freedom of movement thereon through an intermediate cam-member, indicated generally at 33, which is mounted freely on the shaft 32 and comprises a face-plate portion 34 and cam-disk portion 35 of reduced diameter. Both the face-plate portion 34 and cam-disk portion 35 are provided with integral concentric annular flanges 36 and 37 respectively of reduced diameter, the latter flange being of greater diameter than the former, and both projecting forwardly and rearwardly from the face-plate portion and cam-disk portion respectively of the cam-member so as to serve as hubs for supporting the aforesaid gear-wheel 31, and an apertured retaining-plate 38. Both the gear-wheel 31 and the apertured retaining-plate 38 are adapted to be fastened securely to their respective hubs and to be held firmly against the corresponding faces of the cam-member by turning or peening over the outer ends or rims of the respective hubs, as at 39 and 40 respectively. Moreover, the gear-wheel 31 is positively secured to the cam-member 33 by means of a pin 41 which is fastened securely in eccentric axially-aligned apertures of the gear-wheel, cam-member and retaining-plate 38, the pin 41 being substantially flush with the front face of the gear-wheel 31 and extending rearwardly of the rear face of the retaining-plate 38 to provide a post-portion or anchor 42, for engagement by the forward end of a helical transmitting-spring 43, as and for the purpose hereinafter described.

The aforementioned transmitting-spring 43 encircles the concentric hub 44 of a rotor 45 of the motion-converting mechanism 30. As shown in Fig. 6, the rotor comprises a substantially-imperforate disk having a stop-finger 46 projecting radially from one edge thereof, the rotor 45 being secured to the rear end of the shaft 32 by a drive fit or other equivalent fastening-means, and in parallel spaced relationship to the cam-member 33 so as to accommodate the transmitting-spring 43 therebetween. The aforementioned stop-finger 46 is provided with a notch 47 in one edge thereof immediately adjacent the periphery of the disk for receiving the rearward free end of the transmitting-spring 43, whereby the transmitting-spring is coupled to the rotor.

Referring now to Figs. 1, 2 and 3, an additional element of the motion-converting mechanism 30 is an oscillatable latch-arm 48 comprising a reach 49 supported at its extremity 50 on a shaft 51 which is journaled at its opposite ends between the front and rear plates of the movement, the extremity 50 of the reach 49 being supported to

rotate freely on the shaft 51, substantially intermediate the opposite ends thereof by means of a pair of stop-collars 52 secured to the shaft in spaced parallel relationship and on opposite sides respectively of the extremity of the reach. The opposite end of the latch-arm 48 is provided with an enlargement, as shown especially well in Fig. 7, comprising a substantially-flat head-portion 53 provided with a substantially-elliptical cam-aperture 54 at the geometric center thereof; and with a pair of latching-lugs 55. The latter are bent up at substantially right angles to the head at opposite sides thereof, each latching-lug 55 being spaced transversely of the adjacent edge of the head 53 by a clearance-slot 56. Further, the latching-lug on one side of the head 53 is misaligned transversely with the lug on the opposite side thereof so as to provide for rotation of the rotor through successive arcs of substantially 180°, as hereinafter described.

In this connection, it will be noted that the apertured head 53 of the latch-arm is assembled on the cam-member 33 so that the cam-aperture 54 of the head encircles the cam-disk portion 35, the head of the latch-arm being held in cooperative relationship with the cam-disk of the cam member by the retaining-plate 38. More particularly, the outer edge of the latter and the outer edge of the face-plate portion 34 of the cam-member cooperate to form an annular cam-track therebetween for positively retaining the periphery of the cam-aperture 54 and the periphery of the cam-disk portion 35 in operative relationship. Moreover, when the latch-arm is assembled on the cam-member 33, the latching-lugs of the latch-arm will be seen to extend rearwardly on substantially-diametrically-opposite sides of the rotor 45, the lateral spacing of the latching-lugs being such that each lug will be engaged successively by the stop-finger 46 of the rotor 45, thereby to limit the rotation of the rotor to successive arcs of substantially 180°.

Referring again to Figs. 3 and 4, mounted on the forward end of the shaft 32 is the governor-mechanism, indicated generally at 57, of the motion-converting mechanism 30. The governor-mechanism comprises a gear-wheel 58 fixedly secured on a hub-member 59 which is mounted freely on the shaft 32, the gear-wheel 58 being arranged to mesh with the aforesaid pinion 24 of the drive-train, as a consequence of which the gear-wheel is rotated freely on the shaft 32 by the driving-pinion 24 normally at a substantially-uniform speed derived from the driving-train and power source 13. Pivotally mounted as at 60 against the rear face of the gear-wheel 58, is a double-ended pawl 61. The latter, and more especially the teeth 62 and 63 at opposite ends thereof respectively, is adapted normally to ride over the teeth of a ratchet-wheel 64 which is fixedly secured to the shaft 32 in juxtaposition to the rear face of the gear-wheel 58. In the operation of the motion-transmitting device, the normal direction of rotation of the gear-wheel is counterclockwise, as seen in Fig. 3, in which direction of rotation the teeth of the pawl will ride freely over the teeth of the ratchet-wheel 64. However, on reversing the direction of rotation of the gear-wheel 58 or effecting an equivalent result by rotating the ratchet-wheel 64 in a counterclockwise direction at a sufficiently rapid speed to overtake the gear-wheel 58, while the latter is rotating at its uniform rate of speed in its normal counterclockwise direction of rotation, a tooth of the rachet-wheel will pick up one of the teeth of the double-ended pawl 61 and thereby couple the ratchet-wheel 64 to the gear-wheel 58 so that the two wheels rotate together. Since the gear-wheel is being positively driven at a uniform speed by the drive-train and power source 13, whereas the ratchet-wheel is motivated by the force developed by the released but relatively weak transmitting-spring, the speed of rotation of the ratchet-wheel will be governed by the speed of rotation of the gear-wheel 58. That is to say, the driving-train effectively restrains the ratchet-wheel, and more particularly the rotor 45 on the shaft 32 of the ratchet-wheel, from rotating freely at a speed otherwise determined by the force of the released tensioning-spring, the rotor being made to rotate at a predetermined uniform speed, for the purpose hereinafter described.

Referring again to Fig. 4, the shaft 32 is also provided with a pinion 66 which is secured to the shaft for rotation therewith and adapted to mesh with a gear-wheel 67. The latter is fastened securely to the forward end of a shaft 68 journaled at its rear end in an aperture of the rear plate 11 and at its forward end in a bearing-cup 69 secured to and projecting forwardly from the front face of the front plate 10. A pinion 70 is formed or otherwise provided at the forward extremity of the aforesaid shaft within the bearing-cup 69, the toothed perimeter of the pinion 70 being adapted to intersect a cutout 71 in one side of the bearing-cup so as to be accessible for engagement by the gear-wheel of any suitable timing-mechanism (not shown) to be operated thereby, one such timing-mechanism being illustrated and described in applicant's Patent No. 2,191,541 dated February 27, 1940.

The operation of the motion-converting device may be described briefly as follows. Assume that the power source 13 has its lead-wires 15 and 16 connected to a suitable source of alternating current so that the driving-pinion 14 is being continuously rotated at a predetermined speed. Let it be assumed further that the stop-finger 46 of the rotor 45 is restrained against rotational movement in a counterclockwise direction by engagement with the lower left-hand latching-lug 55 of the latch-arm 48, as seen in Figs. 1 and 3. Now, as the driving-pinion 14 drives the driving-train, the latter simultaneously rotates the gear-wheel 31 and the cam-disk portion 35 of the motion-converting mechanism 30 freely on the shaft 32 and in a counterclockwise direction, as indicated by the arrow in Fig. 2. Since the forward end of the transmitting-spring is engaged over the post 42 of the rotating cam-member 33 and the rear end of the spring is engaged in the notch 47 of the stationary rotor-finger 46, the transmitting-spring 43 will be wound up during this interval. Ultimately, rotation of the cam-disk portion 35 will, by cooperative engagement with the perimeter of the cam-aperture 54 of the latch-arm, displace the lower left-hand latching-finger thereof laterally out of the path of rotation of the stop-finger of the rotor. As soon as the stop-finger is released, the rotor will be freed to respond to the force of the wound transmitting-spring 43 and, consequently, will be rotated thereby in a counterclockwise direction. The rotating rotor will, in turn, rotate the shaft 32 to which it is secured and hence the ratchet-wheel 64 and pinion 66, the latter rotating in the same direction as the continuously rotating gear-wheel 58 and its double-ended pawl. At the moment of release of the rotor, the force of the wound transmitting-spring 43 will initiate rotation of the shaft 32 and its ratchet-wheel 64 at a speed in excess of the uniform predetermined speed of rotation of the gear-wheel 58 and, consequently, a tooth of the ratchet-wheel will promptly overtake a tooth of the double-ended pawl of the gear-wheel 58, thereby locking the ratchet-wheel 64 to the gear-wheel 58. In accordance with this circumstance, the ratchet-wheel 64 and hence the shaft 32 and rotor 45 will be restrained to rotate at the same speed as that of the gear-wheel 58, in the manner hereinabove described, as a consequence of which the stop-finger 46 of the rotor will not be swung around violently into engagement with the opposite or upper right-hand latching-lug of the latch-arm by an unleashed force of the wound transmitting-spring, but will be governed by the driving-train to swing into engagement with the aforesaid latching-lug at a predetermined uniform speed.

After swinging through an arc of substantially 180°, the stop-finger of the rotor will bring up against the upper right-hand latching-lug of the latch-arm and further rotation of the rotor will be stopped, the double-ended pawl 61 of the continuously-rotating gear-wheel 58 being carried out of engagement with the ratchet-wheel and remaining disconnected therefrom until further rotation of the cam-disk 35 displaces the upper right-hand latching-lug from the path of the stop-finger of the rotor, so as to again release the latter.

The successive latching and releasing of the stop-finger 46 of the rotor 45 by the latch-arm 48 will thus transmit intermittent rotation to the rotor-shaft 32 and to the pinion 66 at the forward extremity thereof. The latter, through the gear-wheel 67 and pinion 70, is adapted, in turn, to drive a timing-mechanism referred to above. In this connection, it should be pointed out that inasmuch as the speed of rotation of the intermittently-rotated shaft 32 is governed by the driving-train so as to be maintained at a uniform predetermined speed, the wear and tear which would otherwise be inflicted upon the motion-converting mechanism 30 and on the elements of the timing-mechanism by a violent and unrestrained release of the force of the transmission-spring is effectively eliminated, thereby prolonging the life of the motion-transmitting device and of the timing-means or other mechanism operated thereby.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. A rotary motion-translating device, including in combination; a driving-member; means to rotate said driving-member continuously and at a substantially-uniform speed; an intermittently-rotatable driven-member; motion-converting mechanism comprising an intermediate member driven continuously at a substantially-uniform speed by said continuously-rotating driving-member, resilient transmitting-means arranged to couple said intermediate continuously-driven member to said intermittently-rotatable driven-member, and a latch-element operated by said intermediate continuously-driven member ar-

ranged to successively latch and release said intermittently-rotatable driven-member to impart intermittent rotation thereto; and governor-mechanism driven at a substantially-uniform speed by said continuously-rotating driving-member, said governor-mechanism being arranged to be coupled with said intermittently-rotating driven-member to control its speed of rotation such that during successive intervals of rotation its speed of rotation corresponds substantially to the uniform speed of rotation of said governor-mechanism.

2. In a device of the class described, a motion-converting mechanism comprising a continuously-rotating driving-member; an intermittently-rotatable driven-member including a ratchet-wheel and pinion; a resilient-member arranged to couple said continuously-rotating driving-member to said intermittently-rotatable driven-member; a latch-member operated by said continuously-rotating driving-member and arranged to successively latch and release said intermittently-rotatable driven-member to impart intermittent rotation thereto and to said ratchet-wheel and pinion; a drive-train arranged to drive the driving-member of said motion-converting mechanism continuously and at a substantially-uniform speed; and governor-means including a pawl driven by said drive-train at a substantially-uniform speed and arranged to be interlocked with the said ratchet-wheel of said driven-member to control its speed of rotation such that during successive intervals of rotation the speed of rotation of said pinion corresponds substantially to the uniform speed of rotation of said governor-means.

ARTHUR B. POOLE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,016,501	Horton	Feb. 6, 1912
2,227,133	Hall	Dec. 31, 1940