June 23, 1942. F. A. GREENAWALT 2,287,679

DIAL CLOCK

Filed Feb. 21, 1941 2 Sheets-Sheet 1

Fig. 1.

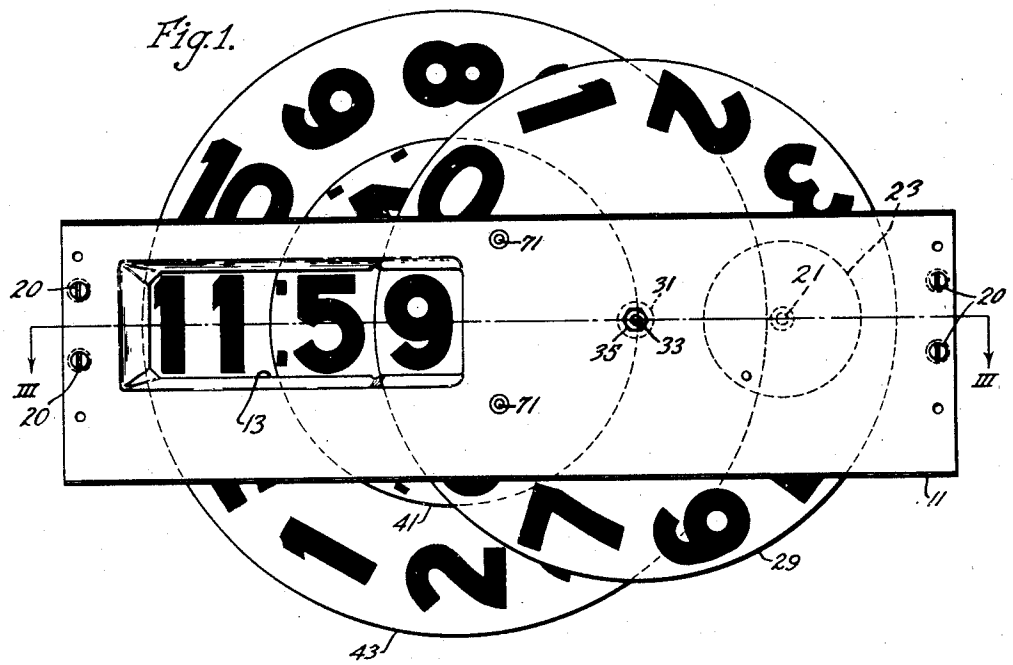
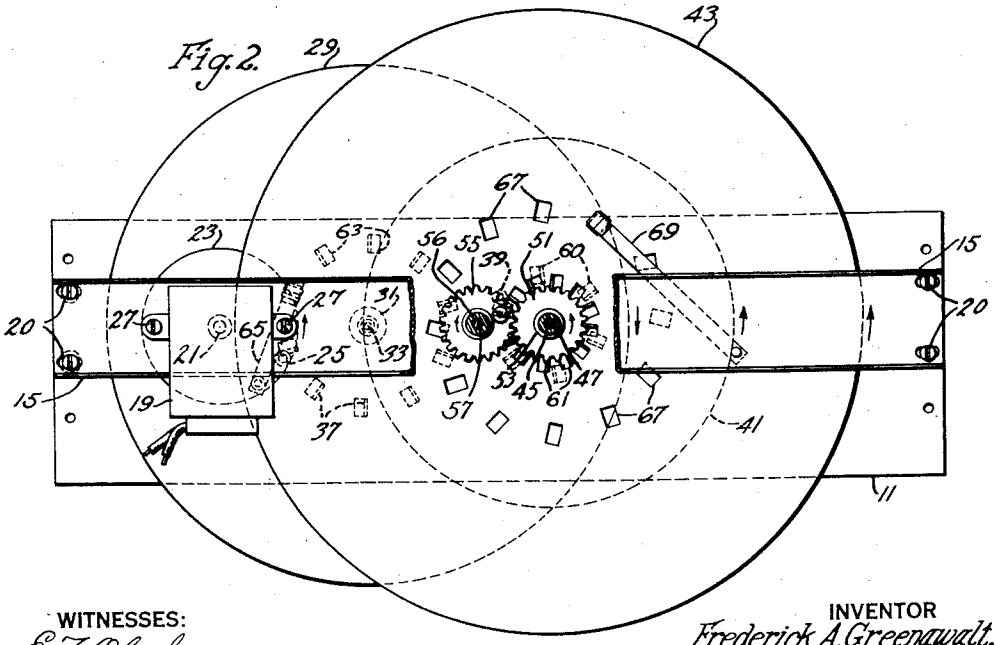


Fig. 2.



WITNESSES:
E. F. Oberheim
R. J. Fitzgerald

INVENTOR
Frederick A. Greenawalt.
BY N. M. Biebel
ATTORNEY

June 23, 1942. F. A. GREENAWALT 2,287,679

DIAL CLOCK

Filed Feb. 21, 1941 2 Sheets-Sheet 2

Fig. 3.

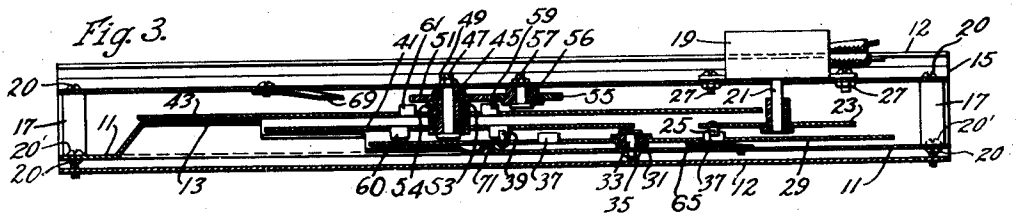


Fig. 4.

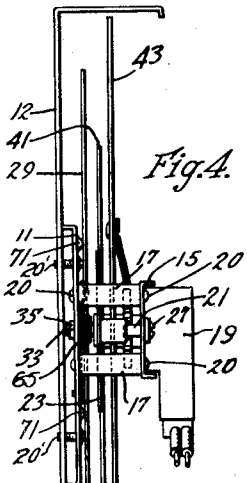


Fig. 5.

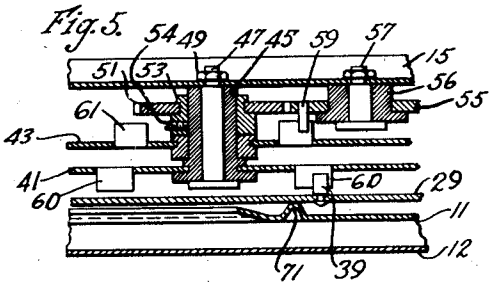
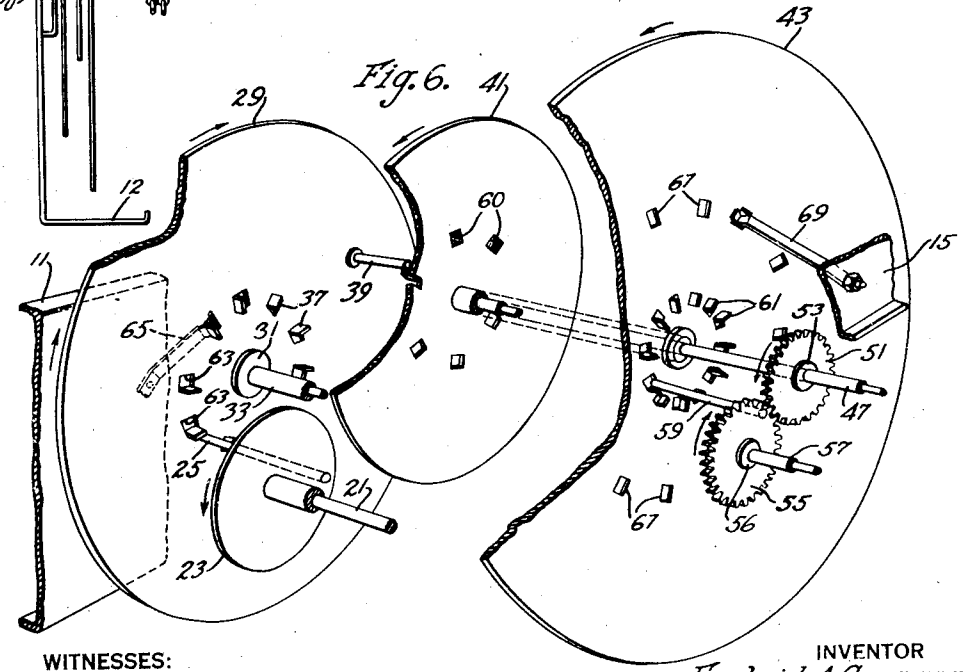


Fig. 6.



WITNESSES:

E. F. Oberheim.

R. J. Fitzgerald

INVENTOR

Frederick A. Greenawalt.

BY H. M. Biebel

ATTORNEY

Patented June 23, 1942 2,287,679

UNITED STATES PATENT OFFICE

2,287,679

DIAL CLOCK

Frederick A. Greenawalt, Columbus, Ohio

Application February 21, 1941, Serial No. 379,963

5 Claims. (Cl. 58—125)

My invention relates to clocks and particularly to dial type numeral clocks.

It is the main object of my invention to provide a dial type numeral clock comprising a minimum number of operating parts of relatively light weight, which can be easily and quickly assembled and which are relatively inexpensive.

Another object of my invention is to provide a dial type numeral clock structure that shall permit of varying the size of the numerals indicating the time of day and the size of the dial discs carrying these numerals with but relatively small changes in the construction except as to the size of the parts.

Another object of my invention is to provide relatively simple and inexpensive means to hold the dials in their stationary positions.

Other objects of my invention will either be apparent from a description of one form of my invention now preferred by me or will be pointed out hereinafter in the description and operation of this form of my invention and will be particularly set forth in the appended claims.

In the drawings,

Figure 1 is a view in front elevation of the clock mechanism when not mounted in an enclosing casing,

Fig. 2 is a view in rear elevation thereof,

Fig. 3 is a longitudinal section through the clock mechanism taken on the line III—III of Fig. 1,

Fig. 4 is a view in end elevation thereof taken from the right-hand side of Fig. 1,

Fig. 5 is an enlargement of a part of Fig. 3 of the drawings showing more particularly the mounting of two of the dials, and,

Fig. 6 is an exploded perspective view of certain parts of the mechanism as seen from the rear thereof.

My clock structure comprises first of all a frame structure including a front frame plate 11 which frame plate is relatively narrow, relatively long and which may be of channel shape in lateral section. This front frame plate may be used to support the clock structure in a suitable casing or back of a metal frame 12 and is provided with an elongated opening 13 therein near the left-hand end of the frame plate as seen from the front thereof. A rear frame plate 15 is also provided which frame plate is also of relatively flat channel shape in lateral section and may be somewhat narrower than front frame plate 11. The two frame plates are mechanically connected as by short studs 17 into which small machine screws 20 may extend, these screws passing through the front and rear frame plates and having screw-threaded engagement with their studs 17. Frame 12 may be secured to plate 11 by screws 20' as shown in Fig. 4. As will be seen from Fig. 1 of the drawings, I may provide four such studs 17 in order to obtain a relatively rigid but light frame supporting the rest of the mechanism constituting my improved clock structure.

I provide as a motor means for causing turning movement of the respective number-bearing dials an electric motor 19 which is preferably of the sub-synchronous type and which I now prefer to mount on the frame secured to the rear frame plate 15 as is shown more particularly in Fig. 3 of the drawings. The speed of rotation of the motor shaft 21 is one revolution per minute and this shaft has mounted thereon a disc 23 which has mounted thereon a driving pin 25 which driving pin will therefore rotate through a complete revolution in one minute. It will be noted that I now prefer to support the motor by any suitable means such as short machine screws 27 outside of the frame, that is, against the back surface of frame plate 15 so that the shaft 21 will project through a small opening in frame plate 15 and the shaft is of such length that the disc 23 is positioned a short distance back of the front frame plate 11.

I provide a minute dial 29 which has printed thereon the numerals 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 in the proper sequence so that when the dial 29 is turned through a predetermined angular or peripheral distance once each minute the consecutive numerals appearing at the right-hand side of opening 13 will increase to indicate elapsed minutes of time. Dial 29 is rotatably supported as by a bushing 31 which is held in its proper operative position as by a small machine screw or stud 33 extending through the front frame plate 15 and which is held by a nut 35 threaded thereon. While I have shown a particular embodiment of a bearing, it is to be understood that I am not limited to the particular construction shown since any other bearing for supporting the dial 29 made of relatively thin sheet material may be utilized. The dial 29 is provided with ten integral punched-out ears or tabs 37 these bent-out ears being on a diameter considerably less than the outside diameter of the dial 29. It will be noted that the ears 37 have a flat surface and I now prefer to have one of these surfaces extend substantially radially from the axis on which the dial turns when the clock is in operation. It will be noted that the

number of bent-out ears 37 corresponds to that of the total number of numerals imprinted or otherwise shown on the dial adjacent the periphery thereof. The dial 29 is provided also with a relatively short driving pin 39 for a purpose to be hereinafter referred to.

I provide two co-axially supported dials 41 and 43. The dial 41 is the ten minute dial and will therefore have imprinted or otherwise shown thereon the numerals 0, 1, 2, 3, 4 and 5, while the sixty minute or hour dial 43 will have imprinted or shown thereon numerals 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12. It will be noted that the outer diameter of the ten minute dial 41 is somewhat smaller than the outer diameter of the minute dial 29 while the outer diameter of the sixty minute dial 43 is larger than that of the ten minute dial 41 and is, in fact, almost or substantially double the diameter of the ten minute dial. I provide a bushing member 45 to support the two dials 41 and 43 co-axially with each other, with dial 43 in the rear of dial 41. This tubular bushing member 45 is free to rotate on a headed stud 47 extending therethrough and through an opening in the rear frame plate 15 against which it may be held by a nut 49 engaging the outer or rearmost threaded end of stud or bolt 47. The ten minute dial 41 is fixedly mounted on the bushing member 45 so that it and its support may turn as constrained to do by means and in a manner to be hereinafter set forth. A small spur gear 51 is also fixedly mounted on an auxiliary bushing 53 held on the bushing member 45 by a set screw 54 so that gear wheel 51 will turn with dial 41. A second spur gear 55 is fixedly supported on a bushing 56 which is rotatably mounted on a short headed stud 57 supported on the rear frame plate 15 so that the gear wheel 55 will mesh with gear wheel 51 to be turned therewith. Gear wheel 55 has mounted thereon a driving pin 59 to turn therewith.

Dial 41 is provided with a plurality of punched-out ears 60, six in number, which ears or tabs are adapted to be engaged consecutively by the driving pin 39 on dial 29 when the dial 29 is caused to turn through one-tenth of its periphery because of engagement of one of the bent-out ears 37 by the driving pin 25 on disc 23 continuously rotated by the motor 19. The ten minute dial 41 will therefore be turned through one-sixth of its total periphery and in a direction counter to that in which dial 29 is turned so that the numerals on the two dials, namely the minute and the ten minute dial, will indicate correctly at one time during each minute the number of minutes of the time of day.

The turning movement of the dial 41 causes a corresponding turning movement of gear wheel 51 in one direction and a corresponding turning movement of the gear wheel 55, which is of the same size as gear wheel 51, in the opposite direction so that driving pin 59 will make one complete revolution of 360° once in each hour and will engage one of the bent-out ears 61 provided on the dial 43 to change the numerals indicating the hour of the day once each sixty minutes. It is, of course, to be understood that the position of the driving pins 25, 39 and 59 and the position of the bent-out ears engaged thereby to cause turning movement of predetermined but different degrees of the respective dials are such that the numerals will show in back of the opening 13 in the front frame plate. It is to be further understood that the turning movement of the respective dials is just sufficient to cause a new numeral to show on a dial when the same is turned and it will therefore be obvious that the minute dial 29 will be turned through one complete revolution once in ten minutes to thereby cause predetermined angular turning movement of the ten minute dial once every ten minutes and that one complete revolution of the ten minute dial 41 in sixty minutes will cause predetermined angular turning movement of the sixty minute or hour dial 43 through one-twelfth of its periphery so as to bring another numeral back of the opening 13 in substantially the same manner as set forth for the other dials.

I provide novel means for holding the minute and the hour dial in their stationary positions. Referring to Fig. 6 of the drawings it will be noted that the punched-out ears 37 left openings 63 in the dial and I provide a leaf spring 65 having one end secured to the front frame plate 11. Its other end is provided with a portion of flat V-shape adapted to fit into an opening 63, the spring 65 being bent to bias the V-shaped portion into an opening 63. By proper adjustment of the spring 65 it is possible to cause turning movement of the dial 29 from one to another of its consecutive operative positions with relatively small power and the V-shaped end portion moves into the opening easily and surely and holds the dial in desired position.

I provide a plurality of openings 67 in the hour dial 43, equal in number to the number of numerals on the dial and on a diameter somewhat greater than that of the punched-out ears 61. A leaf spring 69 has one end fixed to the rear frame plate 15 and a portion bent to flat V-shape near its other end is adapted to fit into the respective openings 67 to stop and then securely hold the dial 43 in its consecutive stationary positions.

The leaf spring 65 has a slight tendency to bend the dial 29 and I may provide a small projection 71 in the frame plate 11 adapted to engage the dial 29 to counteract the action of the leaf spring 65. By proper design of the dial 29, the size of openings 63 and of the leaf spring 65 I can dispense with the use of any counterbalancing means.

No such holding means has been found necessary for the ten minute disc since the bearing of the hour dial sets up a sufficient friction on the bearing attached to the ten minute dial to hold and keep it in proper stationary position when not being turned by the pin on the minute dial.

In the assembly of these clock movements it is necessary that the pin on the minute dial turn the ten minute dial the exact distance between two consecutive figures on the dial. To permit of adjusting for this result I make the four holes in the back plate through which the clamping screws 20 extend, of elongated shape as may be seen by reference to Fig. 2. This permits of moving the back frame plate 15 carrying the ten minute and the hour dial to the right or to the left so that the pin on the minute dial will engage one of the ears or tabs on the ten minute dial exactly long enough to turn the ten minute dial through the proper distance to cause the three numerals to line up properly back of the opening 13.

The diameter of the circle on which the openings 67 in the disc are located, is made somewhat larger than the diameter of the circle on which the ears 61 are located, since the latter diameter

is quite small and it would be impossible to use a leaf spring, such as member **69**, to move into the openings left by the punched-out ears **61**. Further the mounting of the holding spring **69** for dial **43** on the rear frame plate **15** brings this spring on the same side of the dial as are the ears or tabs **61**.

While I have not illustrated any enclosing casing it is to be understood that I may mount this clock assembly in an enclosing casing which, for example, may be made of wood and which may have a window therein alined with the opening **13** so that the mechanism and particularly the bearing, on which the dials rotate, may be protected from dust. Such a structure is shown generally by the front frame **12**.

The device embodying my invention includes a relatively simple and inexpensive supporting frame for the supporting mechanism including more particularly a front frame plate which supports the minute dial and includes also a rear frame plate which supports the ten minute and the sixty minute dial as well as the electric motor providing the moving power for the entire clock. The three dials, two of which are mounted coaxially, have their axes spaced apart a short distance only and the line connecting these axes extends longitudinally of the elongated front and rear frame plate and therefore of the supporting frame. It will be noted that the minute dial turns in a counterclockwise direction in the present preferred embodiment of my invention and that the ten minute and the sixty minute dials turn in a clockwise direction to indicate the consecutive minutes of the time of day.

It may be pointed out that if I desire to increase the size of the numerals on the individual dials to permit of mounting a numeral clock of this improved construction farther away from those noting the time, it is only necessary to increase the outer diameter of the respective dials and to space the axis minute dial farther from the axis of the ten minute and the hour dial with other changes called for by these increases in diameter but that it is not necessary to increase the space between the front frame plate and the rear frame plate at all.

I wish to point out further that the mechanical engagement between the respective driving pins and the bent-out ears is against one of the flat faces of the bent-out ears or tabs and that this decreases the friction between the driving pin and the driven bent-out tab and dial so that a relatively small amount of power is needed to cause the desired turning movement of the dial whenever this occurs because of the operation of the sub-synchronous electric motor. I prefer to have one of the faces of the bent-out ears extend substantially radially of the dial so that there will be no unbalanced force acting on this ear, to thereby ensure a minimum friction between the driving pin and the consecutive bent-out ears and it is evident that since the turning movement of the driving pins is relatively slow, little wear of the driving pin or of one face of the bent-out ears will occur during ordinary operation of my improved clock. The holding springs can be made relatively light so that the power required to move the dials is still very small.

While I have illustrated and described a specific embodiment of my invention I do not desire to be limited thereto and all obvious modifications thereof coming within the scope of the appended claims are to be considered as being covered thereby.

I claim as my invention:

1. A dial type clock including an elongated front frame plate, an elongated rear frame plate spaced from and rigidly secured to the front plate to provide a supporting frame, three dial plates rotatably and overlappingly supported in said frame with their axes in alinement longitudinally of said elongated frame and having peripherally spaced figures thereon cooperative to indicate the time of day, a plurality of tabs on each dial plate integral therewith and punched out laterally therefrom on circles of relatively small diameters to have one face thereof extend substantially radially of the dial plate, an electric motor supported on the rear frame plate, a disc supported thereby and caused to rotate through one complete turn in a minute, a driving pin extending laterally of said disc and caused to engage flatwise with consecutive tabs on the first of said dials at one minute intervals to cause said first dial to turn through a predetermined angle and two other laterally projecting driving pins driven by said first dial to engage flatwise with consecutive bent-out tabs on the other dials at different time intervals to cause different predetermined turning movements thereof to cause figures on all the dials alined with the alined axes to indicate the time of day.

2. A dial type clock including a relatively narrow elongated front frame plate having an elongated opening therein near one end thereof, a relatively narrow elongated rear frame plate spaced from and rigidly secured to the front plate to provide a supporting frame, a numeral-bearing minute dial, ten-minute dial and hour dial rotatably supported by said frame longitudinally alined therewith between said front and rear plates and including a single support for the ten-minute and the hour dial, a plurality of flat tabs on each dial integral therewith and punched-out laterally therefrom, one face of each of said tabs extending substantially radially of the dial, an electric motor supported by the frame, a disc supported by the motor and caused to turn thereby through one revolution per minute, a driving pin on the disc adapted to engage said one face of consecutive tabs on the minute dial to cause predetermined angular turning movement of the minute dial once per minute, driving pins for engaging the bent-out tabs of the ten-minute and of the hour dial at short intervals and at different times to cause the numerals on the dials to appear back of said opening in said front frame plate alined with each other longitudinally of the frame to indicate the time of day.

3. A device as set forth in claim 2 in which certain of said dials have circularly spaced openings therein equal in number to the numerals on the dial and a leaf spring supported by the frame and having a bent end portion thereof adapted to move into the openings consecutively to hold the dial stationary when not being caused to turn by a dial driving pin.

4. A dial type clock including a relatively narrow elongated front frame plate having an elongated opening therein near one end thereof, a relatively narrow elongated rear frame plate spaced from and secured to the front plate to provide a supporting frame, a numeral-bearing minute dial rotatably supported by said frame between said front and rear plates, numeral-

bearing ten-minute and hour dials rotatably and co-axially supported by said frame between said front and rear plates with the plane of the ten-minute dial back of the plane of the minute dial and with the plane of the hour dial back of the plane of the ten-minute dial and means for causing predetermined turning movements of the respective dials at intervals of one, ten and sixty minutes, said means including an electric motor, a disc driven thereby and rotated once per minute, a pin on said disc projecting laterally therefrom, flat tabs bent out from the respective dials on circles of relatively small diameters, said pin on said motor driven disc engaging consecutive bent-out tabs on the minute disc flatwise once a minute to cause predetermined turning movement of the minute dial and additional pins moved at ten minute and at sixty minute intervals to engage consecutive bent-out tabs on the ten minute and on the sixty minute dial to cause numerals on the dials to appear back of said opening in said front frame plate alined with each other longitudinally of the opening to indicate the time of day.

5. A dial type clock including front and rear spaced narrow, long, substantially coextensive frame plates, the front one of which has an elongated opening therein near one end thereof, an hour dial, a ten-minute dial and a minute dial rotatably supported by and between said frame plates and having numbers near their peripheries, a single bearing means on the rear plate supporting the hour and the ten-minute dial coaxially with each other with the ten-minute dial in front of and of lesser diameter than the hour dial, a bearing means on the front plate supporting the minute dial in front of the ten-minute dial, an electric motor supported by the rear frame plate, a disc carried by the motor and rotated through one complete turn per minute, a pin on the disc projecting laterally of one face, relatively wide flat tabs on each dial bent out laterally of the dial on relatively small diameters, the pin on the disc being rotated to engage the flat face of consecutive tabs on the minute dial at minute intervals and cause a turning movement in one direction of one-tenth of its periphery, a pin on the minute dial adapted to engage the flat face of consecutive tabs on the ten-minute dial at ten minute intervals and cause a turning movement thereof of one-sixth of its periphery in a direction opposite to that of the minute dial, a gear wheel coaxial and rotatable with said ten-minute dial, a second gear wheel meshing with the first gear wheel and a pin on the second gear wheel adapted to engage the flat face of consecutive tabs on the hour dial at sixty minute intervals to cause a turning movement of one-twelfth of its periphery in the same direction as that of the ten-minute dial, the numbers on the three dials being visible through the opening in the front plate to indicate the time of day.

FREDERICK A. GREENAWALT.