

A NEW Chronometer

(Reported from the American Yacht.)



Reprinted from the American Jeweler



Fig. 2. Waltham Marine Chronometer

Rw 681
W23
no. 5.

THE NEW AMERICAN CHRONOMETER.

We illustrate herewith a new lever chronometer, manufactured by the Waltham Watch Co., which is notable for several reasons. In the first place it is the only chronometer manufactured in America, notwithstanding the fact that several firms in the east are advertising as chronometer makers and do an extensive business in selling and regulating these time keeping instruments. The writer, during four years of experience in marine circles, satisfied himself that there were no chronometers made in America, the movements being imported, generally at about \$90.00 each, and the balances sprung and the chronometers boxed on this side, after which they were rated and sold as an American product.

One reason for this state of affairs is the small number which are consumed in marine circles. It is a common thing to find chronometers 150 to 200 years old, still in service, and coming regularly to the shops in Atlantic ports to be cleaned, repaired and regulated. After careful investigation it was found that less than 800 marine chronometers were manufactured annually in the entire world; and that barring accidents the life of these instruments is indefinitely prolonged.

A chronometer practically never wears out. Even when vessels are sunk, unless they are lost at sea, the divers generally recover the chronometers and after a visit to the shops they are again in service, the only injury being rust of the steel parts by exposure to salt water and subsequent exposure to the air. If they remain wet until they reach

the shop there is practically no rust and they only require cleaning and respringing. If somebody connected with their recovery attempts to dry them out before shipping them to the repairer, there is always more or less rust and pitting, in which case new steel parts are generally required. Except the balances, the new steel is generally made by the repairer; but fuzees, wheels, balances and pinions are purchased from the maker just as the watchmaker buys new parts, the only difference being that it is necessary to give the number of the chronometer in order to obtain parts to fit; therefore the only loss of these instruments occurs where the vessel goes down in deep water, or burns, and the principal demand for new instruments comes with the building of new vessels.

As may be readily seen, there is a large demand for second hand chronometers in good condition, although a chronometer is inferior to a really good clock in everything except its portability. Owing to the peculiarity of construction and the accuracy of time-keeping rate required, very few, even expert watchmakers, are able to get a decent rate from chronometers after putting in new springs, although it is comparatively simple when one understands the points of difference between the chronometer and the ordinary watch construction.

Most of the chronometers which have been sent inland and rest in the possession of jewelers as show window attractions have a rate which is very much inferior to that of the railroad watch; and if you are sufficiently well acquainted with the person who owns one of them, so that he dare be perfectly frank, he will tell you it is because he has resprung it. While respringing is necessary about every ten years, it takes a master hand to do it properly.

The watchmaker who undertakes adjustments in such a case generally begins at the wrong end. He puts in a

new main spring and then when the chronometer goes off in its rate he commences to manipulate the hair spring and detent spring, never dreaming that the real trouble lies in the barrel. The balance is so highly detached in the spring detent escapement that uniform power is a necessity.

Theoretically the fuzee is supposed to equalize the pressure of the main spring in its varying positions between fully up and fully down. As a matter of fact this is true only for the spring which originally accompanied that fuzee, it being found easier in practice to turn a fuzee and then fit the spring to exert an equal pull on that fuzee than to attempt to make both conform to theoretical requirements. This fitting is accomplished by "weighing" the spring with the barrel held rigidly and a poising rod attached to the fuzee winding square bearing a weight which is fitted to slide along the graduated portion of the rod. In this manner the pull exerted by successive turns of the spring is measured and if it is found to exert an uneven tension on successive turns, which is generally the case, this tension is relieved by thinning the spring with emery at such portions until the increase is uniform (or practically so) with successive turns.

It will be seen that this is an operation which would be more readily understood if seen than when it is merely described and the variations in the springs are such that each must receive individual treatment to adapt it to exert an even pull with any given fuzee. This and the peculiarities of the detent spring, which requires a trained hand to make and fit it, are sufficient in themselves to account for the great difficulty in maintaining the rate of the old style chronometer at anywhere near the excellence it had when it left the manufacturer as a new instrument.

Another difficulty lies in the fact that the cylindrical hair spring has two terminal curves, both of which should be

isochronal, while the watchmaker is trained only to succeed reasonably well with the curve on the outer end of a Breguet spring, which is much weaker and where consequently the terminal curves are more easily formed.

In addition to this there is no regulator, its absence being intentional, so that nobody but the person employed to rate it can change its rate. This precaution is designed to prevent persons with a little knowledge and no skill from tampering with these instruments while at sea. All regulation is made therefore by the timing screws on the balance and it requires expert knowledge in order to bring a chronometer to time easily and surely and without putting the balance out of poise.

Another difference between chronometer practice and that of ordinary watchmaking is that a chronometer is never regulated to keep exact time. The makers recognize the fallibility of all human effort in this direction and instead of adjusting the chronometer to where it will alternately gain and lose (as is a common practice in watchmaking) the chronometer is regulated so as to have a small but steady rate—preferably a gain. Some of the best of them gain as little as one second per week, this rate being obtained in the shop and not at sea. Many others gain larger amounts up to one-fourth of a second per day. It is customary not to allow a greater gaining rate than one-fourth of a second per day in the shop, and after timing, the rate at which the chronometer is gaining is supplied to its owner when the instrument is delivered, the date of repairing, the time elapsed in regulating and the given rate being written on a piece of paper and placed in the upper lid, resting on the glass of the chronometer box. Occasionally a chronometer goes to sea with a losing rate, but this fact is also definitely stated and supplied to the owner in cases where time will not permit the proper regula-

tion. It is customary for each vessel captain to take the chronometers to a chronometer maker, after each voyage of any length, for inspection and to obtain their rate, even if nothing is done to them, as the thickening of the oil will gradually change the rate. Where time permits they are cleaned and rerated if the rate is found to be excessive. Liners and coasters have their chronometers cleaned and rated every two years.

A chronometer which is on time and remains on time is regarded with suspicion, as it is known to be alternately losing and gaining and the result might be such that the captain would be thrown off in his reckoning, with serious damage to life and property.

With these peculiarities in the instrument we are discussing, it will at once be seen that their cost of production and maintenance must continue to be excessive.

Another peculiarity is that the governments never order any chronometers when they wish to purchase. Notification is sent out to all who are likely to be interested that a chronometer trial will be undertaken at the astronomical observatory conducted in connection with the navy department of that government and that all who wish may submit chronometers for trial and rating. The government reserves the right to purchase as many as it wishes of such instruments as come within the prescribed rates. Those of the first class are purchased at \$350, those of the second class at \$300, and those of the third class at \$250. All rating below this are returned to their makers and if more chronometers are needed at the time another trial is ordered. It will be readily understood that a great deal of amusement was created among those who know by the announcement of a watchmaker connected with a large jewelry firm in one of our western cities that they had received an order to "make a chronometer for the United States navy."

The liability of the spring detent escapement to trip or overturn upon being turned 90 degrees in a horizontal plane, unless it is done very slowly and carefully, is so well known that the navy department has printed positive instructions to all its officers never to turn a corner suddenly and never to swing the instrument by the carrying strap, when making a right angle turn in taking chronometers ashore or returning them to the vessel after rating.

From the above it will be readily understood how great a departure in the line of portability has been made from accepted practice by the Waltham Watch Co., in bringing out its new 8-day, double roller escapement, 15 jeweled, adjusted, lever chronometer as shown in Fig. 1.

The pivots of the two barrel arbors and the intermediate arbor may be seen in Fig. 1 in a line immediately under the words "15 jeweled adjusted." Both barrels engage with the intermediate pinion, and the intermediate wheel gears with the center pinion, the center depthing into the third—these all being secured into specially heavy frames with a capacity of a ten-day run. The fourth and escape are carried in a lighter train section of about the proportions of a fine railroad watch, yet of a size which permits three screws in the train bridge to fasten it to the pillar plate. The pallets and the balance are proportioned and finished with the same degree of excellence of the highest grade of railroad watches. The movement has the Waltham double roller escapement, Breguet spring and patent regulator. The plates are nickel, finished in line damascening on the upper and the pillar plates spotted. All jewels are in settings. All steel work is hardened and tempered and finely finished.

The instrument is absolutely reliable and is accurate to a degree not exceeded by the highest priced imported ships' chronometers, while it is very much less delicate than any



Fig. 1. Chronometer Movement—Full Size.

spring detent escapement. It is adjusted to temperature and isochronism, and is carefully timed in its case before shipping from the factory. The compensating balance has its lower balance pivot running on a diamond endstone. The double roller escapement has a carefully set sapphire jewel pin and pallets and the winding crown, or pendant, winds both springs simultaneously. The hands are also set from the pendant. The winding indicator on the dial between Figs. 3 and 4 shows red at the end of the seventh day, when it is time to wind the chronometer, although the movement will run for 10 days.

The fact of its being designed to run a period of seven days with one winding may appear of doubtful value to some readers; but to such we will say that in the one day chronometer it is necessary to change its position every day (when winding) and there is a corresponding liability of disturbing the rate in so doing. In the seven days' run the instrument is turned over but once and the chances are in favor of this interval's giving the best results. However, one can, if he wishes, wind daily and note the results.

The movement is enclosed in a moisture proof case with screw back and bezel and suspended from gimbals. The weight below in the movement box is sufficiently heavy to keep the chronometer at all times in a horizontal position and the outer case is of polished mahogany, with reinforced corners and brass trimmings. The quality of the cases is insured by their being made at the Waltham factory.

That these instruments with double roller escapement should be more reliable under adverse circumstances than those with the spring detent escapement will be readily understood by every watchmaker, and the fact that they can be sold for \$60.00, while having a rate equal to that which has generally commanded five times the price, makes them one of the most notable productions of this celebrated factory



Fig. 3. Cased for Automobiles—Full Size.

and one which will undoubtedly command instant attention in the marine circles throughout the world. That the company has the greatest confidence in these movements is shown by the fact that it is recommending them, not only as chronometers to be run in one position, but also for automobiles where they are cased in water proof metal cases, without gimbals and are subject to fully as much jarring and tossing as if they were carried about on horseback. Figure 2 shows the chronometer boxed for navigation purposes and figure 3 shows it in water proof metal case, for automobiles. The same style of movement is also made as shown in figures 4 and 5, as a limousine watch, and as a traveling or desk watch. In the latter form it has been shown at conventions of the Retail Jewelers' Association and was first exhibited at the National Convention of Retail Jewelers in Detroit. The very low price of \$60.00 for the box chronometer is partly explained by the fact that the movement can be made in quantities and applied to the other purposes indicated. Every retailer will readily see that were it not for this, it would be impossible to turn out such an instrument at but twenty per cent of the price of the well known hand made marine chronometers. Jewelers who have wanted a marine chronometer in their show windows for its advertising value, will now be able to obtain a first class instrument of superior durability and construction in place of the discarded marine chronometers generally used for this purpose, at a cost no greater than that usually paid for an inferior chronometer of the old kind, second hand and usually in bad condition.

Those interested may obtain full details on application to the company.

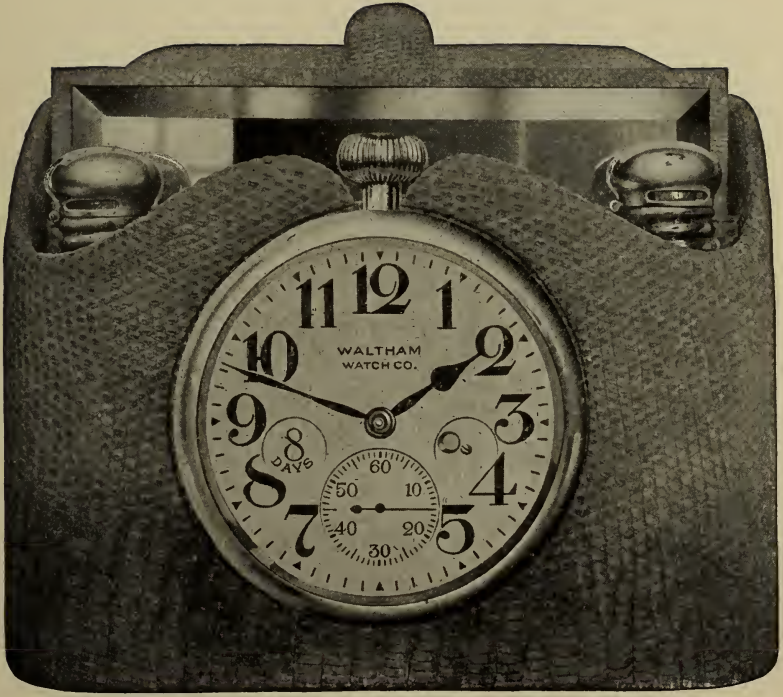


Fig. 4. As a Limousine Watch—Two-thirds Size.



Fig. 5. Traveling or Desk Watch—Closed.



TRAVELING OR DESK WATCH



FOR AUTOMOBILES OR MOTOR BOATS
Waterproof Case—Model D
Actual Size

100-2000

2014

100-2000