March 17, 1936. H. E. WARREN 2,034,498

MEANS FOR DRIVING LARGE CLOCK HANDS

Filed May 22, 1934

Fig. 1.

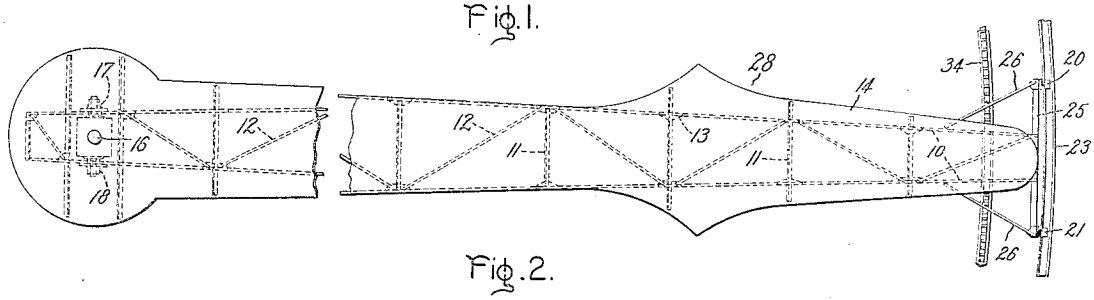


Fig. 2.

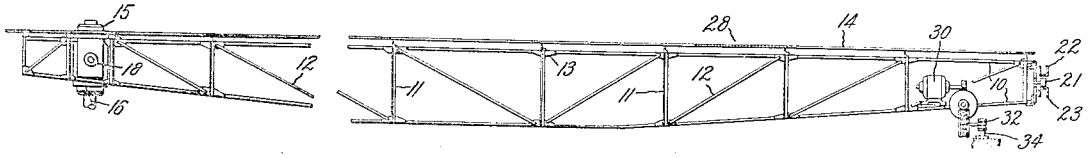


Fig. 3.

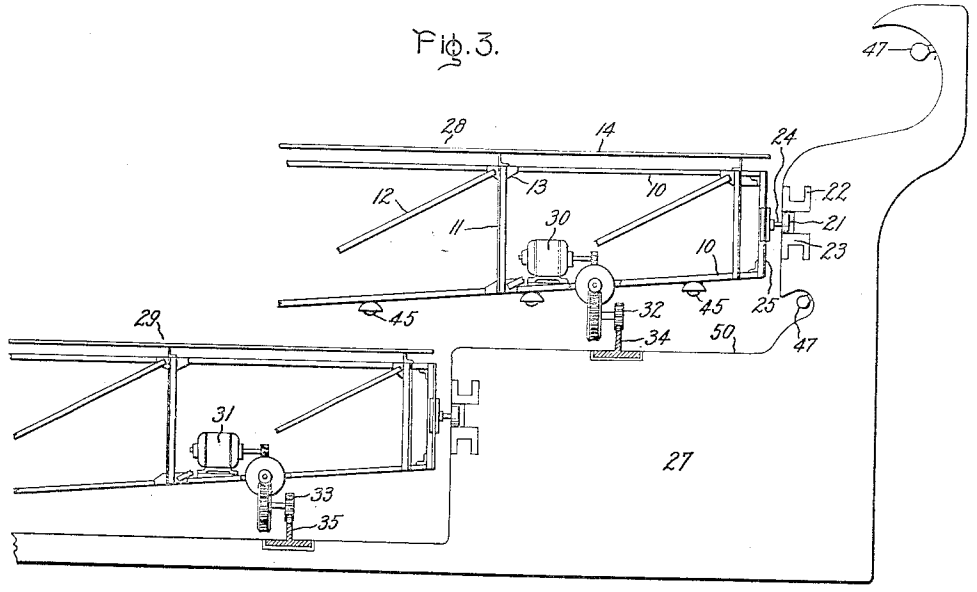


Fig. 5.

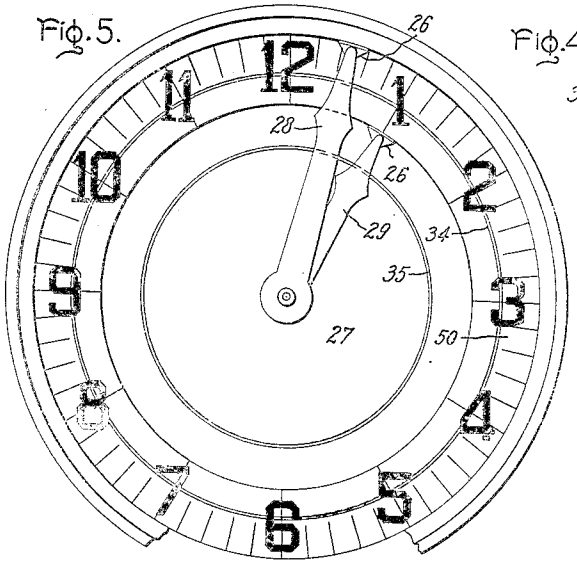
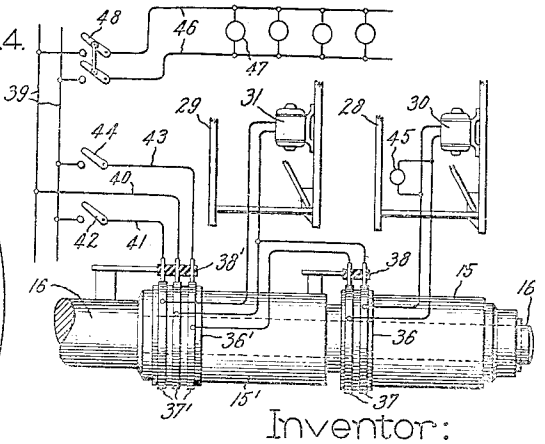


Fig. 4.



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by Harry E. Dunham
His Attorney.

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UNITED STATES PATENT OFFICE

2,034,498

MEANS FOR DRIVING LARGE CLOCK HANDS

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Application May 22, 1934, Serial No. 726,881

6 Claims. (Cl. 58—26)

My invention relates to large clocks, such as those used on towers and skyscrapers, where it is impracticable to enclose the hands and dial in a protective glass housing and where the hands are of such size as to be subject to stresses of considerable magnitude due to wind pressures. Assume, for example, a clock having a minute hand one hundred feet in length and otherwise proportioned to resemble an ordinary clock from a distance. It is impracticable and probably impossible to cover the dial of such a clock with glass. Such a clock hand will have a large surface area which, in use at exposed elevations, will be subjected to wind pressures of high velocity. The wind load on a clock hand, such as referred to above, may easily reach several tons. It is the object of my invention to provide a method and apparatus for driving and properly supporting clock hands of the general character above referred to.

In carrying my invention into effect, I provide supporting means at the tips of the pointers. This may take the form of suitable rollers on the pointers running on circular guide tracks about the dial. I prefer to drive the pointers with individual synchronous electric motors mounted on the pointers near the tips and geared to circular racks concentric with the dial. For setting the clock hands, these motors may be individually controlled.

The features of my invention which are believed to be novel and patentable will be pointed out in the claims appended hereto. For a better understanding of my invention reference is made in the following description to the accompanying drawing in which Fig. 1 shows a face view and Fig. 2 a side view of portions of a large clock hand illustrating the general manner in which a clock hand of the size under consideration may be constructed; Fig. 3 illustrates how the tip ends of hour and minute hands of a large clock may be supported and driven; Fig. 4 indicates how electrical energy may be conveyed to the electrical driving motors located on the clock hands; and Fig. 5 illustrates a face view of such a clock as viewed from a distance.

Referring now to Figs. 1 and 2, it will be noted that the supporting structure of the clock hand illustrated is of a truss construction. This framework may be made from steel girders 10 at the four corners running lengthwise of the pointer and connected at numerous points by steel cross-pieces 11 and diagonal braces 12. The joints may be provided with suitable angle plates 13 and the parts welded or riveted together as is common in truss steel constructions of this general character. Covering the face of the pointer supporting framework and firmly secured thereto at various points in any suitable manner, as by riveting or welding, is a sheet metal covering forming an observation plate 14 having an outline in the shape of a clock hand. All parts will be painted and the structure will otherwise be adapted for exposure to outdoor weather conditions.

A one hundred foot pointer proportioned as represented in Figs. 1 and 2 and located outdoors on an elevated structure must be secured against rupture and displacement due to high wind pressures likely to be encountered. It is calculated that the wind load normal to the face of such a pointer may reach 34,000 pounds and the wind load normal to the edge may reach 6,200 pounds, and the design is made to withstand these stresses without damage or displacement.

The pivot end is supported on a suitable hub 15 having a bearing on a stationary shaft 16. In securing the pointer structure to the hub, swivel joints are used at the two sides of the pointer as represented at 17 and 18 pivoting the pointer to the hub on an axis at right angles to the shaft and pointer. This permits a limited amount of bending or flexing of the pointer structure in a direction normal to its face without placing an undue strain on the bearing tending to bend the shaft 16.

The tip end of the pointer is provided with two rollers 20 and 21 which run between track rails 22 and 23 with a slight clearance. The stationary track is circular and extends around the inner edge of the rim of the clock dial concentric therewith. The rollers preferably have roller bearings running on stationary shafts 24 extending radially from the tip end of the pointer and displaced circumferentially from each other in the plain of rotation of the pointer beyond the two extreme edges of the pointer at this point. The roller shafts 24 are secured in a skeleton plate 25 extending across the tip end of the pointer structure and fastened between the ends of the four corner girders 10 and having braces 26 between the outer corners of the plate and the pointer structure back from the tip end.

This manner of supporting the outer end of the pointer prevents any material movement of the pointer normal to its face at this point and, moreover, resists tipping stresses but does not prevent the pointer from moving in a circular path about the dial, but simply guiding it in such path.

For a one hundred foot pointer, the rollers 20 and 21 may be separated by twelve feet, be 6½ inches in outside diameter, and run between track rails separated by a slightly greater distance than the diameter of the rollers so that one roller will not touch both rails at once. A single rail track with rollers on either side may also be used.

The arrangement for driving the pointers in their circular paths is best shown in Fig. 3 which represents a section through the edge of the clock dial 27 together with portions of the ends of the minute and hour hands 28 and 29 lying adjacent thereto. The minute hand 28 is provided with a synchronous motor 30 and the hour hand 29 with a synchronous motor 31 supported on the truss construction beneath the observation plate 14. These motors drive suitable worm gear speed reduction units which have their low-speed pinions represented at 32 and 33 in mesh with racks 34 and 35 fastened to the face of the clock. The racks are circular concentric with the dial and have a radius corresponding to the radius of the pointers opposite these points. The teeth in pinion and rack are cut sufficiently deep so that the slight displacement of the pointers in a direction normal to the clock face to be expected at these points will not interfere with the driving engagement.

The tendency for the pinions 32 and 33 to move out of driving engagement with their racks 34 and 35 will not be serious as these driving engagements are made close to the tip ends of the pointers which are supported against tipping and any material displacement towards or from the clock face by the track and roller arrangement above described.

It will be assumed that the synchronous motors are supplied with 60 cycle alternating current. One manner of supplying such current is represented in Fig. 4 where 15 and 15' represent in outline the hubs for the minute and hour hand pointers. These hubs have bearings on the stationary shaft 16 and are suitably secured against endwise displacement thereon. The hubs are provided with sleeves 36 and 36' which carry electrically insulated slip rings 37 and 37'. Stationary brushes 38', connected as shown to a source of supply 39 contact with the three slip rings 37'. A pair of brushes 38 supported on hub 15' and electrically connected to two of the slip rings 37' on this hub, contact with slip rings 37 on hub 15.

Supply circuits run from the slip rings on the hubs 15' and 15 to the synchronous motors 31 and 30 near the outer ends of the hour and minute hands 29 and 28. It will be noted that both motors are supplied through wire 40 and the central slip ring 37' in common, that the return circuit for motor 31 is through wire 41 and switch 42, and the return circuit for motor 30 is through wire 43 and switch 44. The motors may, therefore, be individually controlled and, consequently, the hour and minute hands may be individually set. After the pointers have been properly set, both switches 42 and 44 will remain closed. The same circuits may supply such lamps as it may be desirable to use on the pointers for illumination and such lamps are represented at 45. Circuit 46 is a circuit for supplying illuminating lamps 47 about the stationary part of the clock dial and this circuit will usually be opened at a switch 48 during daylight hours.

The motor 30 for a one hundred foot minute hand having a total weight of about six thousand pounds, including motor and gear reduction, may be a 4 pole 5 horse power self-starting synchronous motor running at 1800 revolutions per minute and having a gear reduction to its pinion 32 of 600 to 1. The pinion 32 may then have ten teeth and the rack 34 eighteen hundred teeth. This will cause the minute hand to be driven at the proper speed of one revolution per hour.

The motor 31 for the hour hand, which is somewhat smaller and of less weight and moves at one-twelfth the speed of the minute hand, may be correspondingly smaller and its gear reduction will be higher.

The supporting flanges of racks 34 and 35 may be sunk to the level of the adjacent clock dial surfaces and the guide rails 22 and 23 will preferably be flush with the adjacent surfaces of the clock dial so that, from a distance, these parts will not mar the appearance of the clock dial and may be so incorporated in the dial design as to harmonize therewith, as indicated in Fig. 5. The raised surface of the clock dial, indicated at 50 in Fig. 3, will appear as a band from a distant point and may have the time figures painted or otherwise mounted thereon as represented in Fig. 5.

Indirect illumination, as represented in Fig. 3 may be provided and the minute hand may carry a few lamps on its under structure for furnishing illumination beneath this hand and to make adjacent clock indications clearly visible and annul undesirable shadowing of the hour hand when adjacent the minute hand.

The braces 26 and plate 25 at the tips of the pointers while visible may be toned down by proper coloring and rendered practically unnoticeable. The truss construction of the pointers and the motors with their gear reduction units will be hidden from view by the covering surfaces of the pointers.

I have not attempted to illustrate details of the supporting structure of the clock dial as this forms no part of the present invention and will vary with the nature of the supporting structure on which the clock is mounted. It is sufficient to state that the racks and guide tracks must be firmly secured and braced in place by whatever construction is employed.

In the foregoing description, certain data applicable to a one hundred foot pointer has been given by way of example but not with any intention of confining my invention to a pointer or to a clock conforming to the data mentioned.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A clock comprising a dial, minute and hour hands pivoted at the center of said dial, a synchronous motor carried by each of said hands, a pair of circular racks concentric with said dial, and speed-reducing gear trains carried by said hands connecting said synchronous motors in driving relation with said racks.

2. A clock comprising hour and minute hands, a dial, a shaft rotatively supporting said hands at the center of the dial, circular racks supported on the face of the dial concentric therewith, synchronous motors supported on the hands in

driving relation with said racks, and means for supplying said motors with alternating current including switching means for individually controlling the movement of said hands.

3. A clock pointer for large clocks comprising a truss steel supporting structure, a sheet metal pointer-shaped covering secured to and supported by said structure on one side thereof, a bearing provided at one end of said structure, guide rollers secured at the other end of said structure, and a synchronous electric motor carried by said structure for driving the same, the sheet metal covering concealing said motor and truss construction when the pointer is viewed from the covering side thereof.

4. A clock including a dial, a clock hand, a shaft at the center of the dial for rotatively supporting said hand, means for supporting the outer end of said hand against displacement in a direction normal to the face of the dial while permitting its rotation about the dial, a hub for said hand mounted on said shaft, and means for pivoting said hand to said hub on an axis at right angles to said shaft and hand to relieve said shaft from bending stresses due to any bending of said hand.

5. A clock having a dial, a clock hand rotatively supported at the center of said dial and means for supporting the outer end of said hand against tipping and movements normal to the face of the dial while permitting its rotation comprising a pair of rollers rotatively mounted on radial axes at the outer end of the hand and spaced apart in the plane of rotation of the hand, and a circular track concentric with the dial having rails spaced apart a distance slightly greater than the outer diameters of said rollers in a direction normal to the clock dial and between which rails said rollers extend.

6. A clock comprising a dial, hour and minute hands pivoted at the center of said dial, the hour hand being shorter than the minute hand and located between the latter and the face of the dial, said dial having a portion adjacent to which the hour hand rotates and a raised concentric portion adjacent which the outer end of the minute hand rotates, said portions lying parallel to said hands, rollers secured to the outer ends of said hands, circular tracks concentric with said dial in engaging relation with said rollers for supporting said hands while allowing their rotation about the dial, synchronous motors and speed-reducing gear trains driven from the motors on each hand near their outer ends, and circular racks in the depressed and raised portions of said dials and concentric therewith with which the gear trains engage in driving relation.

HENRY E. WARREN.