THE WARREN TELECHRON MASTER CLOCK TYPE A

by Harry S. Holcomb, III (VA) and Robert Webb (IA)

About 30 years ago, when I was a young boy, my father gave me a clock which he had obtained from the New England Power Company with which he was associated. It had been sitting around there collecting dust and they wished to get rid of it. It was a Warren Telechron Master Clock Type A. I took the clock apart, cleaned the works, and refinished the case. It has been running beautifully ever since. My father told me that the clock was once used to regulate the cycles put out by the power company and that only about 25 of these clocks were made.

Recently I read an inquiry in the NAWCC BULLETIN Answer Box section from Robert Webb (IA), also the owner of a Master Clock Type A.[1] This stimulated my interest and led to our joint effort to learn more about the history and function of this clock. Our search has revealed that this clock played a pivotal role in the history of electric timekeeping. To understand its function and significance it is necessary to know a little about Henry Warren and his work.

Henry Ellis Warren, a native of Boston, graduated from the Massachusetts Institute of Technology in 1894. He settled in Ashland, MA, in 1907 and set up a small workshop there where, as a hobby, he tinkered with electrically driven clocks. He developed a battery driven clock and took out his first patent on this clock in July 1909. The Warren Clock Company was founded in 1912 and his commercial production of battery driven clocks began in 1915. However, he considered these clocks inadequate and unreliable, and thus sought other methods of telling time accurately. Al-

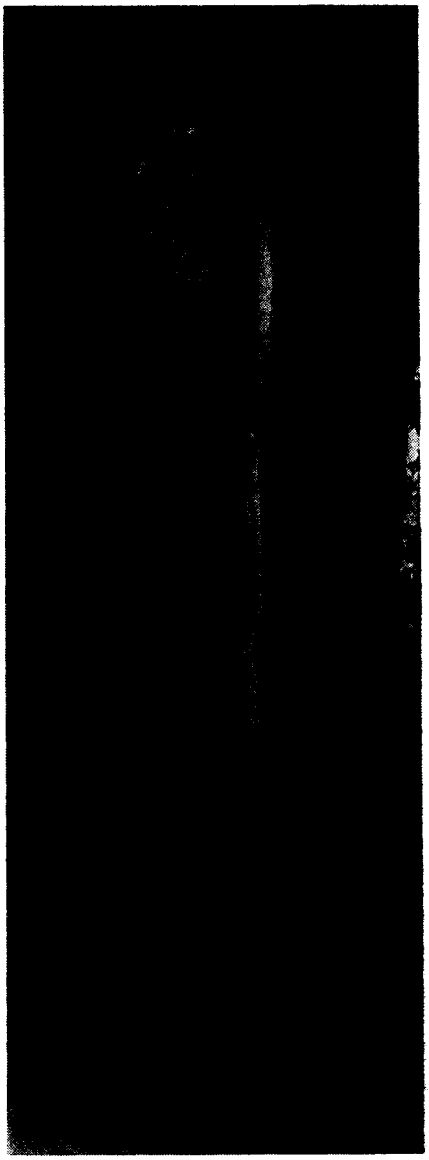

Fig. 1 ——————>

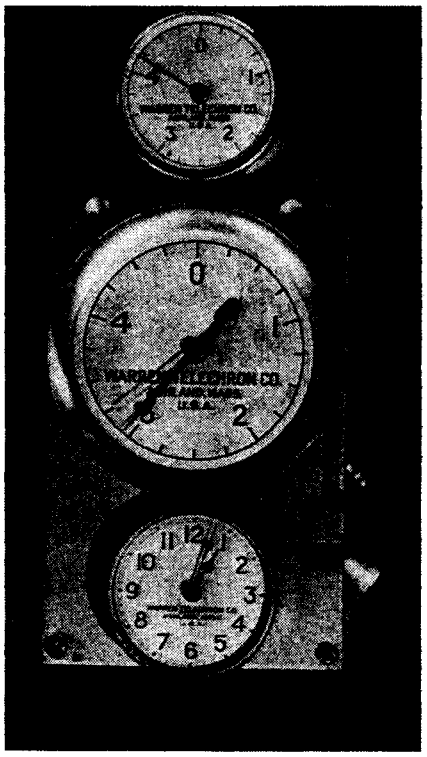

Fig. 2

though the idea of driving electric clocks with alternating current was not new, Henry Warren was the first to develop, in early 1916, a simple self-starting alternating current motor which was truly "synchronous" with an alternating current and which could be produced inexpensively.* However, he discovered that the synchronous motor clock, when driven by alternating electricity from the local power company, still did not keep perfect time, losing up to 15 minutes per day. The reason for this was because the power companies had difficulty controlling precisely the alternations or frequency of their generators. Henry Warren realized that the next problem he faced was "to bring about in some manner the accurate regulation of the alternating current impulses which were being sent in all directions over the wires so that these impulses, in connection with the newly designed motor, might be used to supply power companies' customers with a dependable time telling device."[2] He went to work and "took only a few months to design and build a thoroughly satisfactory master clock which could be used at power stations so as to indicate errors in the average frequency, which were hundreds of times smaller than could be measured with instruments then in use."[3] His first clock was installed for demonstration purposes at the L Street Station of the Boston Edison Company on October 23, 1916. The company was so impressed with the clock that they insisted on keeping it.[4]

The concept of the Telechron Master Clock is very simple. Its large 5-minute dial carries two hands, both of which are center mounted. One hand is connected to an accurate pendulum clock and the other to a synchronous motor. The synchronous motor is so geared that when the frequency of the generators is correct (exactly 60 cycles per second) the gold hand will rotate at exactly the same speed as the black pendulum regulated hand. As described by J. E. Coleman, "The generating station operator watches the clock and adjusts his turbine governors regulating the frequency so as to keep the black and gold hands in line. By doing this the other synchronous clocks plugged into the system automatically keep correct time."[5]

There was a second benefit for the power company from the use of the Master Clock. Since the current (cycles per second) could be regulated very precisely, it became possible for several generators of generating plants to hook together efficiently in one large grid system. By 1921 the Master Clock Type A, or improved versions of it, and the synchronous motor driven electric clock were in widespread use.

A photograph of the Master Clock is seen in Figure 1. It has an oak case which stands 4'8" tall. In addition to the large 5-minute dial previously mentioned, there is a lower 12-hour dial with hour and minute hands (Figure 2). The upper dial is a 5-minute

*The Warren Clock Company became the Warren Telechron Company in 1916; Telechron meaning "time from a distance."

dial with one hand driven by a synchronous motor. This is an auxiliary clock motor to be kept running at all times in case the primary motor should fail. The pendulum rod is made of invar, a metal with a "negligible coefficient of linear expansion." The seconds beating clock, when properly regulated, is to run with an error of less than one second per day using the Graham "dead beat" type escapement.[6]

The pendulum movement, which drives the black hands on the center dial and the lower dial, is regulated by two methods. The first means of adjustment is by adding or subtracting small weights. The weights are applied to a pan fastened to the pendulum rod. They are marked with a numeral displaying the number of seconds per day which that particular weight would change the clock's rate. Weights are added to the pan to increase the rate and removed from the pan to slow it.

A second way of regulating the clock is with two small rheostats located in the top of the case (Figure 3). These control the intensity of a magnetic field set up by a battery coil in the bottom of the case and affect the pendulum swing. One rheostat will set the clock, correcting small errors of up to five seconds. The other rheostat will correct the rate of pendulum movement and acts in the same manner as the weights on the pendulum pan.

The pendulum movement is powered by a spring which is kept wound by a connection with the synchronous motor. If the clock should stop, the synchronous motor must be turned off to prevent over-winding of the clock spring. The main and auxiliary synchronous motors are controlled by means of toggle switches in the top of the case.

The instruction manual suggests that the movement be cleaned and overhauled and that new synchronous motors be installed every two years.[7] These clocks were to receive very good maintenance to insure reliable service for the power plants.

Henry Warren's Master Clock Type A and the synchronous clock motor, both relatively simple in concept and

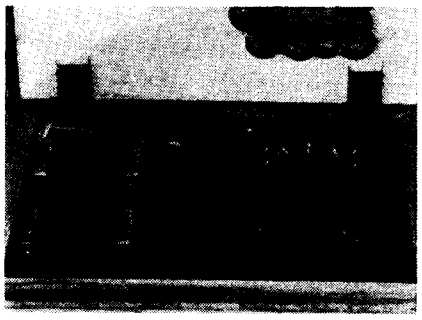

Fig. 3

design, were ingenious products. Their development made possible, for the first time, the widespread use of the household electric clock that we know today.

The authors would like to hear from other owners of the Type A Master Clock or from anyone who has information pertaining to this clock. Address correspondence to: Harry S. Holcomb, III, Box 44, Franktown, VA 23354.

REFERENCES

1. NAWCC BULLETIN #224, Vol. 25, No. 3 (June 1983), p. 369.

2. Henry E. Warren, "Modern Electric Clocks." A paper read at the meeting of the Boston Clock Club, February 6, 1937. Reproduced in The Journal of The Electrical Horology Society, v. 4, No. 3 (June 1978), pp. 2-9.

3. Ibid., p. 7.

4. *American Horologist and Jeweler*, v. 31, No. 6 (June 1964), p. 28. The original Master Clock was donated to the Smithsonian Institution, June 1964, and is on exhibit there.

5. *The Best of J. E. Coleman, Clockmaker*, Orville R. Hagans, Ed. American Watchmakers Institute Press (1979), pp. 196, 428.

6. "Warren Master clock for Maintaining Constant Average Frequency," General Electric Company Bulletin no. 46037 (May 1919).

7. "Instructions for Telechron Master Clock Type A." Warren Telechron Company, Ashland, MA, Bulletin M-13.