July 14, 1931. R. E. MALLES 1,813,942

FREQUENCY INDICATOR

Filed Nov. 26, 1927

FIG. 2

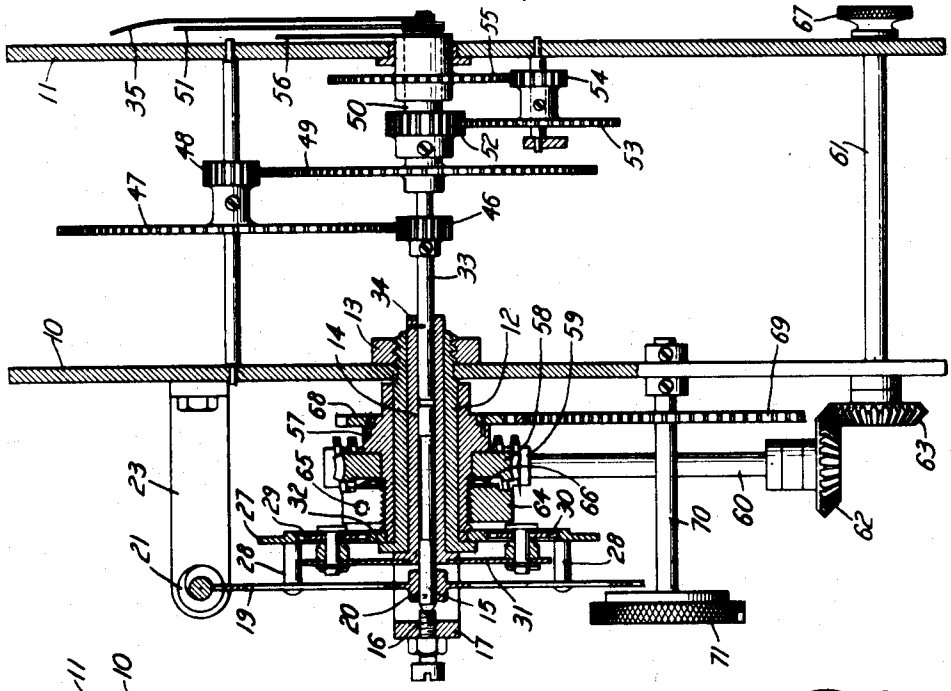
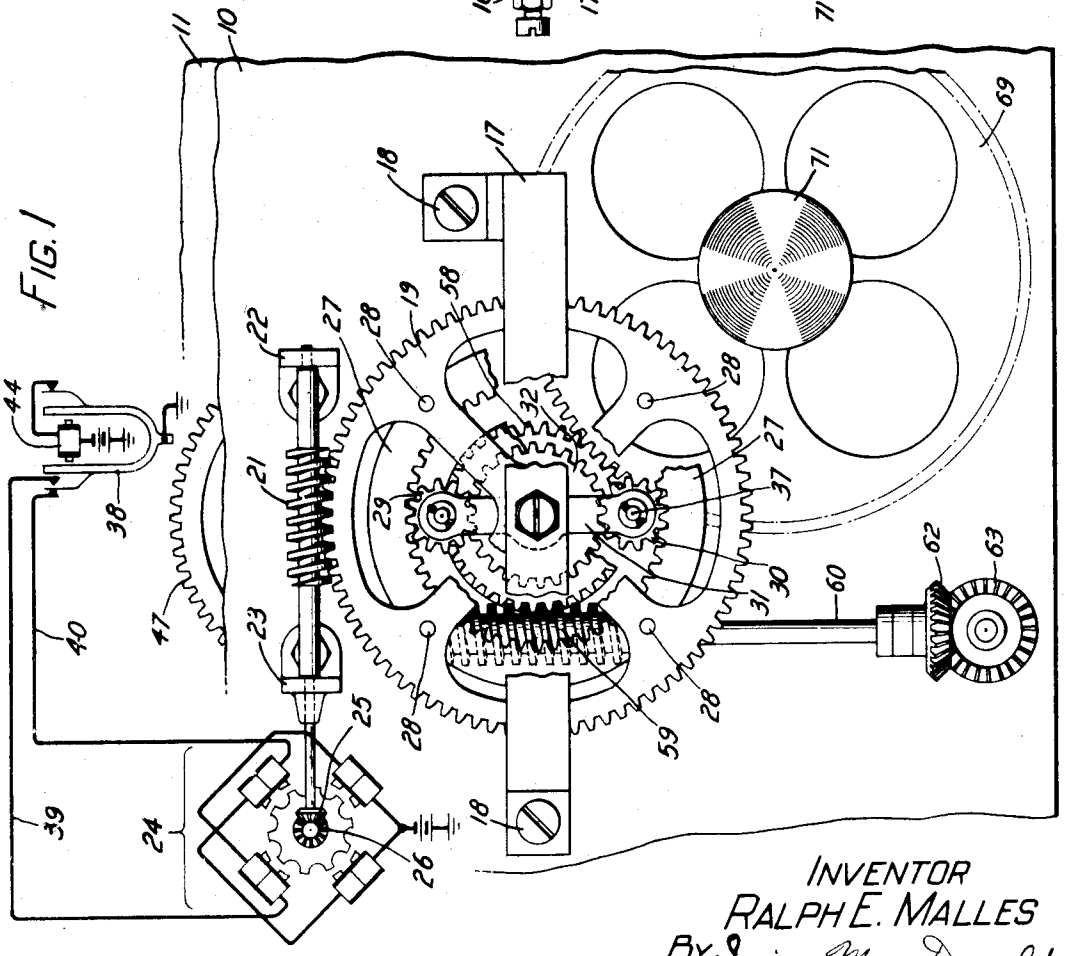


FIG. 1



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Patented July 14, 1931 1,813,942

UNITED STATES PATENT OFFICE

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FREQUENCY INDICATOR

Application filed November 26, 1927. Serial No. 235,831.

This invention relates to clock driving mechanism and more particularly to clocks driven by synchronous motors.

The object of this invention is to provide means for adjusting the hands of the clock without disturbing the synchronism of the motor. The invention is particularly well adapted for use in the system of Patent No. 1,560,056 to J. W. Horton issued November 3, 1925 wherein a tuning fork oscillation generator is used as a standard frequency source to calibrate other oscillation generators. The output of this generator also drives the synchronous motor of a clock which serves to count and indicate the frequency of the generator in order that the constancy of the primary generator frequency may be compared with another standard.

In accordance with this invention, an adjusting mechanism is provided for the clock whereby the hands may be turned in either direction while the drive is in motion without the addition of friction which would disturb the synchronism of the driving motor. More specifically, the connection between the motor and clock drive comprises a worm on the motor shaft and a worm gear on the clock drive to which gear is attached the internal or ring gear of a system of planetary gearing. The ring gear drives two planetary pinions mounted on an arm, the sun pinion, with which the planetary pinions mesh, remaining stationary. This arm is directly connected to the second hand shaft of a standard clock movement. The sun pinion can be revolved to set the hands of the clock movement either by a knob fastened to a spur gear on the drive proper, or by a worm and gear, the former providing for coarse, and the latter for fine, adjustments.

Other features of the invention and advantages will appear from the following description and by the claims appended thereto, reference being had to the accompanying drawings, in which:

Fig. 1 is an assembly view of the device showing the driving motor and its operating circuit schematically; and

Fig. 2 is a side view of the device showing a portion of the indicators' operating mechanism in section.

The device of this invention consists of supporting plates 10 and 11 which may be held in spaced relation by a number of ordinary spacing members not shown.

In plate 10 there is mounted a bushing 12 which extends laterally therefrom and secured by means of nut screw 13. In bushing 12 there is rotatably mounted a bushing 14 in which the shaft 15 is rotatably mounted and held against lateral movement therein by an end thrust bearing in the form of adjustable screw 16 which is supported by bracket 17, this bracket being in turn fastened to frame plate 10 by screws 18. On the outer extending end portion of shaft 15 there is mounted a worm gear 19 keyed thereon by pin 20. This wheel meshes with a worm screw 21 which is journaled at each end portion in brackets 22 and 23 in turn secured on frame plate 10. Worm screw 21 is operatively connected to a synchronous motor 24 by miter gears 25 and 26. This motor is of ordinary construction and operates on current impulses of 60 cycles per second generated by tuning fork 38 of an oscillator circuit, not shown. The electrical connections between the tuning fork and motor are through an obvious circuit.

Worm gear 19 carries an internal or ring gear 27 secured thereon by a number of laterally extending posts 28. Gear 27 meshes with two satellite pinions 29 and 30 mounted on their respective spindles 36 and 37 carried by a yoke 31. Pinions 29 and 30 in turn mesh with a normally stationary rack or pinion 32. Yoke 31 is secured on the outer end portion of bushing 14 which is keyed to shaft 33 by a pin 34. On the other end portion of shaft 33 there is mounted the second hand 35 of the clock.

As shown in Fig. 2 the movement of shaft 33 to which the hand 35 is connected is made use of for driving the minute and hour hands through an ordinary clock reduction gear mechanism. The movement of shaft 33 is imparted to the minute hand through pinion 46 secured on shaft 33, intermediary gears 47 and 48, gear 49 having a hub por-

tion 50 on the outwardly extending end portion of which the minute hand 51 is mounted. The movement of sleeve 50 is imparted to the hour hand 56 by pinion 52 keyed on hub portion 50. This pinion meshes with intermediary gear 53 carrying pinion 54, in turn engaging gear 55 on the hub portion of which the hour hand 56 is mounted. Through the movement of the hands 35, 51 and 56 the frequency of the generator may thus be conveniently checked. The hands may be adjusted on the time marks by means of fine and coarse setting mechanisms which will be hereinafter described. The fine adjustment mechanism comprises sun pinion 32 secured on a bushing 57 which in turn is loosely mounted on bushing 12. On bushing 57 there is loosely mounted a worm gear 58 which meshes with worm screw 59. This worm screw is keyed on shaft 60 which in turn is operably connected to shaft 61 through miter gears 62 and 63. On bushing 57 there is mounted a collar 64 which may be moved in adjusted position on the threaded portion of bushing 57 and set thereon by screw 65. This collar cooperates with a spring ring 66 and worm gear 58 to form a friction clutch device for rotating sun pinion 32 by the manual operation of knob 67 on shaft 61 and for permitting the movement of sleeve 57 and sun pinion 32 carried thereby under control of a coarse adjustment mechanism which comprises knob 71 mounted on shaft 70, and spur gear 69 engaging gear 68 on sleeve 57.

In the operation of the device the movement of motor 24 under control of tuning fork 38 is effective to operate worm gear 19 and ring gear 27 carried thereby through miter gears 25 and 26 and worm screw 21. Ring gear 27 imparts its movement to satellite pinions 29 and 30 which mesh with the sun pinion 32 and thereby operate yoke 31 and the second hand 35 carried thereby. Now assume that the speed of the tuning fork is fast or slow with respect to signals from the master clock and that it is desired to retard or advance the hand 35. This is accomplished by the operation of knob 71 actuating the coarse adjustment mechanism from the rear of the panel, or knob 67 actuating the fine adjustment from the front of the panel. The movement of knob 67 is effective to turn sleeve 57 and rack or sun pinion 32 carried thereby through the friction clutch which includes as above stated spring washer 66 and collar 64. The movement of this pinion is effective to impart a relative movement to satellite pinions 29 and 30 and therefore to yoke 31 with respect to the movement imparted thereto by internal gear 27 for changing the position of hand 35.

The setting of hand 35 may also be effected through the movement of knob 71 of the coarse adjustment setting mechanism in a manner similar to that described in connection with the fine adjustment above referred to. It is obvious that the movement of shaft 33 and hand 35 carried thereby is effective to move the pointers 56 and 51 through the gear reduction trains above described an amount proportional to that of hand 35 in a manner similar to that of an ordinary clock mechanism.

In each setting operation of the hands the movement of sun pinion 32 as above described does not materially affect or change the torque carried by the motor which permits the motor to turn at any instant in accurate synchronism with the tuning fork.

What is claimed is:

1. A clock driving mechanism comprising a synchronous motor, a clock reduction gearing and clock hands driven thereby, a gear reduction train including a yoke operated by said motor to drive the hands of the clock through said gearing, and manually operable means mounted on the clock for moving said yoke in either direction without disturbing the synchronism of the motor.

2. A clock driving mechanism comprising a synchronous motor, a clock reduction gearing and second, minute and hour hands driven thereby, a gear reduction train for transmitting the movement of the motor to the clock reduction gearing including a ring gear driven by the motor, a normally stationary sun pinion, a yoke, planetary pinions carried thereby and meshing with said ring gear and sun pinion, said yoke being connected to said second hand, a knob on the clock, and gearing connecting said knob and sun pinion whereby the sun pinion may be rotated in either of two directions for actuating the clock hands.

3. In an indicator mechanism, a synchronous motor, a driven shaft, a gear mechanism operatively connecting the motor shaft to said driven shaft, a hand carried by the driven shaft, said mechanism including an annular gear actuated by the motor, a normally stationary gear mounted concentric with the annular gear, a pair of gears mounted on said driven shaft and intermeshing with the annular and normally stationary gear, and manually operable means for rotating the normally stationary gear for changing the angular relation of the driven shaft with respect to the motor shaft in either of two directions.

In witness whereof, I hereunto subscribe my name this 16th day of November A. D. 1927.

RALPH E. MALLES.