Dec. 1, 1942. K. H. KARLSEN 2,303,365

CLOCK MECHANISM

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Fig. 1.

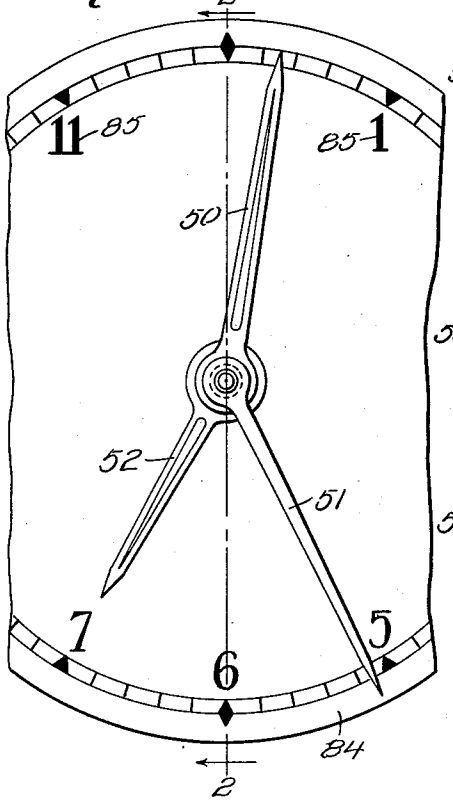


Fig. 2.

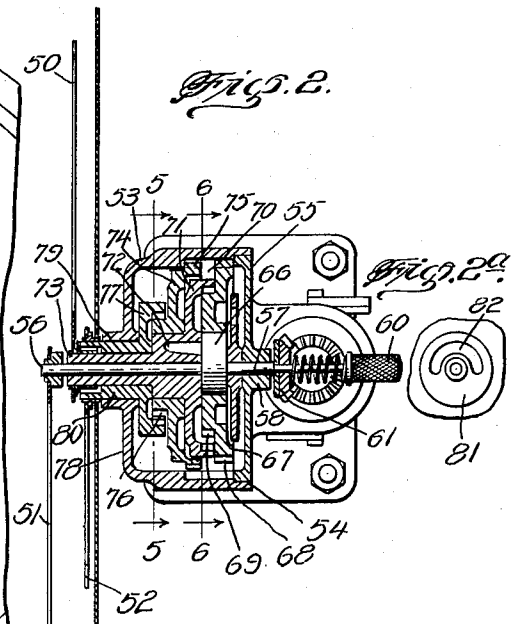


Fig. 2a.

Fig. 3.

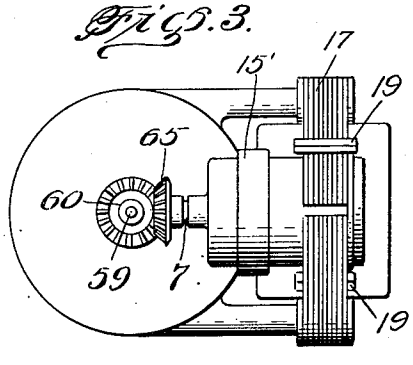
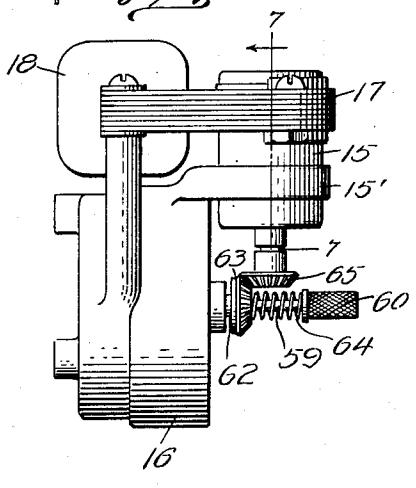


Fig. 4.



Karl Henry Karlsen, INVENTOR

BY Victor J. Evans & Co.

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Fig. 5

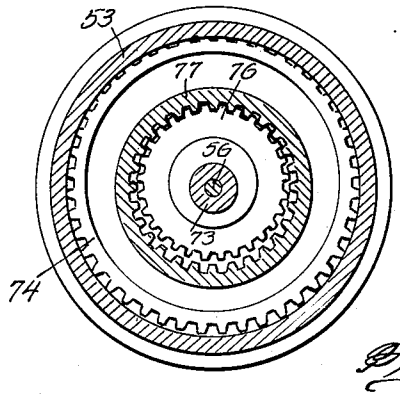


Fig. 6.

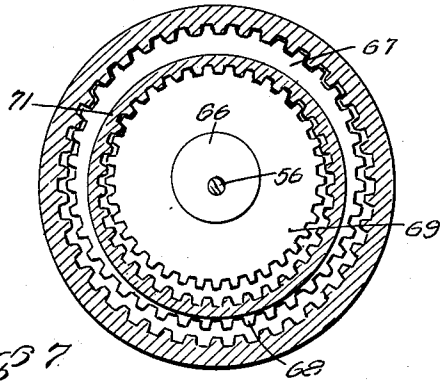


Fig. 7

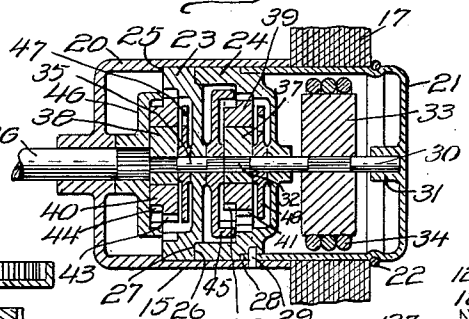


Fig. 10

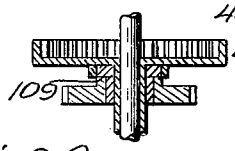


Fig. 11.

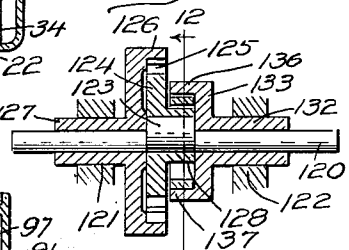


Fig. 9.

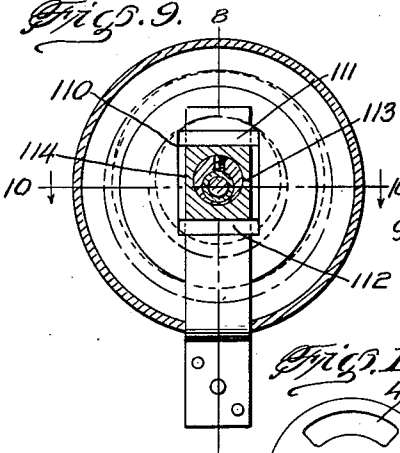


Fig. 8

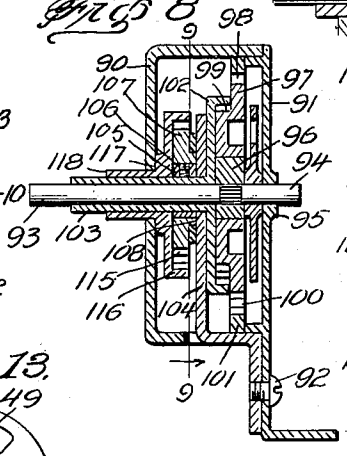


Fig. 12.

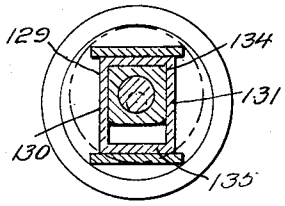
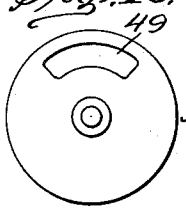


Fig. 13.



Karl Henry Karlsen. INVENTOR

BY Victor J. Evans & Co.

ATTORNEYS

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UNITED STATES PATENT OFFICE

2,303,365

CLOCK MECHANISM

Karl Henry Karlsen, Brooklyn, N. Y.

Application November 14, 1939, Serial No. 304,425

5 Claims. (Cl. 74—307)

My invention relates broadly to new and useful improvements in reduction gearing, and more particularly to a reduction gearing primarily adapted for use in time instruments and the like.

An important object of my invention is the provision of an improved reduction gearing that is simple in construction, but that is efficient and efficacious in the performance of its duties.

Another object of my invention is the provision of an improved reduction gearing wherein the simple construction of the same will permit low manufacturing costs and will afford substantial economy by increased speed of assembly.

Still another object of my invention is to provide an improved reduction gearing for time instruments that is light in weight, compact in construction, quiet in operation, and that employs few threaded parts to loosen and adversely affect the operation thereof.

Other objects and advantages of my invention will be apparent during the course of the following description.

In the accompanying drawings, forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a front elevation of a device embodying my invention,

Figure 2 is a vertical sectional view taken on the line 2—2 of Figure 1,

Figure 2—*a* is an elevation of the balancing wheel embodying a part of my invention,

Figure 3 is a rear elevation of my device,

Figure 4 is a top plan view thereof,

Figure 5 is a vertical sectional view taken on the line 5—5 of Figure 2,

Figure 6 is a vertical sectional view taken on the line 6—6 of Figure 2,

Figure 7 is a vertical sectional view taken on the line 7—7 of Figure 4,

Figure 8 is a vertical sectional view illustrating a modified form of the invention,

Figure 9 is a vertical sectional view taken on the line 9—9 of Figure 8,

Figure 10 is a transverse sectional view taken on the line 10—10 of Figure 9,

Figure 11 is a vertical sectional view illustrating another modification of the gearing,

Figure 12 is a vertical sectional view taken on the line 12—12 of Figure 11, and

Figure 13 is an elevation of the balancing wheel embodying a part of my invention.

In the drawings, wherein for the purpose of illustration, is shown a preferred embodiment of my invention, the numeral 15 designates a motor having direct drive engagement with the time instrument 16 which is securely attached thereto by the integral band 15'. The motor 15 includes a bi-polar field comprising the laminated plates 17 which are excited by the induction coil 18 drawing power from a single phase alternating current circuit. Each pole of the field plate 17 has a copper shading plate 19 which imparts a rotating torque to the magnetic field by causing the flux through the pole arms with the shading coils to lay behind the flux through the unshaded arms.

The construction of the motor is such that the direction of rotation of the motor can be reversed by withdrawing the motor casing 15 from the field structure and inserting it in the opposite side. The motor casing comprises interfitting cupular sections 20 and 21. The poles of the laminated field plate 17 embracingly engage the sections 21 of the casing in an abutting relation to the free end of the section 20 and are held securely in position by the locking ring 22 which is received in an annular groove in the periphery of the section 21. The spaced stationary internal ring gears 23 and 24 are mounted in the section 20 of the motor housing. The gear 23 abuts the annular shoulder 25 formed on the inner peripheral surface of the section 20 and the end 26 of the gear 24 is received in an annular groove 27 in the rear of the gear 23. The free end of the section 21 of the housing is received in an annular recess 28 in the rear surface of the gear 24 to hold the gears in mutually pressed interlocking engagement, and the locking pin 29 is inserted in aligning openings in the sections 20 and 21 and the gear 24 to hold the same against axial or radial displacement.

The rotor shaft 30 is mounted for rotation in the journal 31 and extends axially of the casing with the end 32 thereof rotatably received by and extended beyond the ring gear 24. The core 33 of the rotor is splined to the shaft 30 intermediate the end of the casing 21 and the gear 24 and has the coils of wire 34 wrapped around its periphery in the conventional manner. An intermediate shaft 35 is rotatably carried by the gear 23 and in axial alignment with but disengaged from the rotor shaft 30. The driven shaft 36 is rotatably carried by the closed end of the section 20 and is in axial alignment with but separated from the intermediate shaft 35. Eccentrics 37 and 38 are fixedly mounted on the rotor shaft and intermediate shafts respectively and carry the loosely mounted cluster gears 39 and 40. The gears 39 and 40 are provided with annular sets of teeth 41, 42 and 43, 44 respec-

tively. The sets of teeth 41 and 43 are adapted to mesh with the ring gears 24 and 23 as the cluster gears 39 and 40 are eccentrically actuated by the rotor. The teeth 42 of the cluster gear 39 are adapted to mesh with the internal ring gear 45 splined to the intermediate shaft 35. The teeth 44 of the cluster gear 40 are adapted to mesh with the internal ring gear 46 splined to the driven shaft 36. The balance wheels 47 and 48 are carried by the rotor shaft 30 and intermediate shaft 35, respectively, to counteract the unbalancing effect produced by the eccentric rotation of the cluster gears 39 and 40. The balance wheels are of circular formation in plan and are provided with an arcuate slot 49 in the portion thereof adjacent the heaviest portion of the eccentrics so that the greatest weight will be positioned in a manner to balance the eccentrics.

The rotor 33 will rotate at 3600 revolutions per minute by virtue of the bi-polar construction of the field and the eccentric 37 carried thereby will be rotated in accordance therewith. The axis of the cluster gear 39, idly mounted on the eccentric 37, will be rotated by the eccentric 37 to impart a planetary motion thereto and to bring the peripheral teeth 41 into engagement with the internal teeth of the stationary ring gear 24. As the cluster gear 39 rotates, the teeth 42 will progressively mesh with the teeth of the ring gear 45 to impart rotation thereto. The ratio of this train of gears is 100 to 1, so that the ring gear 45 will make 36 revolutions for every 3600 revolutions of the rotor. The rotation of the ring gear 45 will be imparted to the eccentric 38 fixed to the opposite end of the intermediate shaft 35 and as the eccentric rotates, the teeth 43 of the cluster gear 40, idly mounted thereon, will progressively engage with the stationary internal ring gear 23. The planetary rotation imparted to the cluster gear 40 by the eccentric 38 will cause the teeth 44 thereof to mesh with the ring gear 46. The ring gear 46 is provided with a greater number of teeth than the cluster gear so that a substantially slower rotation will be imparted thereto. The ratio of this train of gears is 36 to 1 so that the driven shaft 36 will make one complete revolution for every 36 revolutions of the intermediate shaft 35. It is obvious that the number of teeth carried by the various gears comprising the above-mentioned mechanism may be varied to suit the manufacturer and as long as the correct ratio is maintained in accordance with the above disclosure, the device will operate in a satisfactory manner.

The mechanism which operates the hands 50, 51 and 52 of the clock is housed in the casing 16 which comprises a stationary cupular portion 53 having an internal annular recess 54 at the open end thereof which receives the backing plate 55. The drive shaft 56 is positioned axially of the casing 16 and the end 57 extends exteriorly of the backing plate through the boss 58 and is formed with a reduced portion 59 which terminates in the knurled actuating knob 60. The thrust washer 61 is carried by the reduced portion 59 of the shaft in abutting relation to the shoulder 62 defined thereby and the beveled gear 63 is yieldingly held in engagement therewith by the helical spring 64. The beveled gear 63 is normally held in engagement with the beveled gear 65 mounted on the outer end of the driven shaft 36 of the motor and is adapted to be rotated in 1 to 1 ratio thereby. The portion of the drive shaft 56 extending through the cupular portion 53 has an eccentric 66 formed thereon adjacent the backing plate 55 and the external cluster gear 67 is idly mounted thereon. The gear 67 is formed with stepped sets of peripheral teeth 68 and 69 in a manner whereby the teeth 68 will mesh with the internal teeth 70 formed in the inner periphery of the cupular casing 53 and a planetary motion is imparted to the gear by the rotation of the eccentric 66. The internal ring gear 71 is loosely mounted on the drive shaft in abutting relation with the eccentric 66 and is adapted to mesh with the annular set of teeth 69 of the cluster gear. The ring gear is formed with an eccentric hub portion 72 and an elongated sleeve 73 which extends axially thereof and exteriorly of the casing 53. The external cluster gear 74 is formed with stepped sets of peripheral teeth 75 and 76 and is idly mounted on the eccentric portion 72 of the ring gear 71. As the ring gear 71 is rotated, a planetary motion will be imparted to the cluster gear 74 by the eccentric 72 in a manner to bring the teeth 75 into engagement with the internal teeth 70 of the casing 53, and the teeth 76 will progressively mesh with the internal ring gear 77 which is loosely mounted for rotation on the elongated sleeve portion 73 of the ring gear 71. The transverse end 78 of the casing 53 is formed with a boss 79 which receives the elongated sleeve portion 80 of the ring gear 77 and which substantially supports each of the sleeves 80 and 73 and the drive shaft 56. The sleeve 73 of the gear 71 extends exteriorly of the boss 79 but terminates a substantial distance from the end of the shaft 56, and the sleeve 80 of the ring gear 77 also extends beyond the boss 79 but terminates a substantial distance from the extremity of the sleeve 73. The balance wheel 81 is carried by the shaft 56 intermediate of the eccentric 66 and the backing plate 55 and a suitable arcuate slot 82 is formed therein to counteract the unbalancing effect of the eccentric 66 and the eccentric hub portion 72 of the internal ring gear 71.

It may be seen that as the beveled gear 65 makes one complete revolution every minute, the drive shaft 56 will make one complete revolution per minute by virtue of the 1 to 1 ratio between the beveled gears 63 and 65. The internal ring gear 71 is provided with a greater number of teeth than the set 69 of the cluster gear 67 so that a substantially slower rotation will be imparted thereto by the said cluster gear. The ratio for this train of gears is 60 to 1, so that the ring gear 71 will make one complete revolution for sixty revolutions of the shaft 56. The ring gear 77 is provided with a greater number of teeth than the set 76 of the cluster gear 74 so that a substantially slower rotation will be imparted thereto by the gear 74. The ratio of this train is 12 to 1 so that the ring gear 77 makes one complete revolution for every 12 revolutions of the internal ring gear 71.

It is obvious that the number of teeth formed on each of the gears is immaterial and may be varied to suit the desires of the manufacturer as long as the correct ratio is maintained.

The second hand 51 is secured to the outwardly extending end of the drive shaft 56, the minute hand 50 is carried by the outwardly extending end of the elongated sleeve 73 of the ring gear 71; the hour hand 52 is mounted on the outwardly extending end of the elongated sleeve 80 of the ring gear 77; and the face 84 of the clock is carried by but spaced from the sleeve 80 between the hands 50, 51 and 52 and the transverse end

78 of the casing and has the annularly disposed equi-spaced numbers 85 printed thereon.

It may be seen that if the face 84 of the clock is positioned in the conventional manner, the second hand 51 will circumvent the face 84 once a minute, the minute hand 50 will traverse the same once an hour and the hour hand 52 will make one complete revolution every twelve hours.

The beveled gear 63 is idly mounted on the reduced portion 59 of the drive shaft so that the same may be disengaged from the thrust washer 61 to permit the hands to be set without rotating the beveled gear 65. After the hands have been properly set the helical spring 64 will force the same against the thrust washer to once more permit rotation to be imparted to the drive shaft 56 thereby. A modified form of the time mechanism is illustrated in Figures 8, 9 and 10. The cupular casing 90 is attached to the supporting bracket 91 and the drive shaft 93 extends axially therebetween and with the end 94 thereof journaled in the boss 95 of the bracket 91. The eccentric 96 is splined to the shaft interiorly of the casing 90 adjacent the supporting bracket 91, and the external cluster gear 97 is idly mounted thereon. The gear 97 is provided with laterally spaced concentric sets of teeth 98 and 99 and, as motion is imparted to the shaft 93, the eccentric 96 will impart a planetary movement to the cluster gear to move the teeth 98 thereof into progressive engagement with the teeth 100 of the internal ring gear 101. The internal ring gear 102 is loosely mounted on the shaft 93 adjacent the eccentric 96 in a manner whereby the teeth 99 of the cluster gear will mesh therewith upon rotation of the said gear. The ring gear 102 is formed with an axially extending sleeve portion 103 which projects exteriorly of the casing 90 but which terminates a substantial distance from the end of the shaft 93. The supporting arm 104 is integrally formed on the casing 90 and extends transversely thereof to receive the sleeve 103 of the ring gear 102 and to hold the said ring gear in engagement with the cluster gear 97. An eccentric 105 is securely held on the sleeve 103 adjacent the bracket 104 by the set screw 106, and the spur gear 107 is loosely mounted thereon. The spur gear is formed with a square hub 108 which abuts the face 109 of the supporting arm 104 to hold the gear 107 spaced away therefrom. A sliding bracket 110 is carried by the arm 104 intermediate of the spur gear 107 and the face 109 thereof which comprises spaced transverse arms 111 and 112 having the extremities thereof bent at right angles thereto and joined by vertical members 113 and 114. The transverse arms 111 and 112 are adapted to slidably receive the horizontal sides of the square hub 108 and the vertically members 113 and 114 slidably receive the vertical edges of the supporting arm 104. Rotation of the internal ring gear 102 will rotate the eccentric 105 which will, in turn, transmit a planetary motion of the spur gear 107. It may be seen that the axis of the spur gear will be rotated but that the gear will be prevented from revolving about its axis by the sliding bracket 110. The square hub portion 108 of the spur gear may freely move in a lateral direction between the transverse arms 111 and 112, and the bracket is freely slidable in a vertical direction on the supporting arm 104. This construction will in no way affect the free movement of the gear but will effectively prevent the rotation of the same about its axis. As the spur gear 107 is actuated by the eccentric 105, the teeth 115 thereof will mesh with the internal ring gear 116 which is provided with a substantially greater number of teeth in a manner whereby a reduced rate of rotation will be imparted thereto. The internal ring gear 116 is loosely mounted on the sleeve 103 of the internal ring gear 102 and is formed with a shoulder 117 which abuts the inner face of the casing 90 and an elongated sleeve portion 118 which extends axially therefrom exteriorly of the casing 90 but terminates a substantial distance from the end of the sleeve 103. The internal ring gear 102 is provided with a substantially greater number of teeth than the teeth 99 of the cluster gear 97 in a manner whereby the ratio of rotation therebetween will be 60 to 1 and the greater number of teeth of the internal ring gear 116 will effect a ratio of 12 to 1 with the spur gear 107. It may be thus seen that if the shaft 93 is made to make one complete revolution a minute, the internal ring gear 102 will make one complete revolution an hour and the ring gear 116 will make one complete revolution every twelve hours.

The second, minute and hour hands, 51, 50 and 52, may be attached to the driven shaft 93, sleeve 103, and sleeve 118, respectively, in the manner hereinbefore described.

Figures 11 and 12 illustrate a modification of the manner in which the spur gear may be given a planetary motion without causing the same to rotate about its axis. The drive shaft 120 is positioned transversely of the spaced supports 121 and 122 and is provided with an eccentric 123 intermediate thereof. The spur gear 124 is idly mounted on the eccentric and the teeth 125 thereof are adapted to mesh with the internal ring gear 126 which is formed with an axially extending sleeve 127 rotatably carried by the support 121. The spur gear 124 is formed with a square hub portion 128 which carries an elongated rectangular frame 129, the vertical sides 130 and 131 of which slidably receive the vertical sides of the hub 128 therebetween. The stationary supporting bracket 132 is formed with a substantially Y-shaped head 133, the bifurcations 136 and 137 of which embracingly receive the ends 134 and 135 of the bracket 129. The stationary bracket 132 is non-rotatably mounted in the support 122 and permits a free lateral movement of the frame 129.

It may thus be seen that when a rotary motion is imparted to the shaft 120, the eccentric 123 formed thereon will rotate the axis of the spur gear 124. The square hub portion 128 of the spur gear is free to move within the frame 129 and the frame may freely move in a lateral direction between the bifurcations 136 and 137 of the supporting bracket 132 so that the rotation of the spur gear about its axis will be efficiently prevented but a planetary motion may be imparted thereto.

It is to be understood that the forms of my invention, herewith shown and described, are to be taken as preferred examples of the same, and that various changes in the size, shape and arrangement of parts may be resorted to without departing from the spirit of my invention, or the scope of the appended claims.

What is claimed is:

1. In a time instrument, the combination of a cupular casing, an internal ring gear positioned within said casing, a shaft extending axially through the casing, an eccentric fixedly mounted on the said shaft, a cluster gear having separate

sets of teeth idly mounted on the eccentric in a manner whereby one of the sets of teeth will mesh with the internal ring gear, a ring gear loosely mounted on the shaft and in mesh with the other set of teeth of the said cluster gear, said last-mentioned ring gear having an elongated sleeve portion, a supporting arm positioned transversely of the casing for rotatably receiving the elongated sleeve of the last-mentioned ring gear and for holding the same in meshed engagement with the said cluster gear, an eccentric fixedly secured to the sleeve portion of the last-mentioned ring gear, a spur gear idly mounted on the last-mentioned eccentric, said spur gear having a substantially square hub portion, a bracket slidably mounted on the supporting arm and having an elongated slot to slidably receive the hub portion of the spur gear, and a ring gear loosely mounted on the sleeve portion of the second-mentioned ring gear and in mesh with the said spur gear.

2. In a time instrument, the combination of a cupular casing, an internal ring gear positioned within said casing, a shaft extending axially through the casing, means to rotate the shaft at one R. P. M., an eccentric fixedly carried by the said shaft, a cluster gear having separate sets of teeth idly mounted on the eccentric and having a set of teeth in mesh with the internal ring gear, a ring gear loosely mounted on the shaft and in mesh with the other set of teeth of the said cluster gear, said last-mentioned ring gear having an elongated sleeve portion and being provided with a greater number of teeth than the cluster gear to permit a rotation of 1–60 ratio therebetween, a supporting arm positioned transversely of the casing for rotatably receiving the elongated sleeve of the last-mentioned ring gear and for holding the same in meshed engagement with the set cluster gear, an eccentric fixedly secured to the sleeve portion of the last-mentioned ring gear, a spur gear idly mounted on the last-mentioned eccentric, said spur gear having a substantially square hub portion, a bracket longitudinally slidable on the supporting arm and having an elongated slot to slidably receive the hub portion of the spur gear and to permit lateral actuation thereof, and a ring gear loosely mounted on the sleeve portion of the second-mentioned ring gear and in mesh with the said spur gear, said ring gear having a greater number of teeth than the spur gear and adapted to be rotated in 1–12 ratio thereby.

3. In a time instrument, the combination of spaced supports, a rotatable shaft mounted transversely of the supports, an eccentric mounted on the said shaft, gear means mounted on and eccentrically operable by the said eccentric, a retaining means coactive to permit vertical actuation of the gear but preventing a lateral movement, means cooperative with the said retaining means to permit lateral actuation of the gear but resisting vertical movement thereof, and an internal ring gear loosely mounted on the shaft and in mesh with and driven by the said gear means, said ring gear having a greater number of teeth than the gear means and adapted to be rotated thereby at a reduced rate of speed.

4. In a time instrument, a support, a driven shaft extending from the support, coactive inner and outer gear means carried by the shaft and having circumferentially spaced teeth, the said inner gear having a substantially square hub, an eccentric mounted on the said shaft and rotatably fitted within the said inner gear whereby the teeth of the inner gear may be progressively meshed with the teeth of the outer gear means to effect rotation of the outer gear during the eccentric travel of the inner gear, and an essentially rectangular frame carried by the hub, one set of parallel side members of the frame slidably engage opposite sides of the hub and the other set of parallel side members of the frame slidably engage the said support.

5. In a time instrument, a support, a driven shaft extending from the support, coactive inner and outer gear means carried by the shaft and having circumferentially spaced teeth, the said inner gear having a substantially square hub, an eccentric mounted on the said shaft and rotatably fitted within the said inner gear whereby the teeth of the inner gear may be progressively meshed with the teeth of the outer gear means to effect rotation of the outer gear during the eccentric travel of the inner gear, and a retaining means mounted on the hub for limiting the movement of the hub to one direction only, said retaining means being slidably associated with the support in a manner to be slidable only in a direction normal to the first-mentioned direction.

KARL HENRY KARLSEN.