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T. D. BARNES

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METER REGISTER

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Fig. 1

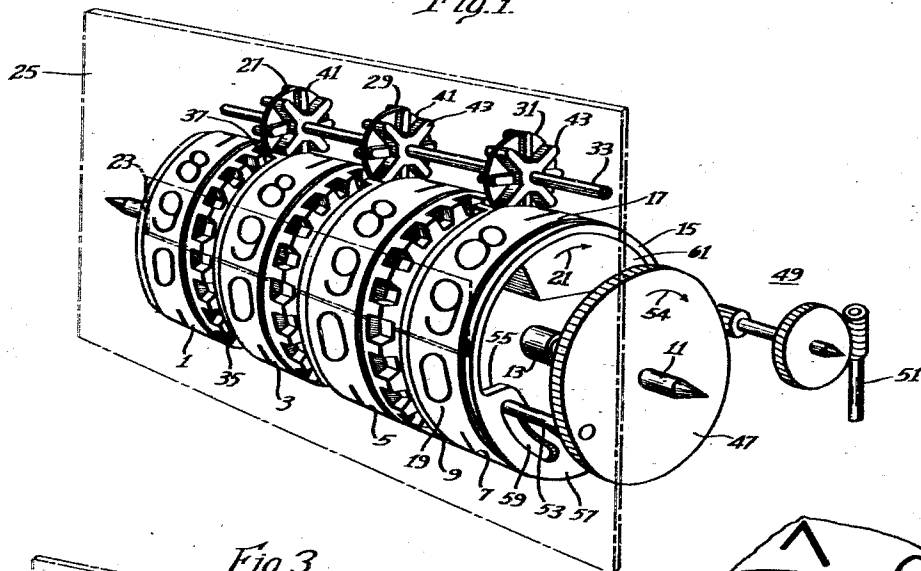


Fig. 3

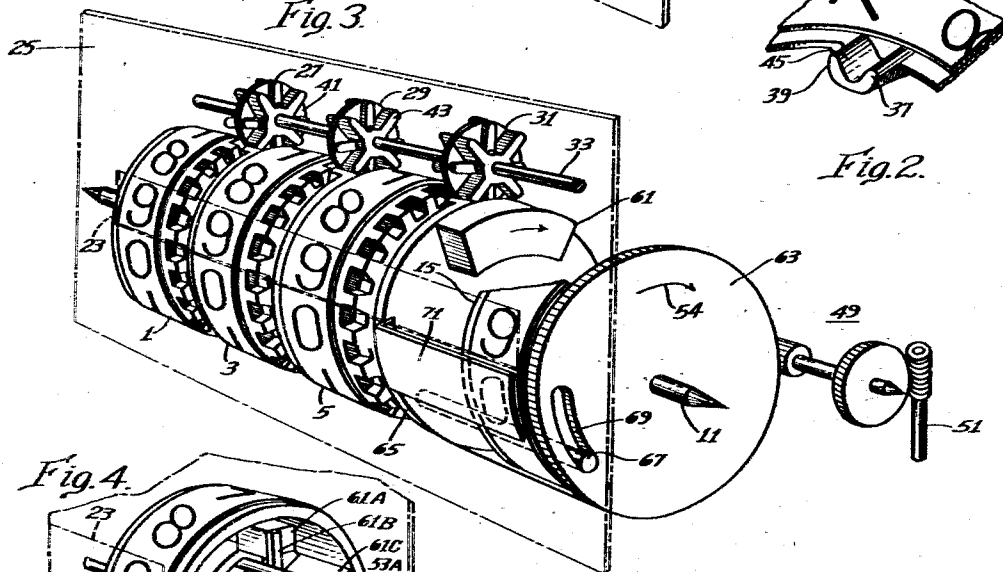
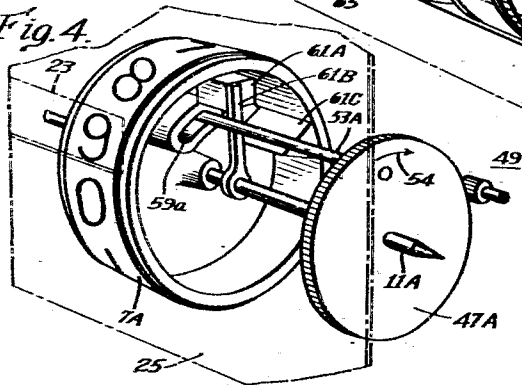


Fig. 2

Fig. 4



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METER REGISTER

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This invention relates to counter devices, and it has particular relation to jump counter devices or cyclometer registers for integrating meters.

In reading counter devices, such as cyclometer registers, errors in reading are difficult to avoid during the period required for the counter device or cyclometer register to change from a first quantity to a second quantity. The possibility of such errors is increased by the provision in the gearing of the counter device or cyclometer register of substantial backlash in order to decrease the friction and possibility of sticking of the register.

In order to decrease the probability of erroneous readings, jump-type counter devices have been constructed. Such counter devices decrease substantially the time required for the counter device to change from a first quantity to a second quantity. Because of their complexity and increased friction, jump-type counter devices have not been generally adopted.

In accordance with the invention, a counter device, such as a cyclometer register, is provided with a driven member which is rotated in a predetermined normal direction by a driving member. Conveniently, both members may be mounted on a common shaft for independent rotation about a common axis. The driven member is employed for actuating the counter device or cyclometer register.

Jump action of the counter device or cyclometer register is effected by providing a lost-motion-coupling between the driving and driven members. The driven member is weighted or biased to oppose rotation of the driven member in its normal direction of rotation until the counter device or cyclometer register is about to change from a first quantity to a second quantity. At this time, the weight or bias changes its biasing direction to urge the driven member in its normal direction of rotation. Consequently, the weight or bias rapidly urges the driven member in its normal direction of rotation for a distance equal to that permitted by the lost-motion-coupling. This distance is sufficient to permit actuation of the counter device or cyclometer register from a first quantity to a second quantity.

It is, therefore, an object of the invention to provide a counter device of improved construction.

It is a further object of the invention to provide a jump-type cyclometer register having its parts mounted for rotation about a common axis.

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 cyclometer register embodying the invention;

Fig. 2 is a detail view in perspective of a portion of the cyclometer register illustrated in Fig. 1; and

Figs. 3 and 4 are views in perspective with parts broken away of cyclometer registers embodying modified forms of the invention.

Referring to the drawing, Figure 1 shows a cyclometer register having four counter wheels 1, 3, 5, and 7. Each of these wheels includes a disk 9 which is mounted for rotation on a shaft 11. For this purpose, the disk 9 may be provided with a hub 13 which serves to mount the disk rotatably on the shaft 11, and which serves additionally to space the disk from adjacent parts of the cyclometer register.

Each of the counter wheels also includes a cylindrical rim 15 which is carried by the disk 9, and which forms therewith a cup or drum structure. The rim may be coated with a layer 17 of material, such as white lacquer, to form a suitable background for indicia 19 which may be printed thereon. In the specific embodiment illustrated in Fig. 1, the indicia on each of the counter wheels take the form of 10 numbers, 0 to 9, inclusive, which are equally spaced about the cylindrical surface of the counter wheel.

In operation, the counter wheel 7 is actuated in the direction of the arrow 21. 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. 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. Therefore, the counter wheels 1, 3, 5, and 7 may be designated, respectively, "thousands," "hundreds," "tens," and "units" counter wheels.

During the rotation of the counter wheels, each counter wheel presents the numbers 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 9,999 through the window 23.

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. The pinion 27 is positioned between the counter wheels 1 and 3 for engaging gear teeth 35 formed on the counter wheel 1 and a pair of gear teeth 37 and 39 formed on the counter wheel 3. Similarly, the pinion 29 engages the gear teeth 35 on the counter wheel 3 and the gear teeth 37 and 39 on the counter wheel 5. The pinion 31 engages similar gear teeth on the counter wheels 5 and 7. For guiding the pinions, each pinion is provided with a web 41 which has its periphery positioned between the associated pair of counter wheels.

The pinions and gear teeth are so proportioned that for each revolution of one of the counter wheels, such as the counter wheel 7, the two gear teeth 37 and 39 on the counter wheel 7 engage the pinion 31 to rotate the counter wheel 5 for a distance equal to the angular spacing between successive numbers on the periphery of the counter wheel 5. In order to prevent movement of the pinions between the periods of engagement of the gear teeth 37 and 39 therewith, extensions 43 are formed on alternate teeth of each of these pinions. These extensions 43 project from the main body of the pinion sufficiently to engage the disk 9 of the associated counter wheel. Since two of the extensions normally overlie the disk 9 of the associated counter wheel and are positioned adjacent the surface thereof, such extensions prevent rotation of the pinion. To permit rotation of each pinion when the associated gear teeth 37 and 39 are in position to actuate the pinion, a groove 45 (see Fig. 2) is positioned in each of the disks 9 to receive one of the extensions 43 of the associated pinion. Consequently, for each revolution of a counter wheel, such as the counter wheel 7, the associated pinion 31 rotates sufficiently to advance the succeeding counter wheel 5 an angular distance equal to the spacing between successive numbers on the periphery thereof. The construction of the cyclometer register thus far specifically described is well known in the art.

For actuating the cyclometer register, a driving gear 47 may be mounted on the shaft 11 for rotation with respect thereto. This driving gear may be coupled for rotation in accordance with any desired quantity. In the specific embodiment of Fig. 1, the gear 47 is coupled through suitable gearing 48 to the shaft 51 of a watt-hour meter. Rotation of the driving gear 47 by the shaft of the watt-hour meter is assumed to be in the direction of the arrow 54.

The driving gear 47 is coupled to the counter wheel 7 through a suitable lost-motion coupling. Conveniently, this lost-motion coupling may take the form of a pin 53 attached to the driving gear 47 and movable into engagement with either of two abutments 55 or 57 carried by the counter wheel 7. These abutments may constitute the end walls of a slot 59. The lost-motion coupling is proportioned to permit rotation of the counter wheel 7 independently of the driving gear 47 for an angular distance equal to the spacing between successive numbers on the counter wheel.

For actuating the counter wheel 7 for the angular distance permitted by the lost-motion coupling, the counter wheel is provided with a weight which is unbalanced with respect to the shaft 11. Conveniently, the unbalanced weight may be produced by means of a weight 61 which is attached to or formed in the counter wheel 7. In a simplified construction, the disk 9, rim

15, abutments 55 and 57, weight 61, and hub 13 all may be formed into a unitary counter wheel by a die-casting operation.

The weight unbalance is designed to urge the abutment 55 against the pin 53 as the counter wheel 7 approaches the position at which the gear teeth 37 and 39 engage the pinion 31 to transfer rotation to the succeeding counter wheel 5. In Fig. 1, the weight 61 is shown in the position which it occupies immediately prior to the engagement of the pinion 31 by the gear teeth 37 and 39.

As the driving gear 47 continues to rotate, the weight 61 is carried past its highest position and operates to urge the abutment 57 towards the pin 53. Since the only opposition to such movement of the counter wheel is that resulting from the small friction of the cyclometer register, the movement takes place with extreme rapidity. The motion permitted by the slot 59 is sufficient to move the succeeding counter wheel or wheels to the next successive position or positions thereof. Because of the rapidity of this movement, errors in the reading of the register are substantially eliminated.

It is believed that the operation of the cyclometer register illustrated in Fig. 1 is apparent from the foregoing description. Assuming that the parts of the register are in the positions illustrated, the register is about to change from a reading of 9,999 to a reading of 10,000 (which is indicated by four ciphers). In this position of the parts, the weight of the counter wheel 7 exerts a torque biasing the counter wheel in a direction opposite to that of the arrow 21 to maintain the abutment 55 in engagement with the pin 53.

As the driving gear 47 rotates, the weight 61 is carried beyond its highest position and thereafter biases the counter wheel 7 in the direction of the arrow 21 to bring the abutment 57 into engagement with the pin 53. Since this movement of the abutment 57 into engagement with the pin 53 occurs with extreme rapidity, the cyclometer register changes to its new reading 10,000 with sufficient rapidity to preclude the probability of an error in reading the register.

As the driving gear 47 continues its rotation, the weight 61 maintains the abutment 57 in engagement with the pin 53 until the weight reaches its lowest position. Thereafter, the counter wheel 7 is held stationary by the weight 61 until the driving gear 47 has moved the pin 53 into engagement with the abutment 55. At this point, the counter wheel 7 resumes its rotation in the direction of the arrow 21 until the number 9 thereon again is presented at the window 23. This cycle of operation of the counter wheel 7 is repeated as the driving gear 47 continues to rotate.

It will be observed that the counter wheel 7 does not rotate at a rate proportional to the rate of rotation of the shaft 51 of the watt-hour meter. When the weight 61 passes its highest point, the counter wheel is urged rapidly from the position presenting the number 9 at the window 23 to a position presenting the number 0 at the same point. Also, when the weight 61 reaches its lowest position, the counter wheel 7 remains stationary until the pin 53 has moved from the abutment 57 to the abutment 55. For these reasons, a small error may be present in the reading of the cyclometer register. Since this error corresponds to only one unit of the counter wheel 7, and since the operation of the cyclometer

register precludes larger errors in reading the counter wheels 1, 3, and 5, the register of Fig. 1 represents a distinct advance over prior art cyclometer registers.

It should be observed further that the abutments 55 and 57 and the weight 61 may be located within the space enclosed by the rim 15. For this reason, the improved cyclometer register of Fig. 1 requires substantially no more space than a prior art cyclometer register. Furthermore, with the exception of the standard pinions 27, 29, and 31, the parts of the cyclometer register are mounted for rotation about the single shaft 11. This construction avoids the complexity and increased friction resulting from the association of parts with additional shafts.

In the modification of Fig. 3, the counter wheels 1, 3, and 5 again are associated with the pinions 27, 29, and 31 in the manner discussed with reference to Fig. 1. However, the rim 15 of the counter wheel 7 is detached from the disk 9 illustrated in Fig. 1, and is attached to a gear 63 which corresponds to the gear 47 of Fig. 1. In Fig. 3, a coupling member 65 which may be similar to the disk 9 of the counter wheel 7 of Fig. 1 is mounted for rotation on the shaft 11. This coupling member 65 cooperates with the pinion 31 to advance the counter wheel 5 in the same manner that the disk 9 of the counter wheel 7 in Fig. 1 cooperates with the pinion 31. It will be observed that the coupling member 65 is provided with the weight 61 for urging the counter wheels 1, 3, and 5 rapidly through a change from one quantity to the next succeeding quantity indicated thereby.

A lost-motion coupling is provided between the coupling member 65 and gear 63 which corresponds to the lost-motion coupling between the counter wheel 7 and the driving gear 47 of Fig. 1. Such lost-motion coupling is represented by a pin 67 which is carried by the coupling member 65 and which has an end projecting into a slot 69 formed in the gear 63.

It is believed that the operation of the modification illustrated in Fig. 3 is clear from the discussion of the modification of Fig. 1. In Fig. 3, the gear 63 is rotated continuously in accordance with the rotation of the shaft 51 of the watt-hour meter. Consequently, the rim 15 is carried with the gear 63 to indicate at all times the unit values of the quantity to be indicated by the cyclometer register.

With the parts in the positions illustrated in Fig. 3, further motion of the gear 63 should result in rotation of the counter wheels 1, 3, and 5 to their next successive positions. Such motion of the gear 63 carries the weight 61 in Fig. 3 past its highest point. The gear 61 then urges the pin 67 from the position in the slot 69 which it occupies in Fig. 3 to the opposite end of the slot. Such motion of the pin is sufficient to permit the coupling member 65 operating through the pinion 31 to actuate the counter wheels 1, 3, and 5 to their next successive positions.

In the modification of Fig. 3, it will be observed that the unit counter wheel represented by the rim 15 at all times presents the correct unit value of the quantity being counted. If desired, the coupling member 65 may carry a shield or mask 71 which covers the number 0 of the unit rim 15 as the number 0 approaches the window 23 of the face plate 25. When the coupling member 65 rotates to advance the counter wheels 1, 3, and 5, it carries the mask 71 away from the number 0 of the unit rim 15 to expose this num-

ber through the window. This construction prevents any error in reading the unit rim 15 during the period required for the rim to move from a position presenting the number 9 to view to a position presenting the number 0 to view.

Fig. 4 discloses a construction which is similar to that of Fig. 2 except for the relationship between the counter wheel 7 and the driving gear 47. In Fig. 4 a shaft 11A, a counter wheel 7A, a driving gear 47A and a pin 53A are provided which correspond to the shaft 11, the counter wheel 7, the driving gear 47 and the pin 53 of Fig. 1. The pin 53A is movable in a slot 59A formed in the counter wheel 7A, this slot corresponding to the slot 59 of Fig. 1.

Instead of the weight 61 of Fig. 1, Fig. 4 includes a weight 61A which is attached to a lever 61B mounted for rotation about the shaft 11A. This lever 61B is movable from a position wherein it engages the pin 53A to a position wherein the weight 61A engages an abutment 61C carried by the counter wheel 7A.

With the parts in the positions shown in Fig. 4, the counter wheel 7A is about to change from a position exposing the numeral 9 through the window 23 to a position exposing the cipher through the window. As the driving gear continues to rotate in the direction of the arrow 54 the pin 53 advances the counter wheel 7A and the lever 61B sufficiently to carry the weight 61A beyond its highest position. Under the influence of gravity the weight 61A then moves towards the abutment 61C. The impact of the weight 61A on the abutment 61C advances the counter wheel 7A rapidly for the distance permitted by the slot 59A. This distance is sufficient to expose the cipher through the window.

When the driving gear 47A has advanced sufficiently to bring the weight 61A to its lowest position, the weight remains stationary until its supporting lever 61B is reengaged by the pin 53A.

If the counter wheel 7A is substantially balanced the slight friction of the register suffices to maintain the pin 53A at the proper end of the slot 59A immediately prior to the point at which the weight 61A reaches its highest position. If desired, the counter wheel 7A at this point may have a slight unbalance urging the counter wheel in a direction opposite to that of the arrow 54.

Since the weight 61A falls freely through an arc which may be of the order of 90°, substantial kinetic energy is developed thereby. For this reason the weight 61A may be somewhat smaller than the weight 61 of Fig. 1.

Although the invention has been described with reference to certain specific embodiments thereof, numerous modifications are possible. Therefore, the invention is to be restricted only by the appended claims.

I claim as my invention:

1. In a counter device, a rotatable member, means mounting said rotatable member for rotation about an axis, said rotatable member having indicia angularly spaced about said axis to be successively displayed by said rotatable member as said rotatable member rotates adjacent a viewing point, and means for actuating said rotatable member 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 driving means mounted for rotation about said axis, said rotatable member and said

driving means having interfitting parts constituting lost-motion coupling means coupling said driving means to said rotatable member, said lost-motion coupling means permitting rotation of said rotatable member about said axis independently of said driving means for an angular distance equal to the spacing of said positions, and means responsive to rotation of said rotatable member for urging said rotatable member from said first position towards said second position when said rotatable member arrives at said first position.

2. In a counter device, a plurality of counter wheels, means mounting said counter wheels for rotation about an axis, said counter wheels bearing indicia angularly spaced about said axis for successive presentation at a viewing point as said counter wheels rotate, means coupling said counter wheels for advancing a first one of said counter wheels by the angular distance between successive indicia thereon for each revolution of a second one of said counter wheels, said coupling means being effective only for a rotation of said second counter wheel equal to the angular spacing between predetermined successively viewed indicia thereon, and means for actuating said second counter wheel, said last-named means comprising driving means rotatable about said axis for rotating said second counter wheel, lost-motion coupling means rotatable about said axis for coupling said driving means to said second counter wheel, said lost-motion coupling means permitting rotation of said second counter wheel independently of said driving means for a distance equal to the spacing of said predetermined successively viewed indicia thereon, and biasing means responsive to rotation of said second counter wheel for opposing rotation of said second counter wheel in a predetermined direction of rotation when said predetermined successive indicia are in advance of said viewing point, and for urging said second counter wheel in said direction of rotation when the first of said predetermined successive indicia arrives at said viewing point, whereby said second counter wheel advances rapidly for the distance between said predetermined successive indicia.

3. In a counter device having a first counter wheel and a second counter wheel, means mounting said counter wheels for rotation about a common axis, spaced indicia on each of said counter wheels positioned for successive movement past a viewing point as said wheels rotate, and coupling means for coupling said second counter wheel to said first counter wheel for moving said second counter wheel in response to movement of said first counter wheel for a portion only of each revolution of said first counter wheel, means for increasing the rapidity of motion of said first counter wheel during said portion of each revolution, said means comprising driving means rotatable about said axis for rotating said first counter wheel, said driving means and said first counter wheel having interfitting parts constituting lost-motion coupling means for coupling said driving means to said first counter wheel, said lost-motion coupling means permitting rotation of said first counter wheel independently of said driving means for an angular distance about said axis equal to said portion of a revolution, said first counter wheel having a weight distribution biasing said first counter wheel against said driving means in advance of said portion of a revolution, and biasing said first counter wheel in its normal direction

of rotation when said first counter wheel reaches said portion of a revolution, whereby said counter wheels move rapidly through said portion of a revolution.

4. In a counter device having a plurality of counter wheels, a plurality of spaced indicia on each of said counter wheels arranged for successive presentation at a viewing point as each of said counter wheels rotates, means mounting said counter wheels for rotation about an axis, and means coupling said counter wheels for advancing a first one of said counter wheels for an angular distance equal to the spacing of the indicia thereon in response to each revolution of a second one of said counter wheels about said axis, said coupling means being effective for only a portion of a revolution of said second counter wheel, means for rotating said second counter wheel in a predetermined normal direction, said last-named means comprising driving means mounted for rotation about said axis, lost-motion coupling means coupling said driving means to said second counter wheel, said lost-motion coupling means comprising interfitting parts on said driving means and on said second counter wheel proportioned for permitting motion of said second counter wheel independently of said driving means for an angular distance equal to said portion of a revolution thereof, said second counter wheel having an unbalanced weight with respect to its axis of rotation for actuating said counter wheel through the angular distance permitted by said lost-motion coupling means, the unbalance of said weight being positioned to bias said second counter wheel against its normal direction of rotation in advance of said portion of a revolution, and to bias said second counter wheel in its normal direction of rotation during the progress of said second counter wheel through said portion of a revolution, whereby said unbalanced weight operates said second counter wheel rapidly for the angular distance required to advance said first counter wheels.

5. In a counter device, a plurality of counter wheels, means mounting said counter wheels for rotation about an axis, said counter wheels having spaced indicia positioned to be successively viewed as said counter wheels rotate adjacent a viewing point, and coupling means between said counter wheels for rotating a first one of said counter wheels in response to movement of a second one of said counter wheels, said coupling means comprising a coupling member, means mounting said coupling member for rotation about an axis, means effective for a portion only of each revolution of said coupling member for coupling said first counter wheel for rotation by said coupling member, lost-motion coupling means coupling said coupling member to said second counter wheel for rotation in a predetermined direction, said lost-motion coupling means comprising interfitting parts on said coupling member and said second counter wheel proportioned for permitting rotation of said coupling member independently of said second counter wheel for an angular distance equal to said portion of a revolution of said coupling member, biasing means opposing rotation of said coupling member in said predetermined direction when said coupling member occupies positions in advance of said portion of a revolution, said biasing means operating during said portion of a revolution to bias said coupling member in said predetermined direction of rotation,

whereby said biasing means actuates said coupling member to take up the lost motion between said coupling member and said second counter wheel during said portion of each revolution of said coupling member.

6. In a counter device, a plurality of counter wheels, means mounting said counter wheels for rotation about a common axis, said counter wheels having spaced indicia on their rims positioned to be successively viewed as said counter wheels rotate adjacent a viewing point, means for rotating a first one of said counter wheels to bring the indicia thereon successively adjacent said viewing point, and means effective only as said first counter wheel during each revolution thereof moves a first distance corresponding to the angular distance between a predetermined pair of indicia thereon for rotating a second one of said counter wheels for an angular distance equal to the spacing between successive indicia thereon, said last-named means comprising a coupling member mounted for rotation about said axis, lost-motion coupling means coupling said coupling member to said first counter wheel for rotation in a predetermined direction, said lost-motion coupling means comprising interfitting parts on said coupling member and said first counter wheel proportioned for permitting rotation of said coupling member independently of said first counter wheel for an angular distance equal to said first distance, said coupling member having a weight unbalanced about said axis, said weight being distributed to carry the center of gravity thereof past its highest portion at the time said means for rotating said second counter wheel is rendered effective, whereby said weight rapidly actuates said coupling member for the distance permitted by said lost-motion coupling.

7. The counter device of claim 1 wherein the last-named means includes a weight member mounted for rotation about said axis and having a weight unbalanced about said axis, said driving means including means urging said weight member about said axis to a position wherein said weight member possesses maximum potential energy when said rotatable member arrives at said first position, whereby said weight member falls through a predetermined path under the influence of said potential energy, said rotatable member having a portion in said path for engagement by said weight member, whereby said weight member actuates said rotatable member rapidly from said first position towards said second position.

8. In a counter device, a plurality of counter wheels, means mounting said counter wheels for rotation about a predetermined axis, said counter wheels bearing indicia angularly spaced about said axis for successive presentation at a viewing point as said counter wheels rotate, means coupling said counter wheels for advancing a first one of said counter wheels by the angular distance between successive indicia thereon for each revolution of a second one of said counter wheels, said coupling means being effective only for a rotation of said second counter wheel equal to the angular spacing between predetermined successively viewed indicia

thereon, and means for actuating said second counter wheel, said last-named means comprising driving means rotatable about said axis for rotating said second counter wheel, lost-motion coupling means for coupling said driving means to said second counter wheel, said lost-motion coupling means comprising interfitting parts on said driving means and said second counter wheel proportioned for permitting rotation of said second counter wheel independently of said driving means for a distance equal to the spacing of said predetermined successively viewed indicia thereon, and means for urging said second counter wheel rapidly through the angular spacing between said predetermined successively viewed indicia, said last-named means comprising a weight member mounted for rotation about said axis and having a weight unbalanced about said axis, said driving means including means for rotating said weight member to a position of substantial potential energy at the time said second counter wheel is to move between the viewing positions of said predetermined successively viewed indicia, and thereafter permitting said weight member to rotate through a path under the influence of gravity, said second counter wheel having an element positioned in said path of rotation of said weight member, whereby said weight member rapidly moves said second counter wheel for the distance permitted by said lost-motion coupling.

9. In a counter device, a plurality of wheel members, means mounting said wheel members for rotation about a predetermined axis, at least certain of said wheel members bearing indicia spaced angularly about said axis for successive presentation at a viewing point as said wheel members rotate, means coupling said counter wheels for advancing a first one of said indicia-bearing wheel members by the angular distance between successive indicia thereon for each revolution of a second one of said wheel members, said coupling means being effective only for a predetermined fraction of each revolution of said second wheel member, and means for actuating said second wheel member, said last-named means comprising a driving member mounted for rotation about said axis, lost-motion coupling means for coupling said driving member to said second wheel member, said lost-motion coupling means comprising interfitting elements on said driving member and on said second wheel member proportioned to permit rotation of said second wheel member relative to said driving member for an angular distance about said axis equal to said predetermined fraction, said second wheel member having a substantial weight with its center of gravity displaced from said axis for releasing substantial potential energy as said second wheel member enters said fraction of each revolution, whereby rotation of said driving member stores in said second wheel member substantial potential energy which is released as said second wheel member enters said fraction of each revolution to move said second wheel member rapidly for the distance permitted by said lost-motion coupling.

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