June 22, 1965 A. W. GARDES ETAL 3,190,066

ELECTRIC CLOCK

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Fig. 1

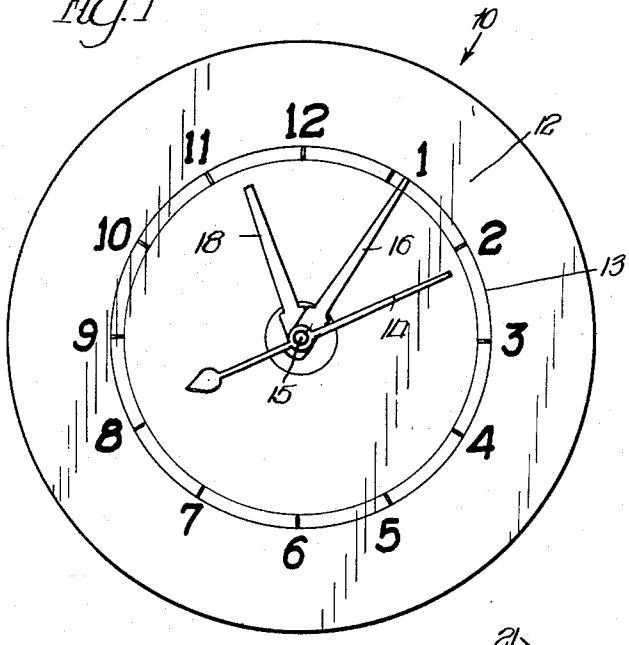


Fig. 2

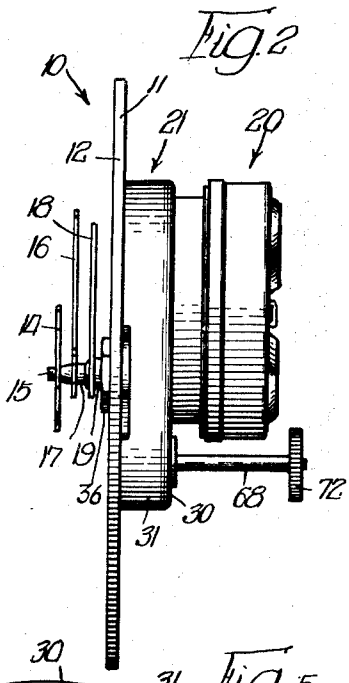


Fig. 3

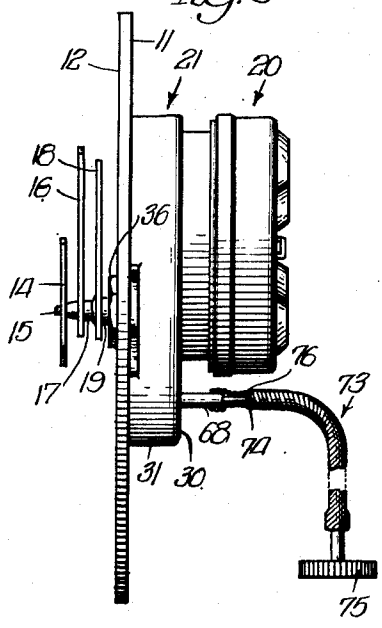
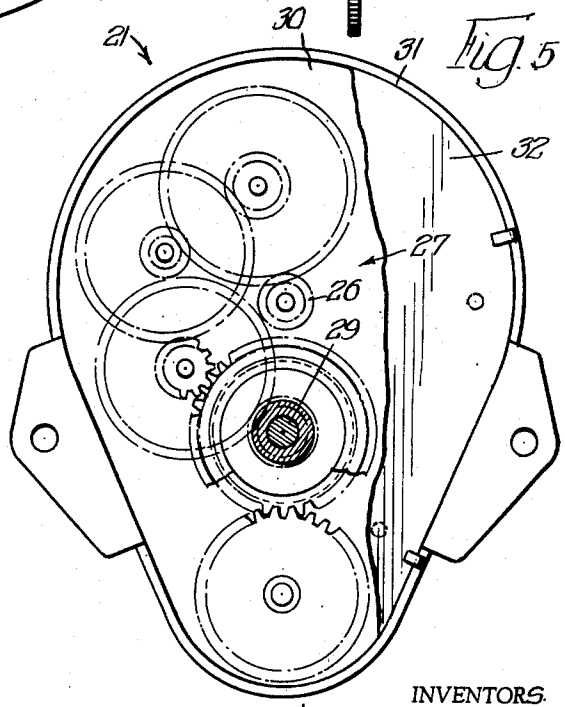


Fig. 5



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Fig. 4

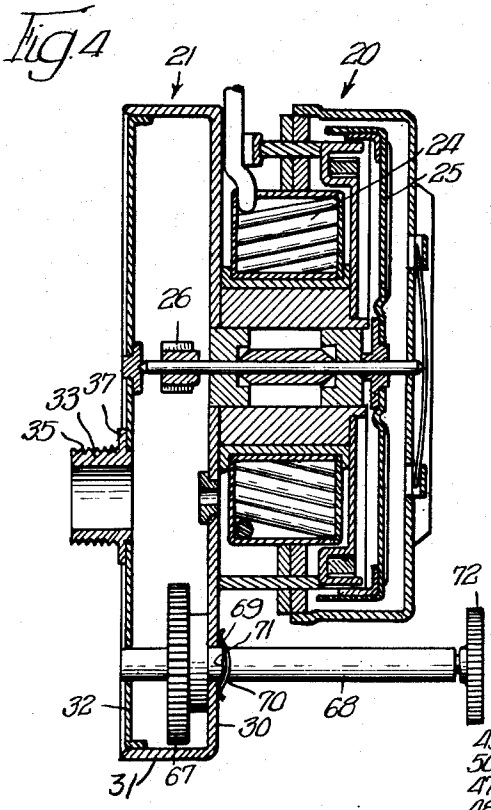


Fig. 6

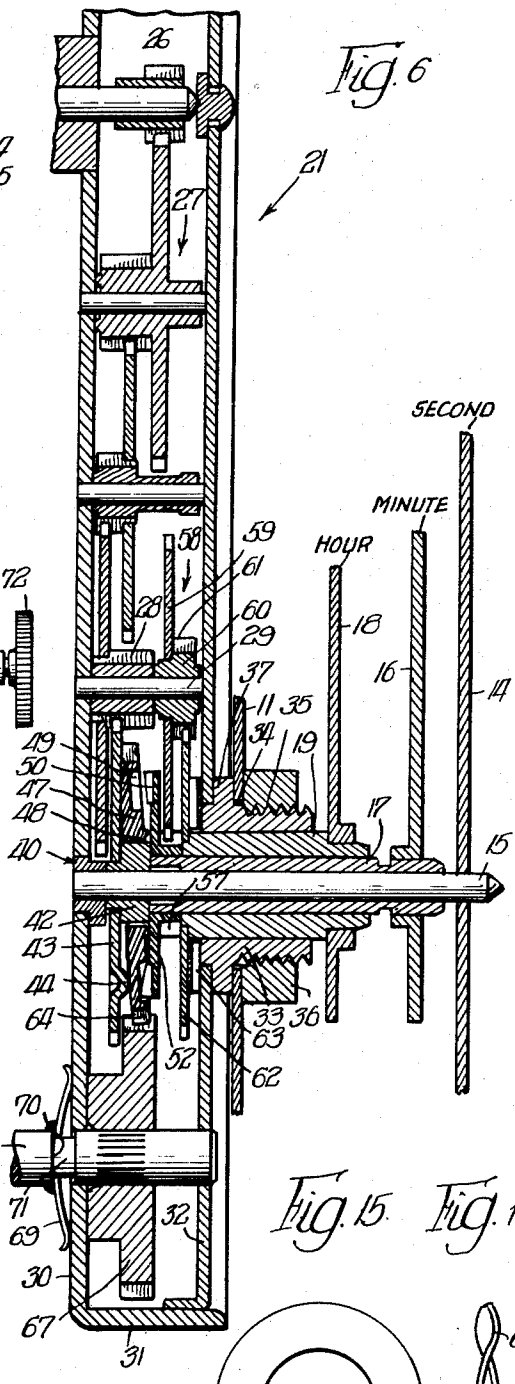


Fig. 8

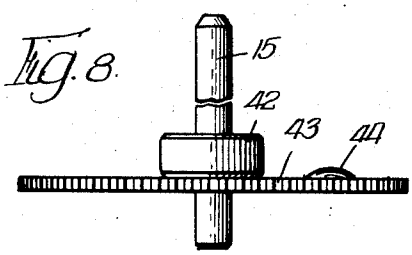


Fig. 9

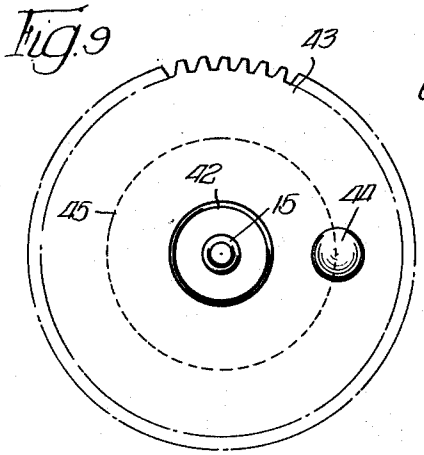


Fig. 15

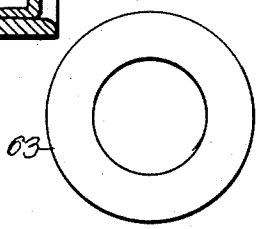


Fig. 16



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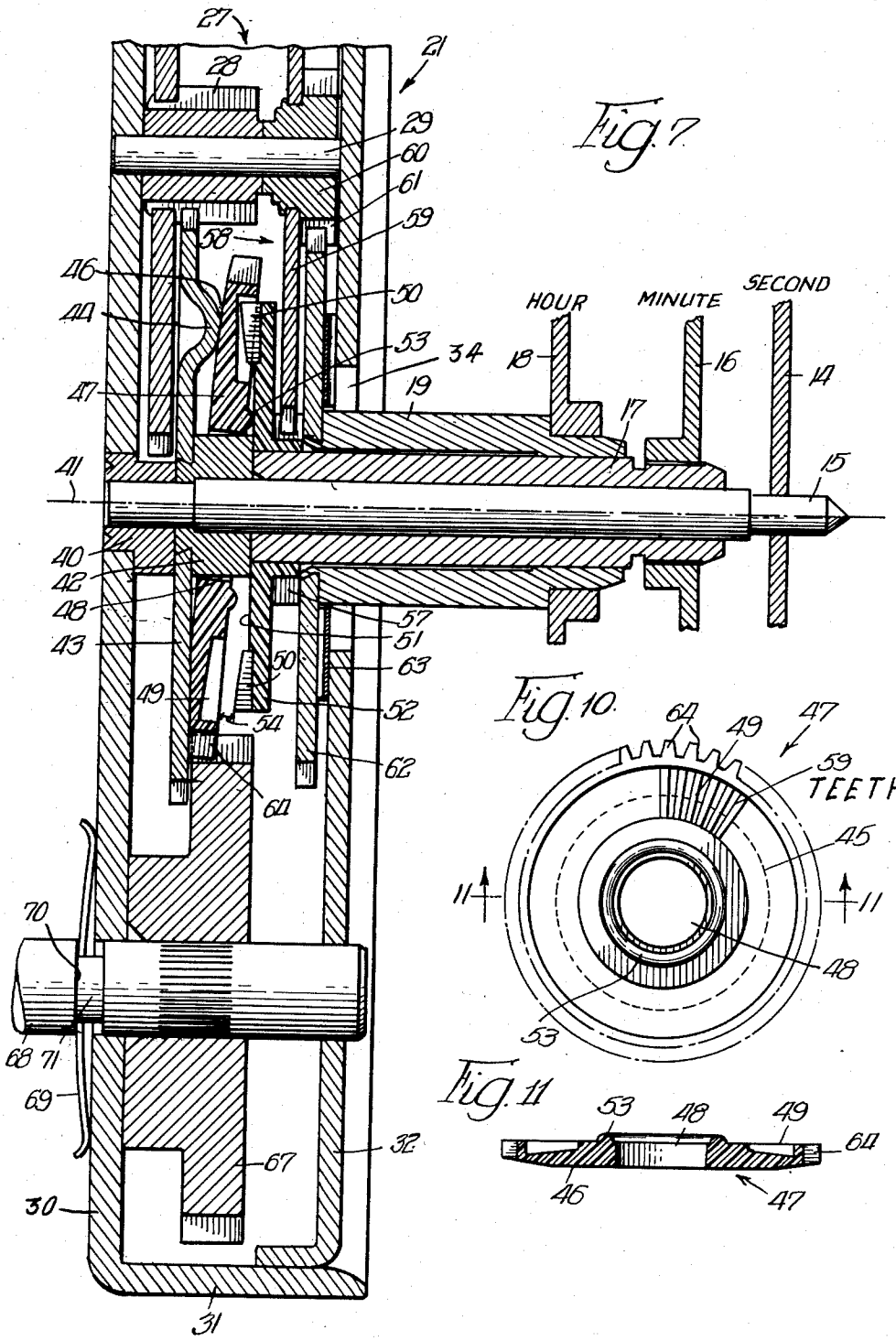


Fig. 7

Fig. 10.

Fig. 11

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Fig. 17

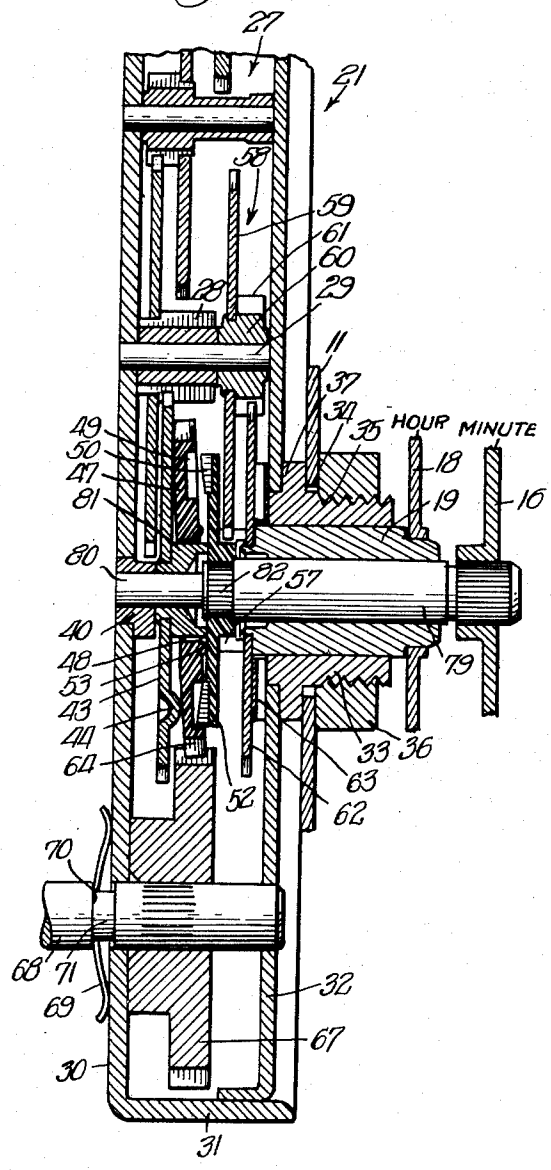


Fig. 12

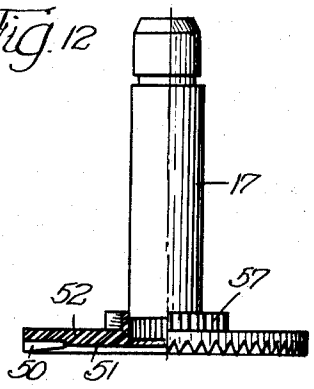


Fig. 13

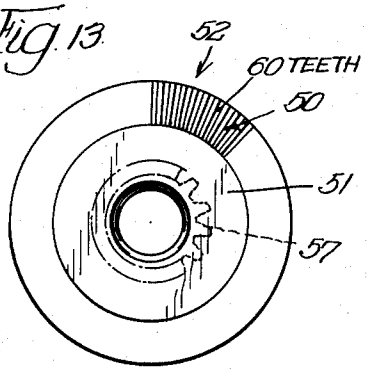
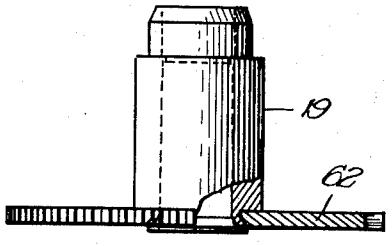


Fig. 14



United States Patent Office 3,190,066 Patented June 22, 1965

3,190,066

ELECTRIC CLOCK

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Filed Dec. 18, 1962, Ser. No. 245,539
3 Claims. (Cl. 58—26)

This invention relates, generally, to clocks and more particularly to secondary electric clocks.

Among the objects of this invention are: To provide a new and improved secondary clock construction; to mount the clock hands, i.e., the hour and minute hands and the second hand, if used, to rotate about a stationary axis; to minimize the space along the axis of rotation of the clock hands occupied by reduction gearing through which they are driven by a gear that rotates at a relatively high speed, i.e., at a speed of one revolution per minute; to employ for this purpose a wobble disc whose axis of wobble movement is coaxial with the axis of rotation of the clock hands; to cause the wobble movement by a spring acting in one direction on the wobble disc and a bump on a gear rotating at a speed of one revolution per minute acting on the wobble disc in the opposite direction; to position a minute hand disc for rotation along the axis of rotation of the clock hands in juxtaposition to the wobble disc with cooperating radially extending teeth on both discs, there being 60 teeth on the minute hand disc and 59 teeth on the wobble disc; to provide an annular fulcrum section on the wobble disc having small area contact engagement with a planar surface of the minute hand gear radially inwardly of the radially extending teeth thereon; to arrange the bump and the annular fulcrum section on the respective gear and disc in such relation that adequate clearance is maintained between the radial teeth on the discs that are out of engagement to permit relative rotation therebetween while providing a favorable lever ratio on opposite sides of the fulcrum section at the area of engagement therewith; to lock the wobble disc against rotation under normal operating conditions while permitting it to wobble; to combine locking means for the wobble disc with manually operable time setting means; and to set the time using either a direct or a flexible connection between a manually operable knob and the gear that locks the wobble disc against rotation.

In the drawings:

FIG. 1 is a view, in front elevation, of an electric clock embodying this invention.

FIG. 2 is a view, in side elevation, of the clock shown in FIG. 1.

FIG. 3 is a view, similar to FIG. 2, showing an alternate construction employing a flexible shaft to set the minute and hour hands of the clock.

FIG. 4 is a vertical sectional view taken through the synchronous motor and showing the gear case on which the motor is mounted, the gear train being omitted.

FIG. 5 is an elevational view of the gear case and gear train for the construction shown in FIG. 4, a portion of the cover plate having been removed in order to show the gear train.

FIG. 6 is a vertical sectional view of a portion of the gear box, the gear train being shown in section with the shafts for certain of the gears of the gear train being shown as if in the same vertical plane in order to illustrate more clearly the details of construction.

FIG. 7 is a view, at an enlarged scale, of the lower portion of the gear box 21 as shown in FIG. 6.

FIG. 8 is a view, in side elevation, of the second hand gear and its shaft.

FIG. 9 is a top plan view of the second hand gear and shaft as shown in FIG. 8.

FIG. 10 is a plan view of the wobble disc.

FIG. 11 is a sectional view taken generally along the line 11—11 of FIG. 10.

FIG. 12 is a view, partly in side elevation and partly in section, of the minute hand disc together with the minute hand sleeve on which it is mounted.

FIG. 13 is a plan view of the minute hand disc shown in FIG. 12.

FIG. 14 is a view, partly in side elevation and partly in section, of the hour hand gear and showing the hour hand sleeve on which it is mounted.

FIG. 15 is a view, in side elevation, of the spring washer that is employed for maintaining driving engagement between the radial teeth on the wobble disc and on the minute hand disc.

FIG. 16 is a view, in side elevation, of the spring washer shown in FIG. 15.

FIG. 17 is a view, similar to FIG. 6, showing the construction that is employed when the second hand and its shaft are not used.

Referring now particularly to FIGS. 1 and 2 of the drawings, it will be observed that the reference character 10 designates, generally, an electric clock of the secondary type in which the present invention is embodied. The electric clock 10 includes a support plate 11 on which a conventional clock face 12 is mounted having hour indications as indicated at 13. The electric clock 10 is provided with a second hand 14 which is mounted for rotation with a second hand shaft 15. Also it is provided with a minute hand 16 that is mounted for rotation on a minute hand sleeve 17 through which the second hand shaft 15 extends and with respect to which it is relatively rotatable. There is also an hour hand 18 that is mounted for rotation on an hour hand sleeve 19 through which the minute hand sleeve 17 extends and with respect to which it is rotatable. The various clock hands are driven by a synchronous motor that is indicated, generally, at 20 and is mounted on one side of a gear box that is indicated, generally, at 21. The synchronous motor 20 may be constructed as disclosed in W. P. Gallagher et al. Patent No. 2,701,848, issued February 8, 1955. The motor 20 is arranged, as will be understood, to be energized from a source of 60 cycle alternating current preferably operating at a voltage of about 117 volts.

FIG. 4 shows certain of the details of construction of the synchronous motor 20. Here it will be observed that it includes a field winding 24 that is arranged to be energized from the 60 cycle 117 volt alternating current source above referred to. A suitable magnetic field structure is provided, as described in the patent above referred to, for effecting rotation of a rotor 25 at a speed that is synchronized with the frequency of the alternating current supply. The rotor 25 is arranged to drive a pinion 26. As shown more clearly in FIGS. 5 and 6 of the drawings the pinion 26 is arranged to drive a gear train as indicated, generally, at 27 which is located within the gear box 21. The gear train 27 includes a final pinion 28 that is rotatably mounted on a shaft 29 which is secured to and extends laterally from a bottom plate 30 of the gear box 21. The bottom plate 30 is formed integrally with a side wall 31 that is arranged to receive a cover plate 32 as shown more clearly in FIG. 4.

Mounted on the cover plate 32 is a mounting bearing bushing 33. One end of the bushing 33 is securely fastened to the cover plate 32 while the other end extends through an opening 34, FIG. 6, in the support plate 11. The end of the bushing 33 that extends through the opening 34 is threaded for receiving a clamp nut 36 which, when tightened, serves to cause the support plate 11 to be gripped on opposite sides between the clamp nut 36 and a shoulder 37 that is formed integrally with and extends radially from the bushing 33. Attention is called to the fact that the hour hand sleeve 19 is journaled in the

mounting bearing bushing 33 and that, as shown in FIG. 6, the minute hand sleeve 17 is journaled in the hour hand sleeve 19 while the second hand shaft 15 is journaled in the minute hand sleeve 17.

Referring now to FIG. 7 of the drawings, which is an enlargement of the lower portion of the gear case 21 shown in FIG. 6, it will be noted that a bearing 40 is secured to the bottom plate 30 and that one end of the second hand shaft 15 is journaled therein. Here it will be understood that the second hand shaft 15 rotates about a fixed axis that is indicated by a broken line 41. Since the minute hand sleeve 17 is journaled on the second hand shaft 15 and the hour hand sleeve 19 is journaled on the minute hand sleeve 17, the second hand 14, minute hand 16 and hour hand 18 all rotate about the same axis which, as pointed out, is indicated by the broken line 41.

A bushing 42 is secured to the second hand shaft 15 and it rotates conjointly therewith. One side of the bushing 42 bears against the juxtaposed side of the bearing 40 thereby limiting movement endwise of the second hand shaft 15 in that direction. A second gear 43 is secured to and rotates with the bushing 42. The second gear 43 is provided with gear teeth along its periphery which mesh with the gear teeth of the final pinion 28. The reduction provided by the gear train 27 from the pinion 26 to the second gear 43 is such that the latter rotates at a speed of one revolution per minute. Since the second hand 14 is mounted on the second hand shaft 15 it makes one revolution per minute as is conventional. It remains to describe how the minute hand 16 and hour hand 17 are rotated at their proper speeds by rotation of the second gear 43 at a speed of one revolution per minute.

For this purpose a laterally extending bump 44 is formed in the second gear 43 intermediate its periphery and its center. The bump 44 is also shown in FIGS. 8 and 9 and in the latter the reference character 45 indicates the path of rotation of the laterally extending bump 44, the path being indicated by the circular broken line. The laterally extending bump 44 on the second gear 43 is arranged to have contact engagement along the circular path 45 with a planar surface 46 on a wobble disc that is indicated, generally, at 47 in FIGS. 10 and 11. The wobble disc 47, which is formed of a suitable plastic, such as nylon, has a central clearance opening 48 through which the bushing 42 extends and with respect to which the wobble disc 47 is permitted to have a wobble movement along the fixed axis indicated by the broken line 41. In alignment with the path 45 of rotation of the laterally extending bump 44 on the second gear 43 the wobble disc 47 is provided on the opposite side with radial gear teeth 49 which are 59 in number for engagement with radial gear teeth 50 which are 60 in number that project laterally beyond a planar surface 51 of a minute disc 52 which is fast on and rotates with the minute hand sleeve 17 and is formed of suitable plastic, such as nylon. In FIG. 7 it will be noted that the location of the radial gear teeth 50, which are also shown in FIGS. 12 and 13, is opposite the laterally extending bump 44 and thereby the radial gear teeth 50 are in alignment with the circular path 45 of the bump 44. Inwardly of the radial gear teeth 49 on the wobble disc 47 is an annular fulcrum section 53. Limited area contact engagement is provided between the planar surface 51 of the minute disc 52 and the annular fulcrum section 53 as the wobble disc 47 wobbles about the axis 41 as caused by rotation of the laterally extending bump 44. Attention is called to the fact that the radial gear teeth 49 in the wobble disc 47 are recessed below the plane of the annular fulcrum section 53 while the radial gear teeth 50 on the minute disc 52 project from the planar surface 51 of the minute disc 52. The relationship between the radial gear teeth 49 and 50 and the annular fulcrum section 53 is such that a clearance 54, FIG. 7, is maintained with the engagement between the gear teeth being limited to those that are directly opposite the laterally extending bump 44.

As a result of the provision of 59 teeth 49 on the wobble disc 47 and 60 teeth 50 on the minute gear 52, the minute hand sleeve 17 is rotated at a speed of one revolution per hour and, since the minute hand 16 is mounted thereon it rotates at this speed as is conventional for a clock.

Formed integrally with the minute disc 52 is a pinion 57 that is arranged to drive a reduction gear train, shown generally at 58, for driving the hour hand sleeve 19. The reduction gear train 58 includes a gear 59 that meshes with the pinion 57 and is mounted for rotation with a hub 60 that is rotatably mounted on the shaft 29. A pinion 61 is formed integrally with the hub 60 and it drives an hour gear 62 which is fast on the hour hand sleeve 19. The reduction provided by the reduction gear train 58 is such that the hour hand sleeve 19 and the hour hand 18 rotatable therewith rotate at a speed of one revolution every twelve hours.

In order to maintain the radial gear teeth 49 and 50 in driving engagement where they are in alignment with the laterally extending bump 44 a spring washer 63, FIGS. 15 and 16, is interposed between the inside of the cover plate 32, FIG. 7, and the juxtaposed side of the hour gear 62. Here it will be observed that the other side of the hour gear 62 bears against the pinion 57 that is integral with the minute disc 52 the other side of which bears against the juxtaposed surface of the bushing 42 which it will be recalled bears against the bearing 40. In this manner the minute disc 52 is urged resiliently toward the wobble disc 47 by the spring washer 63 so that the desired driving engagement between the radial gear teeth 49 and 50 is maintained opposite the laterally extending bump 44 while the required clearance 54 is maintained opposite this position and the required clearance is maintained between those radial gear teeth that are not in driving engagement to the end that the minute disc 52 can rotate relative to the wobble disc 47 which is prevented from rotating and normally only has the wobble movement along the axis 41.

It is possible to set the minute hand 16 and the hour hand 18 by rotating manually the minute hand 16 and thereby the hour hand 18 through the reduction gear train 58. When this procedure is followed, the wobble disc 47 rotate conjointly with the minute gear 52. It may not be feasible to employ this arrangement for setting the time in view of the fact that ordinarily a glass cover overlies the clock hands.

In accordance with this invention provision is made for manually setting the position of the wobble disc 47 and thereby the positions of the minute hand 16 and hour hand 18. For this purpose gear teeth 64 are provided along the periphery of the wobble disc 47 and they are arranged to mesh with the teeth of a setting gear 67. It will be noted that the width of the gear teeth on the setting gear 67 is such as to maintain driving engagement with the gear teeth 64 throughout any position thereof as they move back and forth in conformity with the wobble movement of the wobble disc 47. The setting gear 67 is rotatable with a rigid shaft 68 that is journaled in the bottom plate 30 and cover plate 32 of the gear box 21. A friction spring 69 bears against a shoulder 70 that defines one side of an annular groove 71 in the shaft 68 and its ends frictionally engage the outer surface of the bottom plate 30. The frictional engagement between the spring 69 and the bottom plate 30 is such as to prevent rotation of the shaft 68 and thereby of the setting gear 67. Accordingly, the normally held setting gear 67 meshing with the teeth 64 along the periphery of the wobble disc 47 functions to prevent rotation thereof while permitting it to have the wobble movement under the control of the laterally extending bump 44. At its outer end, as shown in FIGS. 2 and 4 of the drawings, the rigid shaft 68 has a knurled knob 72 secured thereto. This facilitates manual rotation of the setting gear 67 to set the minute and hour hands 16 and 18. They can be set

in either direction without harming the driving mechanism.

The rigid shaft **68** normally extends rearwardly from the gear box **21**. There are some applications of the clock **10** where it is not feasible to set it from the rear. Accordingly, as shown in FIG. 3, a flexible shaft, illustrated generally at **73**, can be employed for connection to the rigid shaft **68** which, in this case, is somewhat shorter than as shown in FIGS. 2 and 4. A flexible wire **74** extends from the end of the rigid shaft **68** to a knurled knob **75** and it is surrounded by a helical spring **76**. The use of the flexible shaft **73** permits the location of the knurled knob **75** at positions other than immediately to the rear of the gear box **21**. For example, the flexible shaft **73** can extend downwardly with the knurled knob **75** being located below the electric clock **10** as permitted by the length of the flexible shaft **73**. Alternatively the knurled knob **75** can be journaled in the support plate **11** at a location where it is accessible from the front. Other locations can be used within the length of the flexible shaft **73**.

FIG. 17 shows a construction employing a gear reduction provided by the wobble disc **47** without using the second hand **14** and its shaft **15**. In the construction here shown a minute shaft **79** is employed on which the minute hand **16** is mounted. It has a reduced diameter section **80** that is journaled in the bearing **40** which is carried by the bottom plate **30** of the gear box **21**. A bushing **81** is rotatably mounted on the reduced diameter section **80** of the minute shaft **79** and it functions in plate of the bushing **42** to permit the wobble movement of the wobble disc **47**. The second gear **43** is fast on the bushing **81** and its radial gear teeth **49** cooperate with the radial gear teeth **50** on the minute gear **52** which, in this construction, is fast on a knurled section **82** which forms a part of the minute shaft **79** between the portion thereof that is journaled in the hour hand sleeve **19** and the reduced diameter section **80**. Since the remainder of the construction shown in FIG. 17 is the same as described hereinbefore where the second hand **14** and the second hand shaft **15** are employed, the same will not be repeated.

It is advantageous to construct the wobble disc **47** and the cooperating minute disc **52** as described of plastic material, such as nylon. This material provides a degree of flexibility that is not present when metal is used. Since the plastic material is somewhat yielding in character, there is less likelihood of binding action developing between the radial gear teeth **49** and **50** on the respective disc with the result that, if a binding condition should occur, the disc flex or wrap sufficiently to overcome this obstruction and continue to move to transmit torque therethrough.

What is claimed as new is:

1. In an electric clock having a synchronous motor for driving time indicating means, means for interconnecting said motor and said time indicating means comprising: a second gear adapted to be driven by said synchronous motor to rotate about a fixed axis at a speed of one revolution per minute and having a bump extending laterally therefrom, a wobble disc mounted in juxtaposition to said second gear to wobble about said fixed axis as caused by rotation of said bump, means normally preventing rotation of said wobble disc, a minute disc for driving said time indicating means mounted in juxtaposition to said wobble disc to rotate about said fixed axis, the adjacent faces of the wobble disc and minute disc having interengaging gear teeth, there being fifty-nine teeth on said wobble disc and sixty teeth on said minute disc whereby said minute disc rotates at a speed of one revolution per hour, an annular fulcrum section on said wobble disc radially inwardly of said gear teeth thereon, and an annular planar surface section on said minute disc radially inwardly from said gear teeth thereon engageable with said annular fulcrum section about which said wobble disc wobbles under the control of said bump on said second gear.

2. In an electric clock having a synchronous motor for driving time indicating means, means for interconnecting said motor and said time indicating means comprising: a second gear adapted to be driven by said synchronous motor to rotate about a fixed axis at a speed of one revolution per minute and having a bump extending laterally therefrom, a wobble disc mounted in juxtaposition to said second gear to wobble about said fixed axis as caused by rotation of said bump, means normally preventing rotation of said wobble disc, a minute disc for driving said time indicating means mounted in juxtaposition to said wobble disc to rotate about said fixed axis, the adjacent faces of the wobble disc and minute disc having interengaging gear teeth, there being fifty-nine teeth on said wobble disc and sixty teeth on said minute disc whereby said minute disc rotates at a speed of one revolution per hour, an annular fulcrum section on said wobble disc radially inwardly of said gear teeth thereon and extending laterally from the plane thereof, and an annular planar surface section on said minute disc radially inwardly from said gear teeth thereon and located laterally from the plane thereof and engageable with said annular fulcrum section about which said wobble disc wobbles under the control of said bump on said second gear.

3. In an electmric clock having a synchronous motor for driving time indicating means, means for interconnecting said motor and said time indicating means comprising: a second gear adapted to be driven by said synchronous motor to rotate about a fixed axis at a speed of one revolution per minute and having a bump extending laterally therefrom, a wobble disc mounted in juxtaposition to said second gear to wobble about said fixed axis as caused by rotation of said bump, gear teeth along the periphery of said wobble disc, a setting gear having gear teeth in driving engagement with said gear teeth of said wobble disc, means cooperating with said setting gear to prevent rotation thereof and thereby rotation of said wobble disc, a minute disc for driving said time indicating means mounted in juxtaposition to said wobble disc to rotate about said fixed axis, the adjacent faces of the wobble disc and minute disc having interengaging gear teeth, there being fifty-nine teeth on said wobble disc and sixty teeth on said minute disc whereby said minute disc rotates at a speed of one revolution per hour.

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