

Aug. 27, 1940.

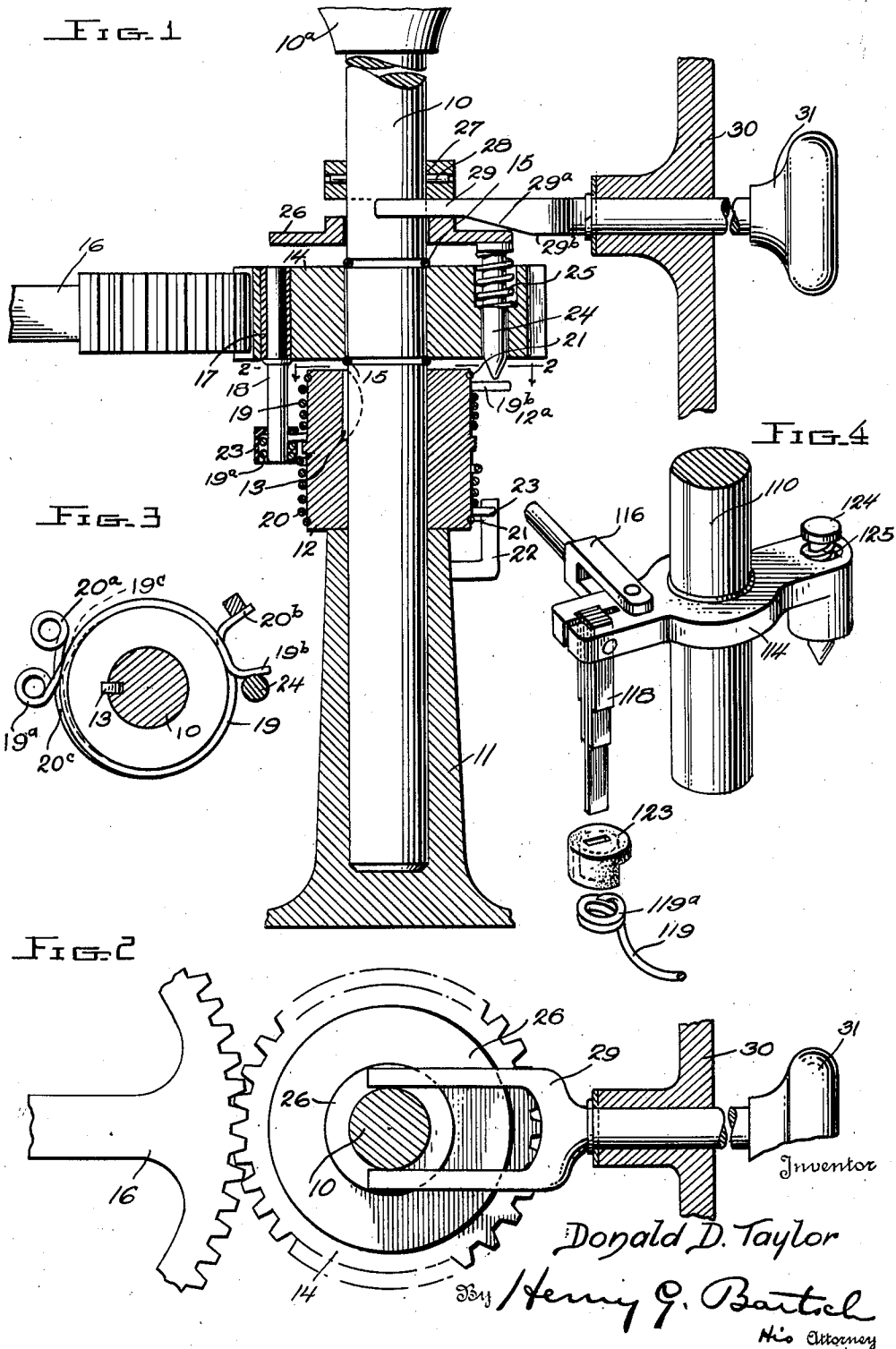
D. D. TAYLOR

2,212,993

DRIVING MECHANISM

Original Filed Jan. 13, 1938

2 Sheets-Sheet 1



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FIG. 5

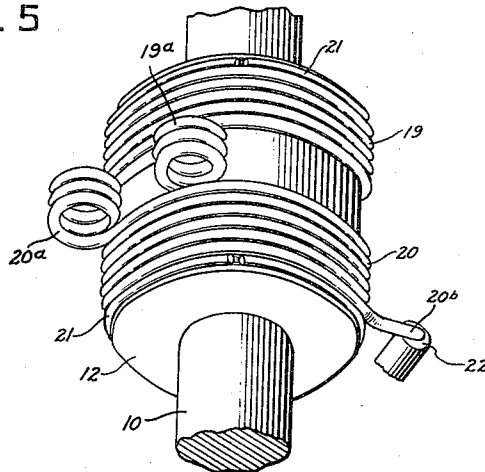


FIG. 6

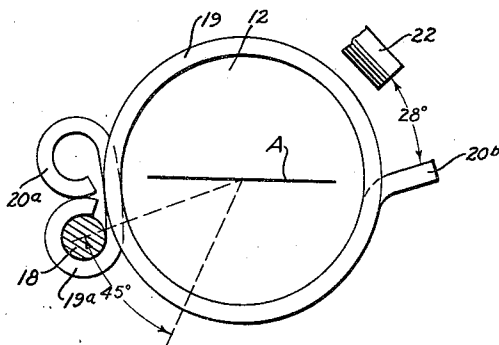


FIG. 8

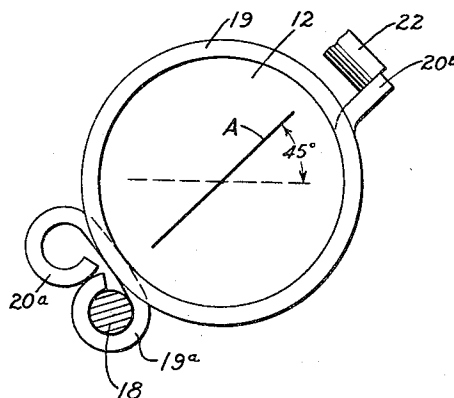


FIG. 7

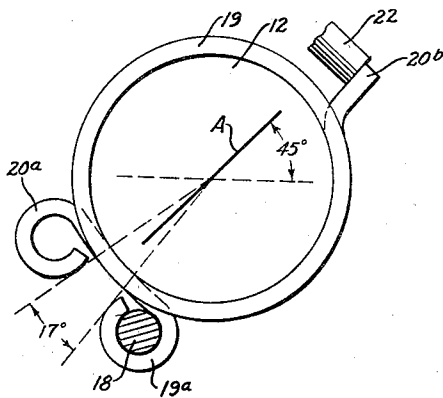
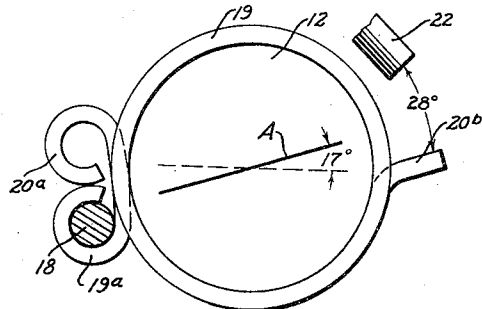


FIG. 9



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UNITED STATES PATENT OFFICE

2,212,993

DRIVING MECHANISM

Donald D. Taylor, Duncannon, Pa.

Continuation of application Serial No. 184,846,
January 13, 1938. This application May 31,
1939, Serial No. 276,734

29 Claims. (Cl. 74—320)

This application is a continuation of my application Serial No. 184,846, filed January 13, 1938.

My invention relates to improvements in driving mechanism for translating conventional rotary or reciprocating movement into oscillatory rotary movement characterized by progressive angular advancement in one direction of rotation. Such a mechanism has a wide field of utility, including the operation of tumbling drums, washing machinery, rolling mills, belt driers, conveyors, mixers and agitators, printing presses, coal stokers and other charging mechanism, winding and reeling machinery and machine tools for cutting, broaching, drilling, tapping and grinding and other work.

My invention has for its purpose the achievement of several well-defined objects. It is a primary object of my invention to provide a simple mechanism for translating conventional symmetrical rotary or reciprocatory motion into asymmetrical oscillatory movement including, and characterized by, predeterminable angular advancement.

It is an object of my invention to provide a motion-translating mechanism of the character defined which lends itself to large scale production at extremely low cost.

It is an object of my invention to provide a motion-translating mechanism of the character defined which has a low ratio of weight to power-transmitting capacity.

It is an object of my invention to provide a motion-translating mechanism of the character defined which is composed of a minimum number of parts.

It is an object of my invention to provide a motion-translating mechanism of the character defined which essentially includes no gears or other parts requiring frequent lubrication and subject to rapid wear.

It is an object of my invention to provide a motion-translating mechanism of the character defined in which vibration and shock are practically absent.

It is an object of my invention to provide a motion-translating mechanism of the character defined which is capable of operation at extreme high speeds.

It is an object of my invention to provide a motion-translating mechanism of the character defined which has an extremely low power of loss.

It is an object of my invention to provide a simple drive-translating mechanism of the class defined which is manually disengageable at will.

Further objects, and objects relating to details and economies of construction, installation and operation will definitely appear to those skilled in the art upon familiarization with the detailed description to follow. In one instance, I accomplish the objects of my invention by the means set forth in the following specification. My invention is clearly defined in the appended claims. Structures constituting exemplary embodiments of my invention are illustrated in the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of the working parts of a mechanism constituting a preferred embodiment of my invention;

Fig. 2 is a transverse sectional view of portions of the same mechanism, the view being taken looking upwardly from the line 2—2 of Fig. 1;

Fig. 3 is a transverse sectional view of the clutch proper of the mechanism, looking downwardly from the line 2—2 of Fig. 1; and

Fig. 4 is a perspective view of a modified form of clutch-element driving mechanism employable in lieu of the rack and pinion elements forming a part of the mechanism illustrated in Figs. 1 and 2.

Fig. 5 is a perspective view of the essential parts of the motion-translating clutch mechanism illustrated in Fig. 1; and

Figs. 6, 7, 8 and 9 are diagrammatic views illustrating the clutch elements of said motion-translating mechanism at various stages of its operating cycle.

Throughout the several views, similar numerals of reference refer to similar parts.

In its broad aspect, my invention finds embodiment in mechanism for translating conventional rotary or reciprocating movement into asymmetrical oscillatory rotary movement characterized by definite angular advancement or progression in clockwise or counter-clockwise direction, said mechanism comprising a member to be rotatively driven alternately clockwise and counter-clockwise, an overrunning clutch element associated with said driven member, driving means coupled to said clutch element for imparting oscillatory rotary movement thereto effecting, therethrough, definite, intermittent unidirectional rotation of said driven member, and mechanism for sequentially imparting intermittent reverse rotation of lesser angular magnitude to said driven member, said reversing mechanism comprising a second normally inactive clutch element and means for effecting driving engagement of said second clutch element with said first-clutch-driv-

ing means and said driven member during a portion only of each overrunning period of said first clutch element. While said overrunning clutch elements may take various forms, I have found the spring-type of clutch commonly used in automobile free-wheeling units to be admirably adapted for my purposes. Accordingly, the driven member of a preferred embodiment of my invention may take the form of a drum having a cylindrical or conical surface in contact with which is associated a helical spring clutch element complementary to said surface and lightly frictionally engaged therewith to provide a slight drag. Associated with a surface of the same drum, or another drum connected thereto, is provided a second, but oppositely acting, clutch element effective to impart reverse motion to the driven member. Where spring-type clutch elements are employed for imparting motion in each direction, the clutches may be substantially identical except for winding in opposite directions and may be mounted upon a common cylindrical drum surface. As is common knowledge in the clutch art, driving clutch elements of this type from one end thereof in a direction tending to "wind up" the spring will cause a gripping of the spring upon a drum snugly fitted within the convolutions of the spring, and driving of said clutch spring through said end in the reverse direction will, through tendency to unwind and enlarge the internal diameter of said spring, effect disengagement of the clutch element from its internally received drum. Where the drum is of the type disposed about the clutch spring, the converse is true, engagement being induced by the application of force tending to expand the spring, and disengagement being induced by the application of force in a direction tending to contract the spring.

For the purpose of obtaining progressive rotary advancement in a structure constituting a broad embodiment of my invention, means are provided for oscillably rotating one of said overrunning clutches by substantially direct connection thereto effecting, therethrough, definite intermittent unidirectional rotation of the drum, said means also intermittently engaging (as by a lost motion connection) the other clutch spring to impart thereto a rotary movement in the opposite direction, which reverse rotary movement is of less angular magnitude than that imparted to the drum by the first-mentioned clutch element.

In accordance with specialized concepts of the present invention as embodied in heavy machinery, means are provided for relieving the mechanism from severe shock incident to periodic reversal in the direction of the drive. Also, means are provided for rendering one of the one-way clutch elements ineffective to impart drive to the member to be driven. Where differential driving is achieved through use of a lost motion connection between the driving member and one of the one-way clutch elements, as disclosed in the present application drawings, the releasing of the other one-way clutch element from driving engagement with the member to be driven has the ultimate effect of interrupting the drive in both directions of rotation, due to the fact that the otherwise unreleased clutch element is not caused to be returned, by the member to be driven, into a position within the influence of the driving member. It is to be borne in mind, however, that, in accordance with the broadest aspect of my invention, differential driving of one clutch element with respect to the other clutch element may be accomplished by means other than the lost mo-

tion connection depicted in this application. An alternate method of effecting differential driving of the two clutch elements will be disclosed in a later application, in which release of one of the one-way clutch elements does not interfere with operation of the other one-way clutch element, with the result that such release produces, not a cessation of motion in the driven member, but an intermittent unidirectional rotation thereof. Accordingly, the present application is intended to be generic to devices of the present character in which release of one clutch element from driving engagement is effective to produce either a cessation of movement in the driven member, or an intermittent unidirectional rotation of said driven member.

More specifically, and with reference to the accompanying drawings wherein I have disclosed my invention as applicable to the driving of a domestic washing machine of the vane-agitator type, Fig. 1 illustrates a driving mechanism including a shaft 10 to be driven and carrying a vane element fragmentally disclosed at 10a, a standard 11 within which the shaft is journaled for rotation, a pinion gear 14 coaxially rotatably mounted on the shaft 10 by means of conventional split rings 15, and means for imparting symmetrical oscillatory rotational movement to the pinion gear comprising a conventional curved rack element 16 supported and caused to be oscillated about its central axis by means (not shown) commonly employed in washing machines of the type referred to.

In accordance with my invention, means are provided for transferring and translating symmetrical rotary movements of said pinion gear 14 into asymmetrical shaft movement characterized by progressive angular advancement in one direction of rotation—in the construction illustrated—advancement in a counter-clockwise direction. This drive-translating means, in the embodiment disclosed, consists of a drum member 12 keyed to the shaft 10 by a key 13, a crank member 18 carried by the gear 14 in an interposed bushing 17 of rubber or the like and a pair of oppositely-acting "over-running" or "one-way" clutch elements 19 and 20 associated with the drum member 12 and effective to impart counter-clockwise and clockwise motion, respectively, to said drum member and its keyed shaft 10. Specifically, though not essentially, these clutch elements 19 and 20 each consists of a helical spring of slightly less normal internal diameter than the external diameter of the drum 12 with which they are associated. The lower spring element 20 is wound in a direction such that clockwise rotation thereof through its looped ends 20a tends to constrict the several turns of the spring about the drum to effect tight clockwise driving engagement therewith. The upper spring element 19 is wound in the opposite direction such that counter-clockwise rotation thereof through its looped end 19a tends to constrict its several turns and effect tight counter-clockwise driving engagement with the drum. Clockwise movement of the spring 19 through its end portion 19a, and counter-clockwise movement of the spring 20 through its end portion 20a, tend to effect, in each instance, expansion of the respective springs into free-running non-engagement with the drum 12.

In the construction illustrated, counter-clockwise driving of the spring clutch element 19 from the pinion 14 is accomplished by the disposition of the crank 18 within the loop end portion 19a thereof. The loop 20a of the clutch 20 is, how-

ever, not so positively engaged with the crank 18, but lies at the side of the loop 19a and is subject to abutment driving thereby, as illustrated in Figs. 3 and 5. Clockwise driving of the clutch element 20 by the pinion 14 is effected, thus, solely through abutment of the loop end 20a by the loop end 19a of the counter-clockwise clutch during its clockwise or "return" movement. Means are provided for effecting differential driving action of the two clutch elements 19 and 20, which means, in the illustrated embodiment of my invention, consists of a stop element 22 carried by the standard 11, which stop is disposed at a selected angular spacing with respect to the tongued end 20b of the clutch 20 disposed at the limit of its clockwise movement induced by the abutting loop end 19a. The said maximum angular spacing of stop 22 and tongue 20b may be of any extent less than the extent of angular "swing" or oscillation in the driving crank 18, and, as will be later explained, the arithmetical difference between the extent of swing and the extent of said stop spacing yields a lost-motion connection between the loops 19a and 20a which quite accurately determines the angular unidirectional advancement per cycle produced by the mechanism.

It will be apparent, from an inspection of Fig. 1 of the drawings, that a certain amount of shock-absorption is inherently realized by the mounting of the pin 18 in the rubber bushing 17 of the pinion 14. Moreover, if the bushing 17 be relatively soft, the pin 18 may "cant" slightly from side to side during the operation of the device under heavy load, thus materially alleviating shock incident to cyclic reversal of the direction of drive. The cup 23 disposed about the spring loop 19a also serves to reduce shock incident to initiation of drive through the spring 20 and, in addition, eliminates a faintly audible click which otherwise may occur at that moment of operation.

Another structural feature of the illustrated mechanism contributes to the reduction of shock therein and is of value when the device driven has considerable mass. It will be noted that the loop-adjacent portions 19c, 20c of the springs 19 and 20 are normally out of contact with the drum 12, being disposed somewhat tangentially. As a result, initiation of rotation thereof in the respective driving direction of each tends to spring the portion 19c or 20c radially inwardly before the load is undertaken, thus further smoothing out the operation of the mechanism.

Means are provided for effecting release of the drum clutch element 19 from driving engagement with the drum 12, which release, in the embodiment of the invention illustrated in Fig. 1, is effective to completely disrupt driving of the drum 12 from the gear 14 through either of the clutch spring elements 19 or 20. This releasing means consists of a depressible pin or plunger 24 slidably mounted in the gear 14 and normally maintained in retracted position by a spring 25. The pin 24 is pointed at its lower end and is so located, circumferentially of the gear 14 and the tongue 19b of the clutch element 19, as to effect expansion of the helical spring 19 when the pin 24 is depressed. Inasmuch as pin 24 is fixed with respect to its angular displacement from the pin 18, these two pins rotate together, and the spring 19 may be maintained in expanded condition with respect to the drum 12, regardless of oscillatory movements of the gear 14. The upper end of the pin 24 is headed and preferably ground to a

smooth surface, upon which the thrust ring 26 rides. A second thrust ring 27 is carried by the shaft 10 and secured thereto against axial movement by a conventional pin 28, and between these two thrust members 26 and 27 is interposed a yoke element 29, the extremities of the tines of which are of uniform thickness and the rear portions of the tines of which are tapered to constitute cam or wedge portions 29a, which, when projected into interposition between the thrust elements 26 and 27, effect the depression of the thrust member 26 and, therethrough, depression of the pin 24 into clutch-releasing engagement with the tongue 19b of the spring element 19. The releasing yoke 29 is slidably journaled in a bracket 30 which may be integral with the standard 11, and projection of the yoke may be manually accomplished through pressure applied to the knob 31 carried by the yoke.

In Fig. 4, I have disclosed a modified form of driving element which is adapted to be substituted for the gear 14 and associated parts. In accordance with this form of my invention, the driving element consists of a double crank arm 114, one side of which carries a symmetrically constructed leaf spring 118, the lower end of which is adapted to be received within a plug 123, which, in turn, is disposed within the loop 119a of a helical spring 119 similar to that, 19, of the device illustrated in Fig. 1. The plug 123, of rubber or equivalent material, is similar to that, 23, forming part of a structure illustrated in Fig. 1, with the exception that a portion of the member 123 extends within, as well as about, the loop 119a and serves as a shim for snugly coupling the rectangular main leaf of the spring 118 to the circular loop 119a. The other arm of the crank member 114 is provided with a clutch-releasing pin 124 and retracting spring 125 identical to those, 24 and 25, of the structure shown in Fig. 1. Oscillatory rotation of the crank 114 about the shaft to be driven, 119, is accomplished through a connecting rod 116 which may be caused to reciprocate by any conventional mechanism, for example, a crank carried by the prime mover (not shown).

The fundamental principles of operation of the illustrated clutch mechanism for translating symmetrical rotary oscillation into asymmetrical oscillatory rotary movement characterized by progressive counter-clockwise advancement may be most readily understood from a study of Figs. 5, 6, 7, 8 and 9, wherein the relative position and movement of the several parts 10, 12, 13, 19, 19a, 20, 20a, 20b and 22 may be observed. For the sake of explanation, let it be assumed that the crank 13 is caused to oscillate, or swing, over an arc of 45 degrees. In Fig. 6 the several parts are shown as positioned at the inception of the counter-clockwise cycle of movement of the driving member 13, with the drum 12 at the position of rotation indicated by the line A. Counter-clockwise movement of the member 13 is imparted to the portion 19a of the counter-clockwise-active clutch element which is thence caused to drive-engage the drum 12 and rotate it a distance of substantially 45 degrees to assume the position depicted by the line A in Fig. 7. By reason of the light frictional drag of the clutch 20 upon the drum 12, it, too, is carried along in counter-clockwise movement but, due to the presence of the stop 22 which is (for example) spaced an angular distance of only 28 degrees from the tongue 20b on the free end of the clutch 20 and lies in the way of its free travel, the extent of counter-clock-

wise movement or co-rotation permitted the riding clutch 20 is only 28 degrees, and the loop 13a of the counter-clockwise clutch is, accordingly, unaccompanied by the loop 20a during the final 17 degrees of counter-clockwise rotation. Thus, as depicted in Fig. 7, an angular spacing of 17 degrees is provided between the loops 19 and 20 at the end of the counter-clockwise cycle.

Upon completion of the counter-clockwise cycle, the clockwise cycle is begun, and the one-way clutch element 19 overruns the drum 12 effecting no transmission of movement thereto. Since the drum 12 is not revolved under the light frictional contact of the element 19, the clutch 20 also remains stationary and, after 17 degrees of clockwise overrunning of drum 12 by the clutch 19, the clearance between the loop ends 19a and 20a is taken up and the parts assume the position depicted in Fig. 8. Note, at this stage in the operation of the mechanism, that the drum 12 is unchanged from its position depicted in Fig. 7.

Since the oscillation of the driving member 18 is symmetrical, 28 degrees of clockwise movement remain to be traveled by the parts 18, 19a, 20a which are now disposed in clockwise abutment. The clockwise-active clutch element 20 is therefore brought into drive-engagement with the drum 12 and the latter is moved clockwise with the parts 18, 19a, 20a and 20 an extent of 28 degrees to the final position depicted in Fig. 9 wherein all the elements except the drum 12 have reassumed the starting position depicted in Fig. 6 and the drum 12, with its keyed shaft 10 has been put through an asymmetrical cycle of movement characterized by a 45 degree swing and an angular advancement of 17 degrees with respect to its initial position.

Referring, now, to the specific mechanism illustrated in Fig. 1, the operation thereof is as follows: The curved rack 16 is caused to oscillate symmetrically about an axis of rotation by means conventional, for example, in the domestic washing machine art. Thereby the pinion 14 is caused to oscillate upon the driven shaft 10 as an axis and, through the crank pin 18 carried by the pinion 14, the clutch spring 19 is similarly oscillated. Inasmuch as the helical spring 19 operates as a one-way or overrunning clutch, the drum 12, and the shaft 10 keyed thereto, is caused to be rotated in one direction (in the present instance, counter-clockwise, viewed from the top of the device), such unidirectional rotation having an angular amplitude substantially equivalent to the swing of the pinion 14 in counter-clockwise direction. The term "substantially" is employed for the reason that a slight canting of the pin 18 is allowed by the resilient bushing 17, a slight radially inward flexure occurs in the helical spring itself adjacent the looped portion 19a and a minute loss of movement takes place during constriction and binding engagement of the spring 19 with the adjacent surface of the drum 12.

The action of the lower spring 20, in inducing clockwise movement of the drum 12, is similar to that above recited, with the exception that the spring end 20a is not positively connected with the pin 18, but is engageable therewith only through abutment by the cup 23 carried by the loop 19a. This abutment, determined by the location of the stop member 22 with respect to the tongue 20b at the free end of the clutch spring 20, may be said to constitute a "lost motion connection" between the pin 18 and the loop 20a of the lower spring. As has been explained previously, the clutch spring 20a is caused to be

rotated, by the abutment mentioned, an angular extent equal to the swing of the upper spring less the angular spacing between the abutting loops 19a, 20a. Thus, there will be imparted to the drum 12 and its shaft 10, a progressive oscillatory rotary movement, the progression of which, per cycle, is equal to the angular extent of spacing between the abutting portions of the loops 19a, 20a. This initial spacing of the abutting loops is effected by engagement of the stop 22 with the tongue 20b of the lower spring, and the extent of progression is determined by the location of the stop 22 with respect to the spring tongue 20b.

As may be readily understood from Figs. 1 and 2 of the drawings and the foregoing description pertaining thereto, the radially inward projection of the yoke 29 is effective, through the thrust member 23, to depress the pin 24 and slightly radially expand the primary spring 19 through the camming effect of the pointed end of the pin 24 with respect to the tongue 19b of the spring. The expansion required for release of the spring 19 is very slight, hence the amplitude of the cams constituted by the pin 24 and yoke 29 need not be great. The rear portion 29b of the yoke is flat, with the result that release of the spring 19, once effected by depression of the knob 31, will be maintained, in the absence of positive manual retraction of the knob 31.

The operation of the device, modified by the substitution of a double crank such as shown in Fig. 4, for the rack and pinion arrangement illustrated in Fig. 1, is substantially identical with that previously described. The inherent flexibility of the leaf spring element 113 corresponds to that afforded through the use of bushing 17 in the form of the invention illustrated in Fig. 1. Likewise, the plug 123 serves to silence the "click" which might otherwise be noted at the moment of abutment of the two spring loops occurring at the initiation of driving through the lower spring. Under some circumstances, where the leaf spring or cantilever pin 113 is of considerable flexibility, the diameter of the pin 124 may be advantageously increased to compensate for a slight yielding of the spring 113 under the expanding stress imposed.

The two embodiments of my invention shown in the drawings are to be regarded as illustrative of broad, basic concepts, and do not purport to exhaust the modes in which the concepts of my invention are susceptible of structural embodiment. I am aware that numerous changes in form, size and proportion may be made without departing from the concepts of my invention. Likewise, I wish it understood that such terms as are employed in the specification and claims of this application are to be given the broadest interpretation consistent with the essential function to be performed by the thus-described parts. For example, the term "drum" is intended to embrace any member of substantially circular form, regardless of whether the element be cylindrical or conical in configuration, and regardless of whether the friction surfaces thereof be continuous, divided, external or internal with respect to the complementary clutch element associated therewith. Moreover, while I have found clutch elements of helical spring form to be especially adapted for use as part of structure embodying my invention, it is to be distinctly understood that other types of overrunning clutches, such as the ball or roller types, might be substituted therefor without departure from the broad concepts of my invention. In addition, 75

the expression "oscillatory movement characterized by progressive angular advancement" embraces movement, the total angular magnitude of which may be a fraction of one revolution or several revolutions. As has been explained earlier in this specification with reference to drive-release arrangements, disruption of the drive through one of the spring elements may, in the case of another embodiment of the invention, not affect the operation of the other clutch element, with the result that, instead of a complete cessation of movement in the drum 12, there may result a continuance of periodic rotation in a single direction. Certain features of my invention may be employed without the embodiment of other features thereof. For example, the crank pin members 18 and 118 may be rigid instead of flexible; the buffer elements 23 and 123 may be omitted; the portions 19c and 20c adjacent the loops 19a, 20a, or one of them, may be formed to lie normally in contact with the drum 12, or the drum 12 may be turned to slightly smaller diameter or "relieved" to accomplish the same shock-absorbing effect. Similarly, where capability for facile interruption of driving is not required, the manually operable drive releasing pin may be eliminated. Conversely, for some purposes, such a release mechanism may be actuated automatically in timed or untimed sequence by the driving mechanism proper. Other variants and phases of my invention will readily appear to those skilled in the art upon familiarization with the disclosure herein. I, therefore, claim my invention broadly, as indicated by the appended claims.

What I claim is:

1. A driving mechanism comprising: a member to be rotatively driven alternately clockwise and counter-clockwise, a pair of oppositely-acting, automatic one-way friction clutch elements associated with said driven member, one clutch element being engageable with said driven member by clockwise movement relative thereto, the other by counter-clockwise movement relative thereto, symmetrically-motive driving means for alternately rotating each of said one-way clutch elements in its respective driving direction, and means rendering one of said clutch elements indefinitely variably less responsive than the other to respective movement of said driving means.

2. A driving mechanism comprising: a member to be rotatively driven alternately clockwise and counter-clockwise, a pair of oppositely-acting, automatic one-way friction clutch elements associated with said driven member, one clutch element being engageable with said driven member by clockwise movement relative thereto, the other by counter-clockwise movement relative thereto, symmetrically-motive driving means for alternately and sequentially rotating each of said one-way clutch elements in its respective driving direction, and means for rendering one of said clutch elements ineffective to impart rotation during an indefinitely variable portion of the idle period of the other clutch element thereby to produce indefinitely variable intermittent progression of said driven member in one direction of rotation.

3. A driving mechanism comprising: a member to be alternately driven clockwise and counter-clockwise, a pair of oppositely-acting, automatic one-way friction clutch elements associated with said driven member, one clutch element being engageable with said driven member by clockwise movement relative thereto, the other by counter-clock-

wise movement relative thereto, driving means coupled to one of said clutch elements for imparting oscillatory rotary movement thereto and effecting, therethrough, periodic rotation of said driven member a definite angular extent in one direction, and means for sequentially imparting periodic reverse rotation of lesser angular magnitude to said driven member, said last-mentioned means including an abutment on the other clutch member engageable with said driving member during its period of return movement and means for effecting clearance between said abutment and said driving means to be taken up during inception of said return movement of the driving means.

4. A driving mechanism comprising: a member to be driven alternately clockwise and counter-clockwise, an over-running friction clutch element associated with said driven member, driving means coupled to said clutch element for imparting symmetrical oscillatory rotary movement thereto effecting, therethrough, definite, intermittent unidirectional rotation of said driven member, and mechanism for sequentially imparting intermittent reverse rotation of lesser magnitude to said driven member, said mechanism comprising a second, normally inactive, friction clutch element co-rotative with said driven member in clockwise and counter-clockwise directions, means on said driving member and said second clutch element engageable during the over-running period of said first clutch element to effect intermittent driving of said driven member in the reverse direction, and means for isolating said last-recited means from driving-engagement during indefinitely variable portion of the overrunning period of said first clutch element.

5. A driving mechanism for producing asymmetrical oscillatory rotary movement characterized by progressive angular advancement in one direction of rotation, comprising: a member adapted to be driven alternately clockwise and counter-clockwise, driving mechanism for intermittently forwarding rotating said member, and means for sequentially imparting intermittent reverse rotation of lesser angular magnitude to said driven member, said reverse-motion-imparting means comprising a normally inactive friction clutch element yieldingly co-rotative with said driven member while driven in said forward direction, means on said driving mechanism and said clutch element engageable during each interval between moments of forward motion of said driven member and effective to impart intermittent reverse rotation to said driven member through said clutch element, and means for isolating said last-recited means from driving engagement during an indefinitely variable portion of each of said intervals.

6. A driving mechanism for producing asymmetrical oscillatory rotary movement characterized by progressive angular advancement in one direction of rotation, comprising: a member adapted to be driven alternately clockwise and counter-clockwise, driving mechanism therefor including an oscillatory member and an associated one-way friction clutch element effective to intermittently forwardly rotate said driven member, means for sequentially imparting intermittent reverse rotation of lesser angular magnitude to said driven member, said reverse-motion-imparting means comprising a second, reversely-active-one-way friction clutch element yieldingly co-rotative with said driven member

while forwardly driven, means on said reversely-active clutch element engageable with said oscillating member during the latter's return stroke to effect reverse rotation of said driven member and means for indefinitely variably limiting the extent of co-rotation of said reversely-active clutch element with said driven member during the active period of said first one-way clutch element.

7. A driving mechanism for producing asymmetrical oscillatory rotary movement characterized by progressive angular advancement in one direction of rotation, comprising: a member adapted to be driven alternately clockwise and counterclockwise, driving mechanism for intermittently forwardly rotating said member, and means for sequentially imparting intermittent reverse rotation of lesser angular magnitude to said driven member, said reverse-motion-imparting means comprising a circular body on said member to be driven, a complementary helical spring clutch element lightly frictionally associated with said circular body and normally yielding co-rotatable with said body while it is being driven in said forward direction, means on said driving mechanism and said clutch element engageable by reverse movement of said driving mechanism during each interval between periods of forward motion of said driven member and effective to impart intermittent reverse rotation to said driven member through said clutch element, and means for effecting clearance between said engageable means to be taken up as idle reverse motion in said driving mechanism, said last recited means consisting of a stop element effective to determine the extent of said co-rotation of said spring clutch element with said circular body.

8. A driving mechanism for producing asymmetrical oscillatory rotary movement characterized by progressive angular advancement in one direction of rotation comprising: a drum member adapted to be rotated clockwise and counterclockwise, a helical spring clutch element lightly frictionally associated with said drum member, a second, but reversely wound, helical spring clutch member lightly frictionally associated with said drum member, symmetrically-oscillatory driving means positively connected to said first clutch element and effective therethrough to impart unidirectional rotation to said drum member, and a lost-motion connection between driving means and said second clutch element effective therethrough to impart sequential opposite unidirectional rotation of lesser angular magnitude to said drum member.

9. A driving mechanism for producing asymmetrical oscillatory rotary movement characterized by progressive angular advancement in one direction of rotation comprising: a drum member adapted to be rotated clockwise and counterclockwise, a helical spring clutch element lightly frictionally associated with said drum member, a second, but reversely wound, helical spring clutch element lightly frictionally associated with said drum member, symmetrically-oscillatory driving means positively connected to said first clutch element and effective therethrough to impart unidirectional rotation to said drum member, and a lost-motion connection between driving means and said second clutch element effective therethrough to impart sequential opposite unidirectional rotation of lesser angular magnitude to said drum member, said lost-motion connection comprising a lug on said second clutch

element arranged for drive-imparting abutment with said driving member during the overrunning cycle of said first clutch element and means for effecting a predetermined initial clearance between said abutment and said driving means.

10. A driving mechanism for producing asymmetrical oscillatory rotary movement characterized by progressive angular advancement in one direction of rotation comprising: a drum member adapted to be rotated clockwise and counterclockwise, a helical spring clutch element lightly frictionally associated with said drum member, a second, but reversely wound, helical spring clutch element lightly frictionally associated with said drum member, symmetrically-oscillatory driving means positively connected to said first clutch element and effective therethrough to impart unidirectional rotation to said drum member, a lost-motion connection between said driving means and one end of said second clutch element to sequentially effect rotation of said drum element in the reverse direction, and stop means engageable with the other end of said second spring clutch element to limit the idle travel of said second spring clutch with said drum to an angular extent less than the angular swing of said first spring clutch element.

11. A releasable driving mechanism comprising: a member to be rotatively driven alternately clockwise and counterclockwise, a pair of oppositely acting, automatic, one-way friction clutch elements associated with said driven member, one clutch element being engageable with said driven member by clockwise movement relative thereto, the other by counterclockwise movement relative thereto, driving means for imparting oscillatory rotary movement to one of said one-way clutch elements therethrough to effect periodic rotation of said driven member a definite angular extent in one direction, means for sequentially imparting to said driven member, through said other clutch element, periodic reverse rotation of lesser angular magnitude, and clutch-element-releasing means for optionally relieving said driven member from driving engagement by said clutch elements.

12. A releasable driving mechanism comprising: a member to be rotatively driven clockwise and counterclockwise, a pair of oppositely acting, automatic one-way friction clutch elements associated with said driven member, one clutch element being engageable with said driven member by clockwise movement relative thereto, the other by counter-clockwise movement relative thereto, driving means for alternately rotating each of said one-way clutch elements in its respective driving direction including means rendering one of said clutch elements indefinitely variably less operative than the other thereby to produce intermittent progression of said driven member in one direction of rotation, and clutch-element-releasing means for optionally completely relieving said driven member from driving engagement by said clutch elements.

13. A releasable driving mechanism for producing asymmetrical oscillatory rotary movement characterized by progressive angular advancement in one direction of rotation, comprising: a member adapted to be driven alternately clockwise and counter-clockwise, driving mechanism therefor including an oscillating member and an associated one-way friction clutch element effective to intermittently forwardly rotate said driven member, means for sequentially imparting intermittent reverse rotation of lesser angular

magnitude to said driven member, said reverse-motion-imparting means comprising a second, reversely-active one-way friction clutch element yieldingly co-rotative with said driven member while forwardly driven, means on said reversely-active clutch element engageable with said oscillating member during the latter's return stroke to effect reverse rotation of said driven member and means for indefinitely variably limiting the extent of co-rotation of said reversely-active clutch element with said driven member during the active period of said first one-way clutch element, and optionally-actuable means for releasing said first clutch element from driving engagement with said driven member in either direction of rotation thereby rendering said oscillating member ineffective to oscillate said driven member through either of said clutch elements.

14. A releasable driving mechanism for producing asymmetrical oscillatory rotary movement characterized by progressive angular advancement in one direction of rotation, comprising: a member adapted to be driven alternately clockwise and counter-clockwise, driving mechanism therefor including an oscillating member coupled to one end of a helical spring clutch element normally lightly frictionally associated with a circular surface of said driven member and effective to impart intermittent forward rotation thereto, means for sequentially imparting intermittent reverse rotation of lesser angular magnitude to said driven member, said reverse-motion-imparting means comprising a second, reversely-active one-way clutch element yieldingly co-rotative with said driven member while forwardly driven, means on said reversely-active clutch element engageable with said oscillating member during the latter's return stroke to effect reverse rotation of said driven member and means for limiting the extent of co-rotation of said reversely-active clutch element, with said driven member during the active period of said first clutch element, and optionally-actuable means for releasing said first clutch element from driving engagement with said driven member in either direction of rotation thereby rendering said oscillating member ineffective to oscillate said driven member through either of said clutch elements, said last-mentioned means comprising a member carried by said oscillating member and engageable with the free end of said helical spring clutch element to distort the latter into released relation with the normally engaged circular surface of said driven member.

15. A driving mechanism for producing asymmetrical oscillatory rotary movement characterized by progressive angular advancement in one direction of rotation, comprising: a member adapted to be driven alternately clockwise and counter-clockwise, driving mechanism therefor comprising an oscillating member and a pair of oppositely acting one-way friction clutches drive-coupled to said oscillating member but differentially effective to impart, to said driven member, an oscillatory rotary movement indefinitely variably biased in one direction of rotation, and optionally-actuable means for releasing one of said clutch elements from driving engagement with said driven member.

16. A driving mechanism for producing asymmetrical oscillatory rotary movement characterized by progressive angular advancement in one direction of rotation, comprising: a member adapted to be driven alternately clockwise and

counter-clockwise, driving mechanism therefor including an oscillating member coupled to one end of a helical spring clutch element associated with a circular surface of said driven member and effective to impart intermittent unidirectional rotation thereto, a second, but reversely-active one-way clutch driven by said oscillating member and effective to impart sequential intermittent reverse rotation of different angular extent to said driven member, and optionally-actuable means for releasing said first clutch element from driving engagement with said driven member in either direction of rotation, said last-mentioned means comprising a member carried by said oscillating member and engageable with the free end of said helical spring clutch element to distort the latter into released relation with the normally-engaged circular surface of said driven member.

17. A driving mechanism for producing asymmetrical oscillatory rotary movement characterized by progressive angular advancement in one direction of rotation, comprising: a member adapted to be driven alternately clockwise and counter-clockwise, driving mechanism therefor including an oscillating member, a pair of oppositely-acting helical spring clutch elements associated with circular surfaces on said driven member and means for coupling said spring clutch elements to said oscillating member and for rendering one of said spring clutch elements less effective than the other in imparting drive from said oscillating member to said driven member, and optionally actuable means for completely releasing said first clutch element from driving engagement with said driven member, said last-mentioned means comprising a member carried by said oscillating member and engageable with the free end of one helical spring clutch element to distort the latter into released relation with the normally-engaged circular surface of said driven member.

18. A driving mechanism comprising: a member to be rotatively driven clockwise and counter-clockwise, a pair of oppositely-acting, automatic one-way friction clutch elements associated with said driven member, one clutch element being engageable with said driven member by clockwise movement relative thereto, the other by counter-clockwise movement relative thereto, driving means for alternately rotating each of said one-way clutch elements in its respective driving direction, means for rendering one of said clutch elements indefinitely variably less effective than the other thereby to produce intermittent progression of said driven member in one direction of rotation, and optionally-actuable means for completely releasing one of said clutch elements from driving engagement with said driven member.

19. A driving mechanism comprising: a member to be rotatively driven clockwise and counter-clockwise, a pair of oppositely-acting, automatic one-way friction clutch elements associated with said driven member, one clutch element being engageable with said driven member by clockwise movement relative thereto, the other by counter-clockwise movement relative thereto, driving means for alternately rotating each of said one-way clutch elements in its respective driving direction, means for rendering one of said clutch elements indefinitely variably less effective than the other thereby to produce intermittent progression of said driven member in one direction of rotation, and optionally-actu-

able means for completely releasing the other of said clutch elements from driving engagement with said driven member.

20. A driving mechanism comprising: a member to be rotatively driven clockwise and counter-clockwise, said driven member being provided with a pair of circular clutching surfaces, a pair of oppositely-acting helical spring clutch elements associated with said surfaces, one clutch element being engageable with said driven member by clockwise movement relative thereto, the other by counter-clockwise movement relative thereto, driving means engaged with one end of each of said helical spring clutch elements for alternately rotating each clutch element in its respective driving direction, means engaging the free end of one of said spring clutch elements to effect release thereof from driving engagement during a portion only of its movement in its driving direction, and optionally-actuatable means for engaging the free end of one of said spring clutch elements to effect its complete release from driving engagement during its entire movement in its normal driving direction.

21. A driving mechanism comprising: a member to be rotatively driven clockwise and counter-clockwise, said driven member being provided with a pair of circular clutching surfaces, a pair of oppositely-acting helical spring clutch elements associated with said surfaces, one clutch element being engageable with said driven member by clockwise movement relative thereto, the other by counter-clockwise movement relative thereto, driving means engaged with one end of each of said helical spring clutch elements for alternately rotating each clutch element in its respective driving direction, means engaging the free end of one of said spring clutch elements to effect release thereof from driving engagement during a portion only of its movement in its driving direction, and optionally-actuatable means for engaging the free end of the other of said spring clutch elements to effect its release from driving engagement during its movement in the opposite driving direction.

22. A driving mechanism comprising: a member to be rotatively driven clockwise and counter-clockwise, said driven member being provided with a coaxial drum surface, a pair of oppositely acting helical spring clutch elements inherently lightly constrictively associated with said drum surface, one clutch element being engageable with said drum surface by clockwise movement relative thereto, the other by counter-clockwise movement relative thereto, an oscillating driving member coaxial with said driven member and engageable with an end of each of said spring clutch elements to effect oscillatory driving of said drum member therethrough, and means for cushioning each of said spring clutches at the moment of institution of driving therethrough, said means comprising a portion of each of said helical spring clutch elements adjacent its point of engagement with said oscillating member, which said spring portion is normally spaced from frictional engagement with the adjacent drum surface but is resiliently flexible into contact with said drum surface upon the application of driving effort to said spring.

23. A driving mechanism, comprising: a member to be rotatively driven clockwise and counter-clockwise, said driven member being provided with a coaxial drum surface, a pair of oppositely-acting helical spring clutch elements associated with said drum surface, one clutch element being

engageable with said drum surface by clockwise movement relative thereto, an oscillating driving member coaxial with said driven member and positively coupled to one end of one of said spring clutch elements, a radially-extending tongue on the other end of said positively coupled spring clutch element, a normally retracted plunger carried by said driving member and shiftable into clutch-releasing engagement with said radially-extending tongue of the helical spring, and means for effecting rotation of the other of said spring clutch elements in its respective driving direction.

24. A driving mechanism, comprising: a member to be rotatively driven clockwise and counter-clockwise, said driven member being provided with a coaxial drum surface, a pair of oppositely-acting helical spring clutch elements associated with said drum surface, one clutch element being engageable with said drum surface by clockwise movement relative thereto, the other by counter-clockwise movement relative thereto, an oscillating driving member coaxial with said driven member and positively coupled to one end of one of said spring clutch elements, a radially-extending tongue on the other end of said positively coupled spring clutch element, an axially slidable plunger journaled in said driving member and a manually-operable wedge element for projecting said plunger into clutch-releasing engagement with said radially-extending tongue of the helical spring, and means for effecting rotation of the other of said spring clutch elements in its respective driving direction.

25. A driving mechanism comprising: a rotatable member to be driven clockwise and counter-clockwise, said driven member being provided with a coaxial drum surface, an oscillating driving member, a pair of oppositely-active helical spring clutch elements associated with said drum surface and driven at one end each by said oscillating driving member, one clutch element being clockwise-engageable, the other counter-clockwise-engageable with said drum surface, a tongue integral with the other end of each clutch spring, means co-rotative with one of said clutch springs and engageable with the tongue thereof to distort said spring to disrupt drum-driving therethrough, and means engageable with the tongue of the other clutch spring, said means resisting rotation with the engaged clutch spring.

26. A driving mechanism comprising: a rotatable member to be driven clockwise and counter-clockwise, said driven member being provided with a coaxial drum surface, an oscillating driving member, a pair of oppositely-active helical spring clutch elements associated with said drum surface, means for imparting oscillatory movements of said driving member to one end each of said helical spring clutch elements, said means consisting of a cantilever crank pin secured at one end to said driving member and slightly laterally flexible with respect thereto, and means for effecting differential driving of said driven member through said clutch elements.

27. A driving mechanism comprising: a rotatable member to be driven clockwise and counter-clockwise, said driven member being provided with a coaxial drum surface, an oscillating driving member, a pair of oppositely-active helical spring clutch elements associated with said drum surface, means for imparting oscillatory movements of said driving member to one end each of said helical spring clutch elements, and means consisting of a multi-leaf cantilever spring mem-

ber secured at one end to said driving member and slightly laterally flexible with respect thereto, and means for effecting differential driving of said driven member through said clutch elements.

28. A driving mechanism comprising: a rotatable member to be driven clockwise and counter-clockwise, said driven member being provided with a coaxial drum surface, an oscillating driving member, a pair of oppositely-active helical spring clutch elements associated with said drum surface, means connecting one end of said helical spring clutch elements to said driving member, means at one end of the other of said helical spring clutch elements adapted to effect driving thereof by abutment, shock-absorbing means between said two spring-end disposed connections and serving as an interposed buffer, and means for periodically spacing said spring-end disposed connections to effect oscillatory rotation of said driving member biased in one direction of rotation.

29. A releasable driving mechanism for producing asymmetrical oscillatory rotation characterized by progressive angular advancement in one direction of rotation, comprising: a member to be driven alternately clockwise and counter-clockwise, said driven member being provided

with a coaxial drum surface, a pinion gear carried by said driven member and coaxially rotated with respect thereto by an oscillating rack member, a pair of oppositely-active helical spring clutch elements associated with said drum surface, one clutch element being clockwise engageable, the other counter-clockwise engageable with said drum surface, a crank pin carried by said pinion gear and coupling one end of said spring clutch elements thereto for rotary oscillation therewith, a second pin carried by said pinion gear in fixed angular position with respect to said first pin and axially movable with respect to said pinion into and out of engagement with the other end of said pinion-coupled spring clutch element, said second pin having a cam surface formed thereon effective by engagement with said pinion-coupled spring clutch element to distort the latter into released relation with respect to said drum surface, means for moving said second pin into and out of distortion-inducing engagement with the pinion-coupled spring clutch element, and means for driving the other spring clutch element from said pinion gear an angular extent less than the angular extent of driving of said releasable spring-clutch element.

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