

May 25, 1954

G. W. ROSENBERGER

2,679,357

METER REGISTER

Filed July 12, 1951

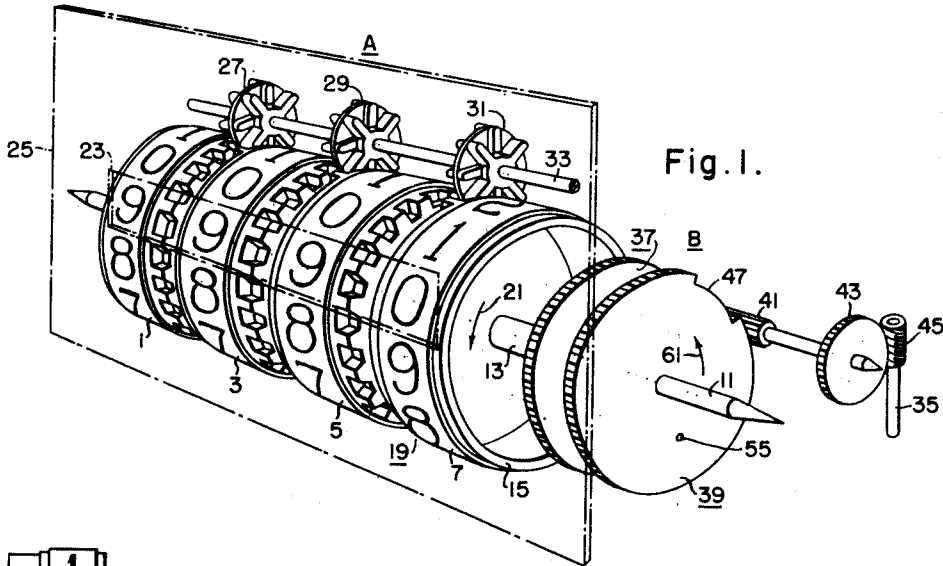


Fig. 1.

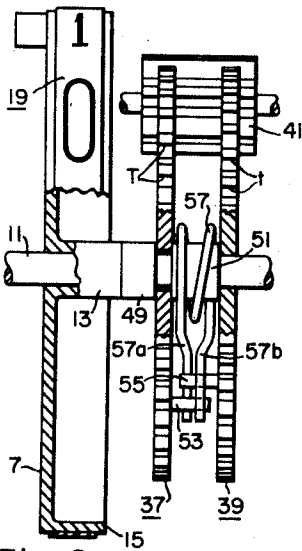


Fig. 2.

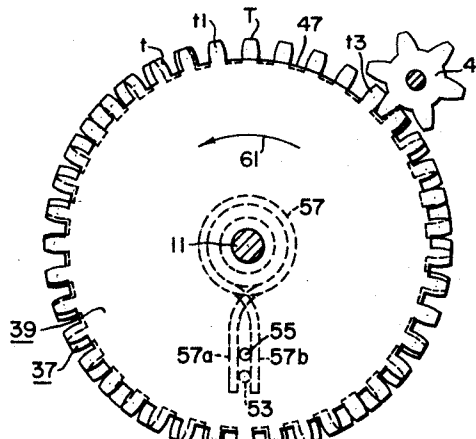


Fig. 3.

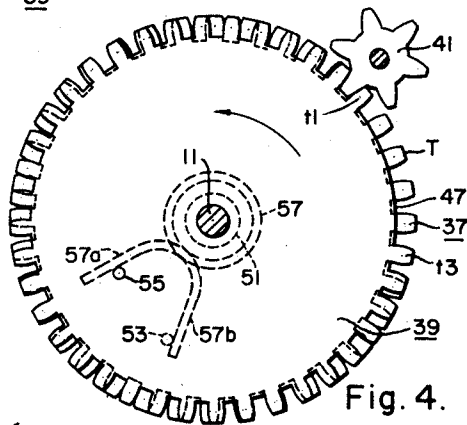


Fig. 4.

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2,679,357

METER REGISTER

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Application July 12, 1951, Serial No. 236,437

13 Claims. (Cl. 235—91)

1

This invention relates to motion-translating devices for converting a relatively continuous motion into motion which has high-speed pulses at predetermined intervals and it has particular relation to jump-type register or counting devices suitable for integrating meters.

In accordance with the invention, a motion translating device includes two rotatable members such as gears coupled to a common input member such as a pinion. The drive ratios differ for the rotatable members to produce a differential motion of the members. The construction of one of the members (which may involve removal of certain teeth in one of the gears) permits biasing means to move the member rapidly for a predetermined distance during each revolution of the member. Such a translating device is particularly suitable for driving counting devices or registers.

It is, therefore, a first object of the invention to provide an improved motion translating device for converting an input into an output motion having high speed pulses at predetermined intervals.

It is a second object of the invention to provide an improved jump-type counting device.

It is a third object of the invention to provide a motion-translating device having two rotatable members driven at different rates, one member being constructed to permit biasing means to restore the members to predetermined relative positions at predetermined intervals.

It is a fourth object of the invention to provide a counter device operated by the output of a translating device as set forth in the preceding paragraph.

Other objects of the invention will be apparent from the following description, taken in conjunction with the accompanying drawing, in which:

Figure 1 is a view in perspective of a counting device embodying the invention;

Fig. 2 is a view in side elevation with parts broken away, showing a portion of the device illustrated in Fig. 1; and

Figs. 3 and 4 are detail views in side elevation showing the positions of certain parts of the counting device of Fig. 1 under different conditions.

As previously pointed out, a motion-translating device embodying the invention may be employed for driving various mechanisms. Since it is particularly suitable for driving counter devices or registers, it will be described in connection with a conventional counter device. Refer-

2

ring to the drawing, Fig. 1 shows a counter device A which may be of conventional construction. In the specific embodiment illustrated, the counter device is of the cyclometer type and includes four counter wheels 1, 3, 5 and 7 which are mounted for independent rotation on a shaft 11. These counter devices have a drum configuration and each may have a hub 13 for receiving the shaft 11.

For transmitting motion from one counter wheel to a succeeding counter wheel a plurality of pinions 27, 29 and 31 are mounted for independent rotation about a shaft 33. These pinions are associated with the counter wheels in the same manner in which pinions bearing the same reference characters are associated with counter wheels bearing the same reference characters in the Barnes Patent 2,365,510, which issued December 19, 1944. The operation of the counter wheels and the pinions will be understood from a study of the aforesaid Barnes patent.

It will be understood that the counter wheel 7 may be arranged for rotation in either direction about the shaft 11. In the present embodiment, it will be assumed that during a normal counter operation, the counter wheel 7 rotates in the direction of the arrow 21. It will be noted that this direction is opposite to the direction of rotation assumed in the aforesaid Barnes patent.

Each of the counter wheels includes a cylindrical rim 15 which carries suitable indicia 19. In the present embodiment, the indicia on the counter wheels take the form of ten numerals 0 to 9, inclusive, which are equally spaced about the cylindrical surface of the counter wheel.

It will be understood that for each full revolution of the counter wheel 7, the counter wheel 5 is actuated in the same direction for an angular distance equal to the spacing between successive numbers thereon for the purpose of transferring the reading of the wheel 7 to the wheel 5. Similarly, the counter wheel 3 is actuated by the distance between successive numbers thereon for each revolution of the counter wheel 5 and the counter wheel 1 is actuated by the distance between successive numbers for each revolution of the counter wheel 3. The counter wheels 1, 3, 5 and 7 may be designated for example, "thousands," "hundreds," "tens" and "units" counter wheels. During the rotation of the counter wheels, each counter wheel presents the numerals thereon successively at a viewing point in the form of a window 23 in a face plate

25 which is illustrated in broken lines. In Fig. 1, the counter wheels are positioned to indicate the quantity 9990 through the window 23.

Each movement of one of the counter wheels 1, 3 or 5 takes place only while the preceding counter wheel moves from a position exposing the numeral 9 to a position exposing the numeral 0 thereon. In order to prevent erroneous readings of the counter device or register, it is desirable that such motion take place rapidly or with a "jump" action. Such "jump" operation is provided in the embodiment of Fig. 1.

The counter device A may be employed for counting the revolutions of a shaft 35 which may, for example, be the output shaft of a conventional watt-hour meter. This shaft is coupled to the counter device through a motion-translating device B.

The motion-translating device B includes a pair of rotatable members such as gears 37 and 39 which are rotated at different rates in accordance with rotation of the shaft 35. To this end, the rotatable members 37 and 39 may be coupled to the shaft 35 through a pinion 41 which engages both of the rotatable members 37 and 39 and a worm wheel 43 which meshes with a worm 45 secured to the shaft 35.

The rotatable member 39 is so constructed that it is uncoupled from the shaft 35 at predetermined intervals. When the rotatable member 39 is uncoupled from the shaft 35, biasing means (described below) returns the rotatable member 39 to a predetermined position relative to the rotatable member 37. Such return is employed for advancing the counter wheel 7 rapidly from a position exposing one numeral through the window to a position exposing a succeeding numeral through the window.

If the rotatable member 39 is in the form of a gear, it may be uncoupled from the shaft 35 by omitting certain teeth of the gear to provide a mutilated gear having a peripheral recess or gap 47. This gap 47 in the mutilated gear is proportioned to permit movement of the gear 39 for a distance sufficient to move the counter wheel 7 through the angular distance between successive indicia on the counter wheel. Although two or more gaps similar to the gap 47 may be provided at spaced intervals about the periphery of the gear 39 in order to provide several jump operations during each revolution of the gear, only one gap is required for the counter device A.

As shown in Fig. 2, the rotatable member or gear 39 is secured to the shaft 11 for rotation therewith. The rotatable member or gear 37 is mounted on the shaft 11 for rotation relative thereto. A spacer 49 may be interposed between the hub 13 of the counter wheel 7 and the gear 37. An additional spacer 51 may be interposed between the two gears 37 and 39.

Suitable biasing means such as gravity or spring means are provided for biasing the two gears 37 and 39 towards a predetermined position relative to each other. Although the biasing means may be constructed to permit relative motion of the gears in only one direction, preferably it is constructed to permit substantial relative motion of the two gears 37 and 39 in either direction.

In the preferred embodiment herein illustrated, spring biasing means are employed. The gear 37 is provided with a protuberance 53 in the form of a pin which projects towards the gear 39. In addition, the gear 39 is provided with a protuberance or pin 55 which projects towards the gear 37. These pins are spaced by different distances from

the shaft 11 and are parallel thereto. Consequently, the pins may rotate past each other without interference.

A spring 57 is coiled about the spacer 51 and has two ends or arms 57a and 57b located on opposite sides of the pins 53 and 55. It will be noted that a plane transverse to the shaft 11 intersects both of the pins 53 and 55. By locating the ends or arms of the springs 57 adjacent this plane, such ends can engage both of the pins.

As shown in Fig. 3, the ends 57a and 57b of the spring 57 are biased towards each other to urge the pins 53 and 55 towards positions wherein the pins and the shaft 11 are substantially in a common plane. The gear 39 may be moved in either direction relative to the gear 37 against the resistance of the spring 57.

As pointed out in the discussion of Fig. 1, the gears 37 and 39 are driven at different rates by the rotation of the shaft 35. Conveniently, such rates may be provided by employing different pitches for the teeth on the respective gears. The differential motion of the gears should be sufficient during each revolution thereof to move the gears relative to each other by the angular distance represented by the spacing between successive numerals of the counter wheels.

In the specific embodiment herein disclosed, the gap 47 represents an arc having an angular distance equal to substantially one-tenth of 360° or 36°. This is the angular distance required to move the counter wheel 7 an angular distance equal to the spacing between successive numerals thereon. To illustrate further suitable values, the gears 37 and 39 may have the same diameter. The gear 37 may be a conventional gear having thirty-six teeth. The gear 39 also has thirty-six teeth but these are indexed in the 324° of peripheral surface left on the gear 39 by the gap 47.

The relationships of the teeth in the two gears are shown in Figs. 3 and 4. In order to distinguish between the teeth on the two gears, the teeth T on the gear 37 are illustrated as being cut somewhat deeper than the teeth t of the gear 39. However, the teeth need not be different in depth in actual practice.

The gap 47 in the gear 39 is located between two of the teeth t1 and t3. The number of teeth selected for the gears preferably is such that when one tooth of the gear 37 is directly behind the tooth t1 in Fig. 3, another tooth of the gear 37 is directly behind the tooth t3. This is not essential if it is unnecessary to permit movement of the gears in either direction. However, if movement of the gears in either direction is desired, the aforesaid selection of the numbers of teeth facilitates proper engagement of the pinion 41 with the teeth during rotation of the pinion in either direction. Teeth t1 and t3 need not be exactly aligned with two teeth of the gear 37 but the displacement from such alignment should not be so great that the teeth interfere with or jam the pinion 41.

In the embodiment herein illustrated, it will be noted that a common pinion 41 engages both of the gears. If desired, the pinion 41 may be constructed in two sections each engaging a separate one of the gears. Each section of the pinion then may have a tooth formation selected for the associated gear. However, in actual practice, it has been found satisfactory to employ a single uniform pinion for both of the gears. It will be noted that the pinion illustrated in the drawing has six teeth.

It is believed that the operation of the inven-

5

tion now may be set forth. In Fig. 1, it will be assumed that the gearing between the watthour meter shaft 35 and the gears 37 and 39 is selected to produce rotation of the gears in the direction of the arrow 61. It will be noted that the gap 47 has just passed the pinion 41. The numeral "0" of the counter wheel 7 is exposed through the window 23. As the gap leaves the pinion 41, the gears and pinion have the relationship illustrated in Fig. 3. It will be noted that the pins 53 and 55 in the shaft 11 are substantially in a common plane. As the pinion 41 continues to rotate it gradually moves the gear 39 and the connected counter wheel 7 relative to the gear 37. Such differential motion is produced because of the provision of different pitches for the teeth on the two gears.

When the pinion 41 next engages the tooth 41, the parts are in the position illustrated in Fig. 4. It will be noted that the pins 53 and 55 now are spaced by an angular distance corresponding substantially to the angular length of the gap 47. At this moment the numeral "9" of the counter wheel 7 is exposed through the window 23. When continued rotation of the pinion 41 carries the pinion into the gap 47, the gear 39 is free to rotate relative to the gear 37 under the influence of the torque applied thereto by the spring 57. Consequently, the spring rapidly forces the pins 53 and 55 towards each other. It will be understood that the spring has sufficient torque to operate any load connected to the gear 39.

As the spring 57 rotates the gear 39 to bring the pin 55 into the plane containing the pin 53 and the shaft 11, the counter wheel 7 is advanced rapidly for a distance corresponding to the angular spacing of successive numerals thereon. The gap 47 is so positioned that this rapid movement of the counter wheel is effective to produce motion of the counter wheel 7 between the numerals 9 and 0. Consequently, the counter wheels 1, 3 and 5 are always operated with a jump action.

It will be noted that the wheel 7 does not move exactly in unison with the shaft 35. Since this is a unit wheel, this slight variation ordinarily is entirely acceptable. However, if desired, the numerals may be omitted from the counter wheel 7. It will be understood that the gearing between the shaft 35 and the gears 37 and 39 is selected to produce a desired motion of the counter wheels.

Although the invention has been described with reference to certain specific embodiments thereof, numerous modifications falling within the spirit and scope of the invention are possible.

I claim as my invention:

1. In a motion-translating device, a supporting structure, first and second members mounted on the supporting structure for independent rotation, a common driving element coupled to the two members, said driving element having a different coupling ratio for each of the members whereby the members rotate angularly relative to each other in response to operation of the driving element, biasing means yieldably biasing the members towards a predetermined position relative to each other and permitting displacement of one of the members relative to the other of the members against said biasing in each direction of rotation away from said predetermined position, the coupling of one of said members to the driving element being interrupted for a predetermined arc of each rotation of the last-

6

named member, said biasing means being effective for moving the last-named member when displaced in each direction relative to the other of the members away from said predetermined position for an angular distance corresponding to said arc as said last-named coupling is interrupted, the members comprising two gears mounted for rotation about a common axis, said gears having different tooth pitches, and said driving element comprising a pinion engaging both of said gears, one of said gears having certain teeth removed to permit movement of the gear relative to the pinion for a predetermined angular distance.

2. In a motion-translating device, a supporting structure, first and second gears mounted on the supporting structure for independent rotation about a common axis, a rotatable pinion engaging both of said gears, said gears having different tooth pitches capable of operation with said pinion, whereby rotation of said pinion rotates the gears at different rates of rotation, said first gear having certain of its teeth omitted to leave a gap, and biasing means yieldably urging said gears towards a predetermined position relative to each other and permitting displacement of one of the members relative to the other of the members against said biasing in each direction of rotation away from said predetermined position, whereby when said pinion enters the gap the biasing means can move the gears to said predetermined position.

3. A counter device having a supporting structure, a rotatable element, means mounting the rotatable element on the structure for rotation about an axis, said rotatable element having indicia angularly spaced about said axis to be successively displayed by said rotatable element as the rotatable element rotates adjacent a viewing point, in combination with means for actuating the rotatable element from a first position displaying a first indicium at said viewing point to a second position displaying a second indicium at said viewing point, said last-named means comprising first and second members mounted for rotation independently of each other on the supporting structure, a driving element coupled to the two members continuously through substantial angles of rotation of the members, said driving element having a different coupling ratio for each of the members whereby the members rotate angularly relative to each other in response to operation of the driving element, biasing means yieldably biasing the members towards a predetermined position relative to each other and permitting displacement of one of the members relative to the other of the members against said biasing in each direction of rotation away from said predetermined position, the coupling of one of said members to the driving element being interrupted for a predetermined arc of each rotation of the last-named member, said biasing means having a biasing range effective for moving the last-named member when displaced in each direction relative to the other of the members away from said predetermined position for an angular distance corresponding substantially to said arc as said last-named coupling is interrupted, the interrupted one of said members being coupled to said rotatable element to effect rotation of the rotatable element, said arc being proportioned to permit movement of the rotatable element by the interrupted member during said coupling interruption from the first position to the second position.

4. A counter device having a supporting structure, a rotatable element, means mounting the rotatable element on the structure for rotation about an axis, said rotatable element having indicia angularly spaced about said axis to be successively displayed by said rotatable element as the rotatable element rotates adjacent a viewing point, in combination with means for actuating the rotatable element from a first position displaying a first indicium at said viewing point to a second position displaying a second indicium at said viewing point, said last-named means comprising first and second gears mounted on the supporting structure for rotation independently of each other about a common axis, a rotatable pinion engaging both of said gears, said gears having different tooth pitches capable of operation with said pinion, whereby rotation of the pinion rotates the gears at different rates, said first gear having certain of its teeth omitted to leave a mutilated gear having a gap, and biasing means yieldably urging said gears towards a predetermined position relative to each other and permitting displacement of one of the members relative to the other of the members against said biasing in each direction of rotation away from said predetermined position, whereby when said pinion enters the gap the biasing means can move the gears to said predetermined position, the mutilated gear being coupled to the rotatable element to effect rotation of the rotatable element, said movement of the gears by the biasing means being proportioned to move the rotatable element from the first position to the second position.

5. In a motion-translating device, a supporting structure, first and second members mounted on the supporting structure for independent rotation, a common driving element coupled to the first member for part only of each revolution of the first member with a first coupling ratio for rotating the first member, said common driving element being coupled to the second member with a second coupling ratio differing from the first coupling ratio for rotating the second member, whereby operation of the common driving element in each of two directions rotates one of the members angularly relative to the other of the members in each of two directions respectively from a predetermined position, and biasing means yieldably biasing one of the members towards said predetermined position relative to the other of the members for any displacement of the members from said position, said biasing means yielding to permit rotation of one of the members relative to the other of the members in each of said two directions in response to operation of the driving element.

6. In a motion-translating device, a supporting structure, first and second members mounted on the supporting structure for independent rotation, a common driving element coupled to the first member for part only of each revolution of the first member with a first coupling ratio for rotating the first member, said common driving element being coupled to the second member with a second coupling ratio differing from the first coupling ratio for rotating the second member, whereby operation of the common driving element rotates one of the members angularly relative to the other of the members, and a spring having ends biased towards each other, said ends being operatively connected to said members for yieldably biasing one of the members towards a predetermined position relative to

the other of the members, said spring yielding to permit rotation of one of the members relative to the other of the members in each of two directions away from said predetermined position in response to operation of the driving element in each of two directions.

7. In a motion-translating device, a supporting structure, first and second members mounted on the supporting structure for independent rotation about a common axis, a common driving element coupled to the first member for part only of each revolution of the first member with a first coupling ratio for rotating the first member, said common driving element being coupled to the second member with a second coupling ratio differing from the first coupling ratio for rotating the second member, whereby operation of the common driving element rotates one of the members angularly relative to the other of the members, a spring having ends biased towards each other about an axis, said first and second members having elements positioned between the ends of the spring, said elements being located at different radial distances from the axis of rotation of the members to permit such elements to pass each other during rotation of the members, said spring yielding to permit rotation of the first member in either of two angular directions relative to the second member in response to operation of the driving element.

8. In a motion-translating device, a supporting structure, first and second members mounted on the supporting structure for movement independently of each other through predetermined paths, a common driving element operable in each of two directions, means coupling the common driving element to the first member continuously and to the second member intermittently for moving the members in their predetermined paths at different rates, and biasing means yieldably urging the first and second members towards predetermined positions relative to each other and permitting displacement of one of the members relative to the other of the members against said urging in each of two directions away from said predetermined position, whereby the driving element when coupled to the second member for each direction of operation moves the second member relative to the first member until the coupling of the driving element to the second member is interrupted whereupon the biasing means moves the second member to its predetermined position relative to the first member.

9. In a motion-translating device, a supporting structure, first and second members mounted on the supporting structure for movement independently of each other through predetermined similarly-directed paths, a common driving element rotatable in each of two directions relative to the supporting structure, means coupling the common driving element to the second member continuously and to the first member during part only of the coupling of the driving element to the second member for moving the second member in its predetermined path in a first direction at a first rate of movement and for moving the first member in said first direction at a rate of movement slower than the first rate, and biasing means yieldably urging the first and second members towards predetermined positions relative to each other and permitting displacement of one of the members relative to the other of the members against said urging in each of two directions away from said predetermined position.

whereby the driving element for each direction of rotation gradually moves the second member ahead of the first member until the coupling of the driving element to the first member is terminated, whereupon the biasing means moves the first member toward its predetermined position relative to the second member.

10. In a motion-translating device, a supporting structure, first and second gears mounted on the supporting structure for rotation independently of each other about a common axis, a common driving element rotatable in each of two directions relative to the supporting structure, gear means coupling the common driving element to the first and second gears for rotating the first gear about the common axis in a first direction at a first rate of rotation and for rotating the second gear about the common axis in the first direction at a rate of rotation faster than said first rate, said first gear having certain of its teeth removed to leave a gap interrupting the coupling of the first gear to the gear means for part only of the periphery of the first gear, and biasing means yieldably urging the first gear towards a predetermined position relative to the second gear and permitting displacement of the first gear relative to the second gear against said urging in each of two directions away from said predetermined position, whereby said driving means in each direction of rotation moves the second gear ahead of the first gear until the driving means encounters said gap whereupon the biasing means moves the first gear towards its predetermined position relative to the second gear.

11. A counter device having a supporting structure, a rotatable element, means mounting the rotatable element on the structure for rotation about an axis, said rotatable element having indicia angularly spaced about said axis to be successively displayed by said rotatable element as the rotatable element rotates adjacent a viewing point, in combination with means for actuating the rotatable element from a first position displaying a first indicium at said viewing point to a second position displaying a second indicium at said viewing point, said last-named means comprising first and second gears mounted on the supporting structure for rotation independently of each other about a common axis, a common driving element rotatable in each of two directions relative to the supporting structure, gear means coupling the common driving element to the first and second gears for rotating the first gear about the common axis in a first direction at a first rate of rotation and for rotating the second gear about the common axis in the first direction at a rate of rotation faster than said first rate, said first gear having certain of its teeth removed to leave a gap interrupting the coupling of the first gear to the gear means for part only of the periphery of the first gear, biasing means yieldably urging the first gear towards a predetermined position relative to the second gear and permitting displacement of the first gear relative to the second gear against said urging in each of two directions away from said predetermined position, whereby said driving means in each direction of rotation moves the second gear ahead of the first gear until the driving means encounters said gap whereupon the biasing means moves the first gear towards its predetermined position relative to the second gear, and means coupling the first gear to the rotatable element to effect rotation of the rotatable element,

said gap being proportioned to permit movement of the rotatable element by the first gear during said coupling interruption from the first position to the second position.

12. A counter device having a supporting structure, a rotatable element, means mounting the rotatable element on the structure for rotation about an axis, said rotatable element having indicia angularly spaced about said axis to be successively displayed by said rotatable element as the rotatable element rotates adjacent a viewing point, in combination with means for actuating the rotatable element from a first position displaying a first indicium at said viewing point to a second position displaying a second indicium at said viewing point, said last-named means comprising first and second gears mounted on the supporting structure for rotation independently of each other about a common axis, a common driving element rotatable in each of two directions relative to the supporting structure, gear means coupling the common driving element to the first and second gears for rotating the first gear about the common axis in a first direction at a first rate of rotation and for rotating the second gear about the common axis in the first direction at a rate of rotation faster than said first rate, said first gear having certain of its teeth removed to leave a gap interrupting the coupling of the first gear to the gear means for part only of the periphery of the first gear, biasing means yieldably urging the first gear towards a predetermined position relative to the second gear and permitting displacement of the first gear relative to the second gear against said urging in each of two directions away from said predetermined position, whereby said driving means in each direction of rotation moves the second gear ahead of the first gear until the driving means encounters said gap whereupon the biasing means moves the first gear towards its predetermined position relative to the second gear, means coupling the first gear to the rotatable element to effect rotation of the rotatable element, said gap being proportioned to permit movement of the rotatable element by the first gear during said coupling interruption from the first position to the second position, a second rotatable element similar to said first-named rotatable element mounted for rotation on the structure, and means coupling the second rotatable element for movement with the first-named rotatable element only during movement of the first-named rotatable element from the first position to the second position.

13. In a motion-translating device, a supporting structure, first and second gears mounted on the supporting structure for independent rotation about a common axis, a rotatable pinion engaging both of said gears, said gears having different tooth pitches capable of operation with said pinion, whereby rotation of said pinion rotates the gears at different rates of rotation, said first gear having certain of its teeth omitted to leave a gap, and biasing means yieldably urging said gears towards a predetermined position relative to each other, whereby when said pinion enters the gap the biasing means can move the gears to said predetermined position, said biasing means yieldably permitting relative movement of the gears in either direction away from the predetermined position, the biasing means including a separate protuberance on each of the gears, the protuberances passing through a common plane transverse to the axis and being at dif-

11

ferent distances from said axis whereby the protuberances can pass each other, and a spring device having arms substantially in said plane biased towards each other to engage said protuberances.

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