April 30, 1940. W. E. MULLAN 2,198,632

CLOCK SYNCHRONIZING AND SETTING DEVICE

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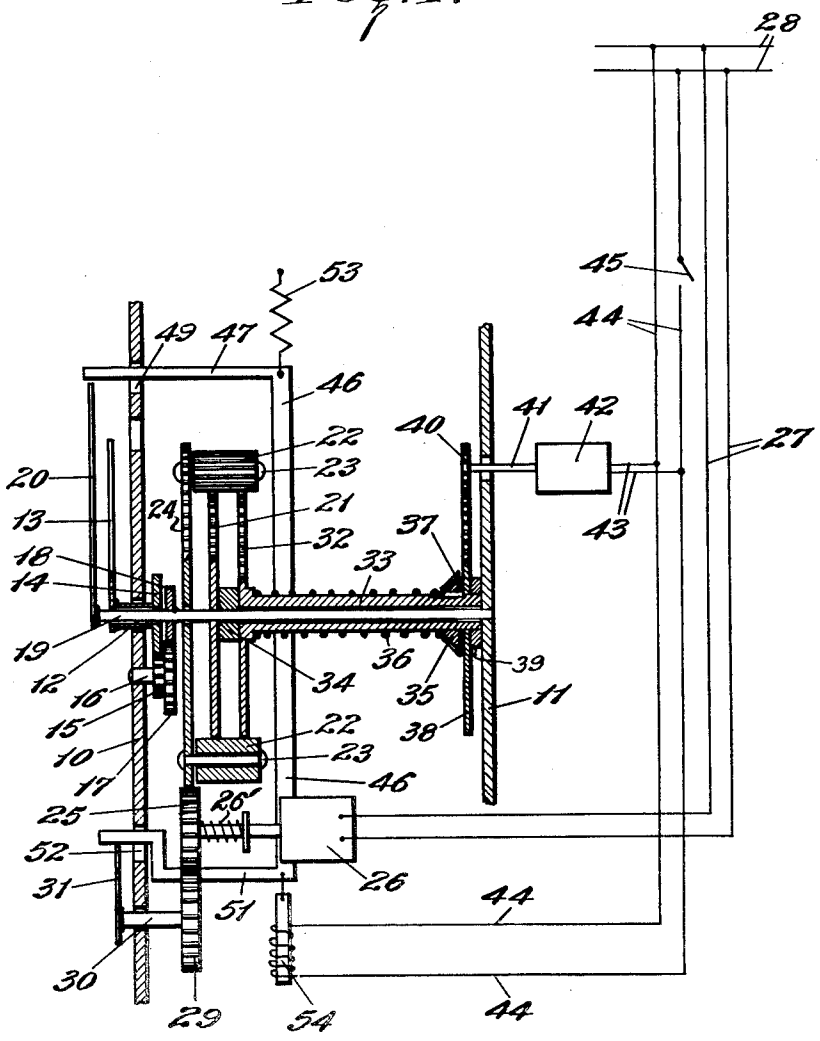
Fig. 1.



INVENTOR
William E. Mullan
BY
Robert A. Lavender
ATTORNEY

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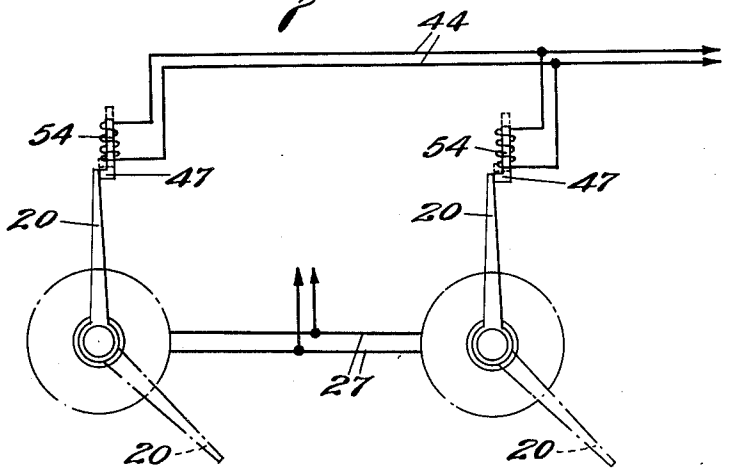
Fig. 2.



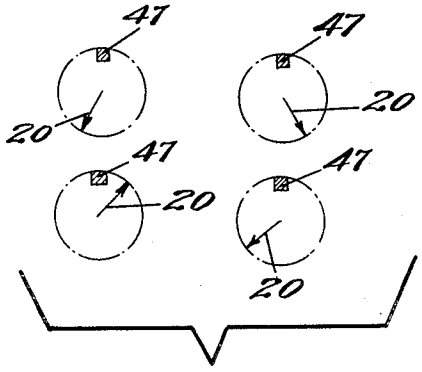


Fig. 3.

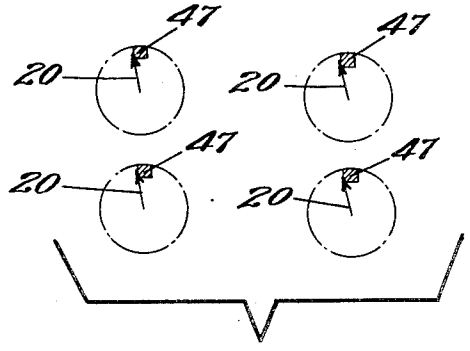


Fig. 4.

INVENTOR
William E. Mullan
BY
Robert A. Terrell
ATTORNEY

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2,198,632

CLOCK SYNCHRONIZING AND SETTING DEVICE

William Evans Mullan, United States Navy

Application March 28, 1936, Serial No. 71,493

4 Claims. (Cl. 58—34)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

This invention relates to clocks, and it has a particular relation to synchronizing and setting devices therefor.

One of the objects of the present invention is the provision of means for setting a clock accurately to the second in accordance with a time signal.

Another object of the invention is the provision of a system for simultaneously setting a plurality of clocks upon the receipt of a time signal so that all of the clocks will operate in synchronism and indicate the same time.

With these and other objects in view, as well as other advantages which may be incident to the use of the improvements, the invention consists of the parts and combinations thereof hereinafter set forth and claimed, with the understanding that the several necessary elements constituting the same may be varied in proportion and arrangements without departing from the nature and scope of the invention, as defined in the appended claims.

In order to make the invention more clearly understood, there are shown in the accompanying drawings means for carrying the invention into practical effect, without limiting the improvements in their useful application to the particular construction, which, for purpose of explanation, have been made the subject of illustration.

In the accompanying drawings:

Fig. 1 is a fragmentary diagrammatic vertical sectional view of a clock embodying the present invention;

Fig. 2 is a diagrammatic view of a plurality of clocks connected in a circuit by means of which they may be set and operated in synchronism;

Fig. 3 is a diagrammatic view of a group of four clocks, the time-indicating hands being shown out of synchronism, but with the individual time-setting stops occupying positions to arrest the hands at the same point on the respective dials; and

Fig. 4 is a similar view with the hands of the clock arrested by the stops at the same time and in positions to be simultaneously released when the time signal is received.

Referring to the drawings, and particularly to Fig. 1 thereof, a clock embodying the present invention is shown as comprising a front or dial plate 10 and a back plate 11, secured to the plate 10 in spaced relation thereto in any suitable manner, not shown. Rotatably mounted in the front plate 10 is a sleeve 12 having an hour hand 13 fixed thereto at its forward end, and a gear 14 fixed to its rear end for engagement with a gear 15. The gear 15 is journalled on a stud shaft 16 mounted in the front plate 10 and is fixed to the face of a slightly larger gear 17, driven by a gear 18 fixed to a shaft 19. This shaft is rotatably mounted in the sleeve 12 and the back plate 11 and has a minute hand 20 fixed to its extreme forward end. Thus, it will be apparent that the gears 14, 15, 17 and 18 will transmit the rotary motion of the minute hand shaft 19 to the sleeve 12 of the hour hand, the ratio of said gears being such as to obtain the proper reduction.

A gear 21 of relatively large diameter is fixed to the shaft 19 for intermeshing engagement with a pair of diametrically disposed planetary pinions 22. These pinions are journalled on stud shafts 23 fixed to the face of a gear 24, rotatably mounted on the shaft 19, and are driven at the proper speed by a drive gear 25 through the medium of suitable reduction gear, not shown. The gear 25 is driven by a suitable main power means such as a synchronous motor 26, through the medium of a suitable slip connection 26'. The motor 26 is constantly energized by electric current supplied thereto through wires 27 from the main bus line 28. This main power means may, however, be a spring motor of any preferred design. The gear 25, also through suitable reduction gearing, not shown, drives a gear 29, fixed to a shaft 30 carrying a second hand 31. The ratio of the gears 25, 29 and intermediate reduction gearing is such as to drive the second hand 31 at the proper speed.

The planetary pinions 22 also mesh with a gear 32 fixed to the forward end of a sleeve 33, mounted for relative rotation upon the shaft 19, but spaced from the gear 24 by a spacing washer 34. A mitered setting gear 35, the associated parts not being shown, is keyed for axial sliding movement upon the rear end of the sleeve 33 and is urged in a rearward direction by a coil spring 36, surrounding the sleeve 33 between the gear 35 and the gear 32. The gear 35 engages a friction washer 37 interposed between this gear and a setting gear 38. Mounted for relative movement on the sleeve 33 in abutting engagement with a spacing washer 39, disposed between this gear and the back plate 11. By means of this construction and arrangement the gear 32, sleeve 33 and parts carried thereby, are normally maintained stationary through friction between the parts, but may at times be rotated against this frictional resistance in order to set the clock, as will presently be described, by means of a

gear 40 which meshes with the setting gear 38. The gear 40 is fixed to a shaft 41 of resetting motor 42, at times energized by electric current supplied thereto by wires 43 and 44 from the bus line 28, the circuit being controlled by a normally open switch 45. The motor 42 may be of the reversible type, or other suitable design, so that the clock may be set by rotating the hands either in a clockwise or counterclockwise direction.

In order to effect relative movement between the gears 21 and 32 so as to rotate the shaft 19 under normal conditions, these gears are formed with different numbers of teeth. For example, the gear 21 may be provided with sixty teeth, and the gear 32 with fifty-eight teeth. As a result, when the pinions 22 are revolving around the gears 21 and 32 and the gear 32 is stationary, due to the frictional drag thereon, as is normally the case, for each complete revolution of the pinions 22 about the gear 32 these pinions will be lacking a complete revolution about the gear 21 by an angle subtended by two teeth of this gear. Therefore, if the gears 21 and 32 have the assumed number of teeth, it will require thirty revolutions of the pinions 22 about these gears to impart a single rotation to the gear 21, which rotation will obviously be in a direction opposite to the direction of revolution of the pinions 22. The structure and operation hereinabove described is generally standard.

For the purpose of simplicity, the improved setting mechanism is herein shown as comprising a vertically extending bar 46 mounted for sliding movement in suitable guides, not shown. This bar is provided at its upper end with an arm 47 which extends forwardly through a slot 49 in the front plate 10 for movement into and out of the path of the minute hand 20. The bar 46 is also provided at its lower end with an arm 51 extending forwardly through a slot 52 in the front plate 10 for movement into and out of the path of the second hand 31. The arms 47 and 51 are normally maintained in their inoperative elevated positions shown, by means of a spring 53 attached to the upper end of the bar 46. These arms, however, may at times be lowered into the path of movement of the hands 20 and 31, so as to arrest their movement, by means of an electro-magnet 54, operatively connected with the lower end of the bar 46. This electro-magnet is energized by electric current from the wires 44, supplying the reset motor 42 with energy.

In operation, let it be assumed that it is desired to set all of the hands of the clock to a given time, twelve noon for example, in accordance with a time signal received at such time. At a selected time, preferably just before the time signal is received, the switch 45 is manually closed, thus causing the electro-magnet 54 to be energized and move the bar 46 downwardly and the arms 47 and 51 into the path of movement of the minute and second hands 20 and 31, respectively. The closing of the switch 45 also causes the motor 42 to simultaneously be energized and, through the medium of the mechanism heretofore described, to rotate rapidly the time indicating hands 20 and 31 to their vertical positions adjacent to the noon hour or zero, where they are arrested temporarily by the stops 47 and 51. This accelerated movement of the hands is effected through the medium of the friction washer 37 and frictional connection 26' and without interrupting the operation of the motor 26, the washer 37 permitting slippage to occur between the motor 42 and the several hands when the movement of the latter is arrested by their respective stops. As soon as the time signal is received the switch 45 is opened, thereby de-energizing the reset motor 42 and electro-magnet 54, and permitting the released hands of the clock to proceed normally under the power of the motor 26, which has been functioning constantly during this setting operation.

The invention has thus far been described with reference to a single clock, but it may be incorporated in a multi-clock system illustrated diagrammatically in Figs. 2 to 4, wherein the hands of all of the clocks may be synchronized and reset by the manipulation of a single switch. In such a system it is only necessary to connect the constantly operating motors 26 with a single source of electric energy and the motors 42 and electro-magnet 54 with the same source through a circuit controlled by a single switch 45. In such event the operations hereinbefore explained will occur simultaneously with all of the clocks in the system. If the several clocks are out of synchronism, as illustrated diagrammatically in Fig. 3, the hands of the clocks will successively be arrested at the zero hour, slippage occurring between the several hands and their driving mechanism as soon as the movement of each is interrupted. When the time signal is received and the switch 45 is opened, the hands of all of the clocks will commence to move in synchronism.

Other modifications and changes in proportion and arrangement of the several necessary elements constituting the invention may be made by those skilled in the art, without departing from the nature and scope of the invention, as defined in the appended claims.

The invention herein described may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed is:

1. In combination with a clock including differential gear mechanism; a time indicating hand fixed to and driven by a portion of said mechanism; another time indicating hand connected to be driven by another portion of said mechanism; main power means for actuating said mechanism under normal conditions; hand setting means for arresting the movement of said hands at predetermined points in their paths of travel; reversible power means for at times actuating said mechanism selectively in opposite directions at an accelerated rate to rotate said hands toward said points when said hand setting means is actuated; and releasable means between said main power means and said mechanism, whereby when said reversible power means is actuated to set said hands backward against said hand setting means they will be held in engagement therewith against the action of said main power means until said hand setting means is released.

2. In combination with a clock including differential gear mechanism; a time indicating hand fixed to and driven by a portion of said mechanism; another time indicating hand connected to be driven by another portion of said mechanism; main power means for actuating said mechanism under normal conditions; hand setting means for arresting the movement of said hands at predetermined points in their paths of travel; reversible power means for at times actuating said mechanism selectively in opposite directions at an accelerated rate to rotate said hands toward said points when said

hand setting means is actuated; and a clutch between said main power means and said mechanism, whereby when said reversible power means is actuated to set said hands backward against said hand setting means they will be held in engagement therewith against the action of said main power means until said hand setting means is released.

3. In combination with a clock including differential gear mechanism; a time indicating hand fixed to and driven by a portion of said mechanism; another time indicating hand connected to be driven by another portion of said mechanism; main power means for actuating said mechanism under normal conditions; hand setting means for arresting the movement of said hands at predetermined points in their paths of travel; reversible power means for at times actuating said mechanism selectively in opposite directions at an accelerated rate to rotate said hands toward said points when said hand setting means is actuated; and a slip connection between said main power means and said mechanism, whereby when said reversible power means is actuated to set said hands backward against said hand setting means they will be held in engagement therewith against the action of said main power means until said hand setting means is released.

4. In combination with a clock including differential gear mechanism; a time indicating hand fixed to and driven by a portion of said mechanism; another time indicating hand connected to be driven by another portion of said mechanism; main power means for actuating said mechanism under normal conditions; hand setting means for arresting the movement of said hands at predetermined points in their paths of travel; reversible power means for at times actuating said mechanism selectively in opposite directions at an accelerated rate to rotate said hands toward said points when said hand setting means is actuated; and a friction clutch between said main power means and said mechanism, whereby when said reversible power means is actuated to set said hands backward against said nand setting means they will be held in engagement therewith against the action of said main power means until said hand setting means is released.

WILLIAM E. MULLAN.