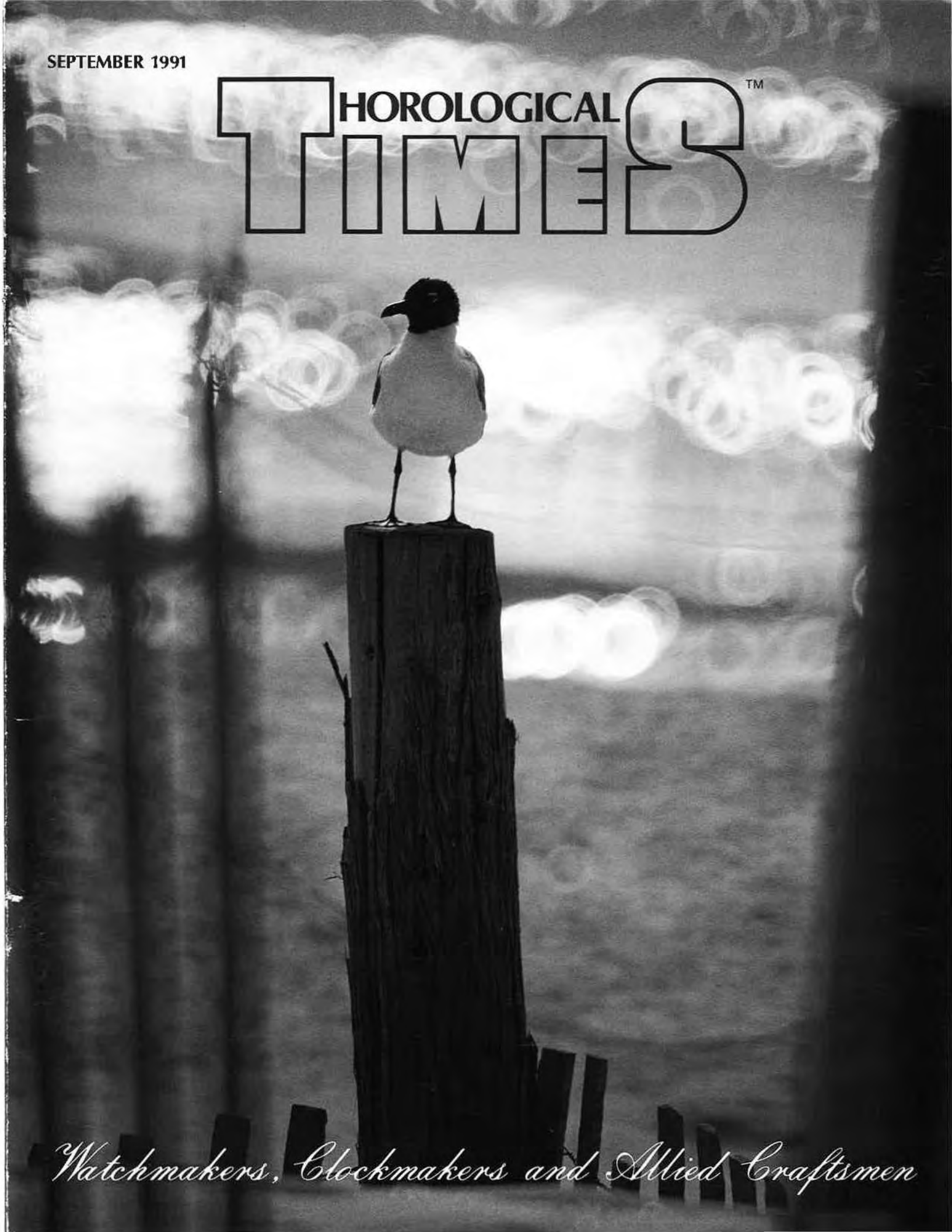
SEPTEMBER 1991

HOROLOGICAL TIMES™



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VOLUME 15, NUMBER 9 SEPTEMBER 1991

HOROLOGICAL TIMES™

Official Publication of the American Watchmakers Institute

HOROLOGICAL TIMES (ISSNO145-9546) is published monthly and copyrighted by the American Watchmakers Institute, 3700 Harrison Avenue, Cincinnati, Ohio 45211, for $40.00 per year ($4.50 per copy in the United States and $50.00 per year; $5.50 per copy outside the U.S.). Second class postage paid at Cincinnati, Ohio. POSTMASTER: Send address changes to HOROLOGICAL TIMES, P.O. Box 11011, Cincinnati, Ohio 45211.

OFFICE HOURS: Monday through Friday 8:00 AM to 4:00 PM (Eastern Standard Time). Closed on all national holidays. AWI HOTLINE: (513) 661-4636 (24-hour recording), FAX: (513) 661-3131.

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President's Message

WHAT IS AN AREA REPRESENTATIVE?

An Area Representative, first of all, is a Director of the American Watchmakers Institute. It was decided several years ago that it would be a good idea to let the Directors be the Area Directors. What this means is that each Area Director has agreed to run for the Board of Directors and has been elected to the position by the membership. At present, there are five new members elected to the Board each year. Also, there are five members of the Board that go off each year.

It is the President's responsibility to appoint Committee Chairmen within 30 days after the annual meeting. One of these chairmen to be appointed will be a Chairman of the Area Representatives Committee. It is my responsibility to divide the country into sections and to assign each Board member a section.

The Chairman of the Area Representatives will receive a communication shortly after his appointment stating the objectives for his committee. The objectives are:

1. To represent the Institute's members in all matters on a national basis and with special emphasis on those areas assigned.

2. To lend special assistance when contacted by a member within the assigned area. This means that should a problem arise in a given area, then that problem will be given to its appointed Area Representative. It will be his job to contact the person with the problem and try to help solve the problem.

Sometimes the Area Representative may be requested by the Identification Mark Committee to go before a group in his area and speak on the Identification Mark System.

Sometimes the Area Representative may be called upon to help an area set up a new guild. This is what happened with the new guild in Georgia. They first contacted their Area Representative who contacted the New Guild Liaison Committee. Then the New Guild Liaison Committee set up an organizational meeting and a seminar for their area.

I know of one case in which a person contacted their Area Representative to try to obtain the name of a person who specialized in repairing cylinder movements. The Area Representative was successful in putting the man in touch with such a person.

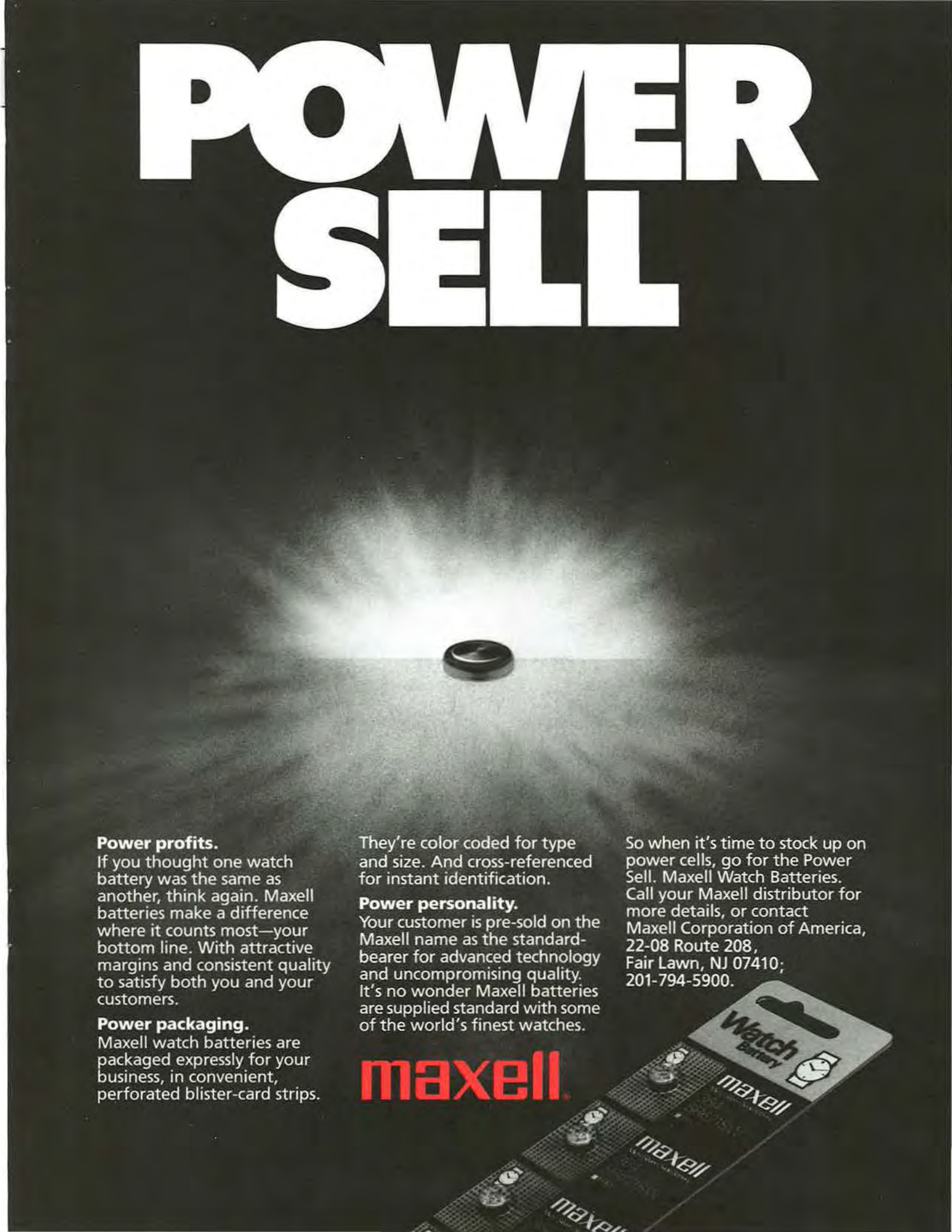
What Area Representatives do *NOT* do is arbitrate quarrels. Besides, AWI members don't quarrel, do they?

If you have a problem and don't know what to do about it (if it concerns AWI), contact AWI Central. They will contact the Chairman who will then put you in touch with your "personal" Area Representative. Every member of that Committee will be pleased to try to help you. **The complete list of Area Representatives can be found on page 4.**

Alice B Carpenter

ON THE FRONT: Seagull at Wildwood, New Jersey. Photo by Jack Goldstein of Cranford, New Jersey.

POWER SELL



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UP FRONT

A recent address to the AWI chapter delegates at the recent AWI meetings by Scott Chou, Senior General Manager Service/ Production Planning Dept. of Seiko Corporation of America has important impact on all watch repairers now and for the future. We are reproducing Mr. Chou's address as this month's guest writer of the "Up Front" column.

It is an honor to be the keynote speaker for the 31st AWI Annual Convention. On behalf of Seiko Corporation of America and myself, thanks to each one of you for giving me this opportunity.

Most of you have been very active in the watch service trade over the past 10 or 15 years. Needless to say, you are all witnesses to the watch industry changes. Speaking of the changes, AWI has changed to the number one position in the watch service training organizations of the world--both financially and in program availability to its members.

Yesterday I visited the AWI's newly established Education Training Center, which will not only benefit the members but anyone in the watch service field. It will also be a benefit to the watch manufacturers as it will relieve some service for the manufacturers. Seiko has been, and will always continue to be, a support to the AWI organization--especially those instructors who conduct bench courses to your members using Seiko products as educational material. Today, I also bring 15 pieces of new hi-tech movements which will be donated to AWI for use in their new training program.

A few years ago all of us often heard the question: "What will be the future of the watch industry relative to watchmakers?" At that time, I introduced to most of you the engineering plastics that would be applied to a watch's major components. As we look back today, it has become more of a reality as you have been seeing many hi-tech, multi-function movements that were made with engineering plastics among some of the watch manufacturers. What the watchmaker has to do in this revolution of hi-tech products produced by the manufacturers is not only to learn the skill of how to repair them, but it is equally important to be told how to earn money by adopting a new philosophy toward their work. In regard to this, often you also hear people make comments that they won't be able to do so, and this is the biggest obstacle to stopping a human's achievement of their goals because they themselves make the predetermination that they will not make it. Instead, if they had in their mind that everything should be tried first, chances are they will not fail. Therefore, all of us in this room who are the leaders in the watch service industry should know how to transfer our knowledge and techniques to the members, all of whom are willing to be in this service trade.

To make this a little more clear in regard to the hi-tech products, basically you will see movements in two major categories in the future. One is adopting the hi-technology to produce an integral unit movement which you might call *nondisassembliable*. The other is a multi-function movement. In order to achieve the multi-function movement which still remains the thickness and size almost equal to the regular movement, this engineering plastic material will continue to exist in the future.

In addition, it has been proven in the past two or three years that the movement made of engineering plastic material served all of the timing purposes with the same quality as the regular metal movements. The differences to a watchmaker are that anyone wishing to handle this movement must update their skill and be more careful to get more direct information from the manufacturer.

In these two categories of movements, the first type--nondisassembliable--very often many of you would say is not repairable. It is unrealistic not to see that the watch industry is facing constant change, what is necessary for us to do now is to make change work. Instead of repairing individual components, it is important to point out that a *nondisassembliable* movement does not mean that it can't be serviced, what must be done is to rotate the complete movement, and in most cases it will be cheaper than you buying circuits or coils, plus labor. This has only one limitation: the manufacturer must also be willing to supply you the original movement, which may vary with the manufacturer.

Presently in the Seiko organization, we have committed that if the movement caliber is in such a category, once it is over the warranty period, we would permit the trade to buy the complete movement from us to permit the watchmaker to service these products. In this situation the movement sales will be handled directly by the COSERV Division. You will very soon see this trend for the future.

The second category for watch movements: You must disassemble and repair all defective components. In this regard, to handle and clean the movement becomes more critical compared to parts made of a different substance (metal). But again, we must emphasize this type of movement has no problem of service from a technical aspect point of view.

Therefore, I suggest all of you should unify and ask different manufacturers to support the watchmaking trade just as Seiko has done by its commitment.

Thanks to all of you for your continued support to Seiko Corporation of America.

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Questions & Answers

Henry B. Fried, CMW, CMC, FAWI, FBHI, ★FNAWCC

Two Swiss Pocket Watches

Tiffany and Chronometre Strahl

Q Enclosed are photos of two watches that I would appreciate some information about. The Tiffany has no factory marking. It has a polished steel pallet bridge.

The other watch has a name but no indication as to its origin.

Also, I just have a comment regarding dial cleaning. I use ammonia for most dials. For some stubborn dials I use cyanide. This, of course, is dangerous stuff to use. It takes quite a lot of experience to know what to use on which dials without getting yourself into trouble!

Lou Roza
Halifax, Nova Scotia

A *I have examined the photos of your two watches. The second watch, with the dial marked "Chronometre Strahl," is of a typical Swiss watch of the 1920 period. According to my records, Rolf. Strahl operated out of Bad Uberkinger in Germany.*

The watch which you claim to be marked "Tiffany" is much older, say about the 1890 period, is Swiss of the Geneva quality. Who made it? From the photos it could have been made by any of a few quality makers who produced items to suit their overseas customers. Tiffany at one time had agents in Geneva to contract for just such items as yours.

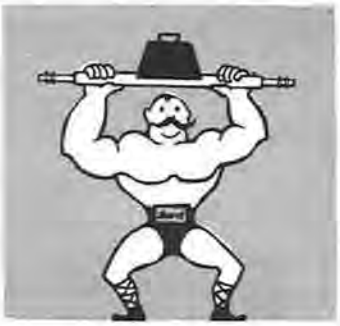
As to your comments regarding the use of cyanide, the "no antidote" poison actually strips a microscopic layer of silver or metal, thus revealing a fresh surface. Too often, applications of this will thus eliminate the plating of any object, dials included.

Diluted sulphuric acid heated will do the same thing, and isn't as dangerous. Just keep the solution pure without any ferrous contamination (including tweezers).

Q I own a clock that I need some history on. Since it is so unique I wonder if it is worth anything. I've been to appraisers in Arizona and New Mexico, but no one can tell me much about this clock. Is it from the 1700s or 1800s? No one can find a picture of this clock in any of their books or catalogs.

The clock depicts a man standing on a green marble and brass base. The globe over his shoulders is thick glass which has a magnifying effect. The beautiful face has emerald green circles with raised gold letters. There is a small circle at the bottom of the face with a second hand. When the clock is running, you may see all the movements in the back through the glass, and that's where it says "Made in France." There are green and white rhinestones in sequence all around the face of the clock. *(Continued on next page)*

Borel World's Strongest SPRING BAR



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1/4
5/16
3/8
7/16
1/2
9/16
5/8
11/16
3/4
13/16
7/8

DOUBLE FLANGE
5/8
11/16
3/4
13/16
7/8

THIN 1.5mm
1/2
9/16
5/8
11/16
3/4
13/16
7/8

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Borel

QUESTIONS & ANSWERS
Continued from previous page

I would appreciate any help you can give me on this clock.

Ruth Lopez
Douglas, AZ

A I am familiar with crystal ball clocks, having two in my own collection. For the very major part of these types, the crystal and ball plus the statue work is French, but the movements are almost always Swiss.

Your photo of the movement is blurred since you didn't remove the back when you photographed it. However, I still can make out the general appearance of a late 19th century high-grade Swiss movement, probably not eight days.

Statues of this type are supposed to represent the Greek version of Atlas holding up the universe. The embellishments around the outside of the clock help to date it as close to the turn of this century at the earliest.

The clock has value, as certain collectors are attracted to them as I am. While I am aware of values, this Institute shies away from rendering appraisal services.

Henry B. Fried

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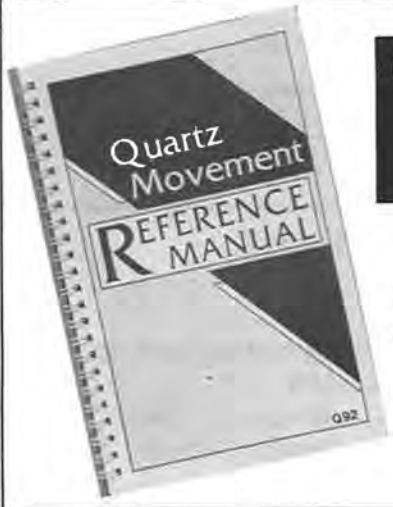

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Bench Tips

Joe Crooks

More About Ultraviolet Adhesive

This is my first anonymous bench tip since I began this column! Anyway, thanks for the tip, whoever you are . . . It's greatly appreciated.

I am sending you a bottle of Norland Optical Adhesive ultraviolet glue which we have been using for the past 10 years. I understand there are many other types of glue available; however, this particular glue has passed our manufacturers' various tests in several different environments and repair situations, and that is why we only use this type of glue.

It is known that the watch service center that sent me this tip has been using this brand of ultraviolet adhesive for a good number of years. Although there are many other brand names of ultraviolet cement, Norland Optical Adhesive passed this service center's various tests in different environments and repair situations, and this adhesive is the only type of ultraviolet cement that they now use.

I don't have the foggiest idea where you can buy this stuff in your town. The address of the distributor is: Norland Products, Inc., New Brunswick, NJ 08902. Write them for your nearest retail outlet.

All fast-drying super glues have about the same ingredients (cyanoecrylate ester), so I thought all ultraviolet adhesives had the same parts of acrylic acid and methacrylic ester. Crystal Clear states that it bonds glass to metal. Norland Optical Adhesive states it bonds to glass, metal, and many plastics. Crystal Clear comes in a .07 fl. oz. container, and the tip is designed to take a hypo needle on the end for easy application to a watch bezel. Norland Adhesive comes in a 1 oz. container, and the tip is not small enough for a hypo needle, but the container has 93% more adhesive than the Crystal Clear.

Zantech sells a UV cement in a .07 oz. tube that includes a hypo needle for easy application. Germanow-Simon now has a UV cement in a tube with a needle on the end, and they claim the tube contains twice as much as other UV glues, and also the adhesive will not yellow with age. You can buy this at your favorite watch supply house.

I strongly suggest that you use UV cement. Be sure to get anUV ultraviolet lamp to cure the cement. It will not cure unless exposed to sunlight or an ultraviolet fluorescent lamp. The tube # is GEF15T8-BL, 15-watt black light (black light is the same as ultraviolet).

Lowes has a fluorescent single unit base for $8.99; tubes cost extra. The bulbs will also fit your Dazor adjustable watch lamp. Always take precautions not to allow your eyes to be exposed to these rays.

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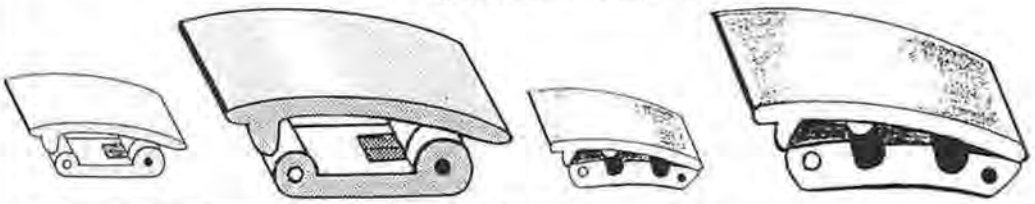

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Ask Huck

CLOCKMAKING BITS About...

By J.M. Huckabee
CMC, FBHI

WIRE SPRINGS IN AMERICAN CLOCKS and HAMMER ARBOR PIVOTS IN OLD AMERICAN CLOCKS

Q. Where can material be obtained to replace wire hammer springs? How is the spring strength determined and the shape formed?

A. I do not recall this subject in any of the literature I have read, yet these springs frequently need attention. I'll give you my methods of making the springs.

Spring wire is available from some parts suppliers in both brass and steel in a variety of sizes. The problem here is choice of size and material. I prefer the brass because it is easier to cut, form, and adjust. Brass spring wire is larger in size for a given beam-strength. Another source of steel wire is a hobby store. They usually have a variety of sizes in straight pieces about three feet long.

I use brass wire from the local hardware store. A small coil, or spool, of wire of approximate size is suitable. When purchased, the wire is very soft and must be hardened to give it the necessary character.

Brass cannot be hardened by the heat-and-cool process used on steel. It must be work-hardened. This work-hardening is very simple and only takes a minute or so.

Select a wire size similar to the original piece, hold with pliers in each hand, and stretch it about 10%. Now test its spring character. As the wire stretches, it becomes harder and ultimately to the breaking point. You can even feel the resistance to stretch increase as it hardens.

I form an end-hook, wind the wire around a hammer arbor, and cut away any excess length.

You may use the wire-stretch technique for other purposes. I pull a wire until it breaks, and use this for a replacement crutch-wire on old American clocks. The wire will be tapered in diameter, smaller at the break-point. If you prefer a soft end for the loop, hold it in a flame for a moment.

Brass is a remarkable material that has endured hundreds of years in our trade.

Q. The hammer arbor holes in most old American clocks are not a close fit to the respective pivot. Do you recommend a bushing to correct the problem?

A. For the most part, time has obscured the engineering thought process and manufacturing techniques used in building these old clocks. It is my opinion that these pivot holes were never the close fit exhibited by the gear train of the same movement. That opinion tells me to leave these pivot holes loose. However, if there is a functional defect, a correction is in order.

It appears that the holes were pierced with no subsequent finishing. Look at the plate edges. These were die-cut. A close inspection shows that one side has the edge slightly rolled, cut about half through its thickness, and then the remaining half-thickness distance is broken. That is the character of a die-cut piece of metal. Look around all of the plate edges for this die-cut-and-break evidence. A pierced hole will have a similar inner surface. The pierced hole has the same character as the die-cut edges of the plates, meaning the pivot would need larger clearance to function properly.

Drilled holes have a better internal finish, reamed holes even better, and the burnished hole probably best of all (each process adding cost).

Modern-day manufacturing uses many methods of forming pivot holes. Pierced holes may be subsequently ball-sized or bullet-sized. This process drives a very hard ball or bullet-shaped device through a pierced hole to stretch and burnish it to a precision diameter and finish. Holes often are bullet-struck on each end to debur and form a chamfered entrance. These techniques were in common practice during my tenure in electric typewriter manufacturing and may well be used in clockmaking.

It's remarkable that the old American clocks have endured the years that have passed--a notable movement to the industrial excellence of years gone by. Take special care with them! ❑

If you have a subject that you would like J.M. Huckabee to address in a future article, send it to: "Ask Huck," c/o *Horological Times*, 3700 Harrison Avenue, Cincinnati, OH 45211.

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PENDULUMS

PART 3
EXPERIMENTING WITH PENDULUMS

By Henry B. Fried,
CMW, CMC, FAWI, FBHI, ★FNAWCC

Nineteen-year-old Galileo watched the church chandeliers swinging in open window breezes. He timed their arcs with his pulse and discovered that those which swayed in wide arcs and those which swayed only slightly all kept the same rhythm.

We can do a little scientific experimenting on our own and learn much about the other basic pendulum principles which were established so long ago by Galileo himself.

EXPERIMENTING WITH GRAVITY

When we drop a ball, it falls due to gravity. If we attach a string to the same ball and, holding the string in one hand and the ball at arm's length, allow the ball to fall, the direction of its drop is not only downward but a nearly circular arc. As the ball arrives at its lowest point, directly below the point of suspension, it is traveling its fastest. Momentum continues the swing upward. The time it took the ball to reach this lowest point from where it was released is governed by the laws of falling objects. And so it is with pendulums.

Knot the end of a long string and force the string through a punctured rubber ball with tweezers. The knot will support the ball when it hangs. Now measure 39 inches from the center of the ball up the string and tie a knot for reference barely above this point. Hang this from some support so that the ball is reasonably clear of obstruction--an open doorway is a good place, such as in Figure 7. Now hold the ball rather wide of its support and let it go. Count the swings against a watch or sweep second hand of a clock; one swing is from the extremity of its arc to the opposite side. All calculations being correct, one should find that the ball will make approximately 30 swings in a half minute, or one every second. For a second experiment, let us use a heavy piece of lead or steel supported by the same type of string. Measure the same distance from the center of the weight along the string as we did with the ball, and suspend it in a similar fashion. Once again, give the weight a healthy swing in as wide an arc and start counting. If the distances of both strings were measured correctly, the number of swings per minute should be the same.

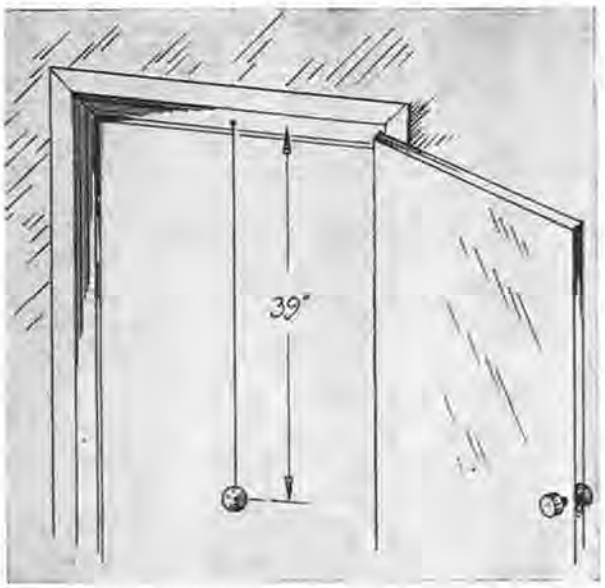


Figure 7. A good way to start experiments with simple pendulums is to hang a ball with string in a doorway. To begin, measure 39 inches from the point of suspension to the center of the weight.

We have proved that the weight of the bob of a *simple pendulum* has no bearing on the frequency of oscillations of this pendulum. Many of us remember an experiment from high school physics showing that a feather and a steel ball fall at the same speed in a vacuum. Out in the open, air resistance would affect a lighter pendulum bob or one whose shape would act as a block to the passing air currents.

Next we can compare what difference there is between a heavy pendlum swinging in short arcs and one swinging in wide arcs. Since we already know how many wide swings our metal weight took in

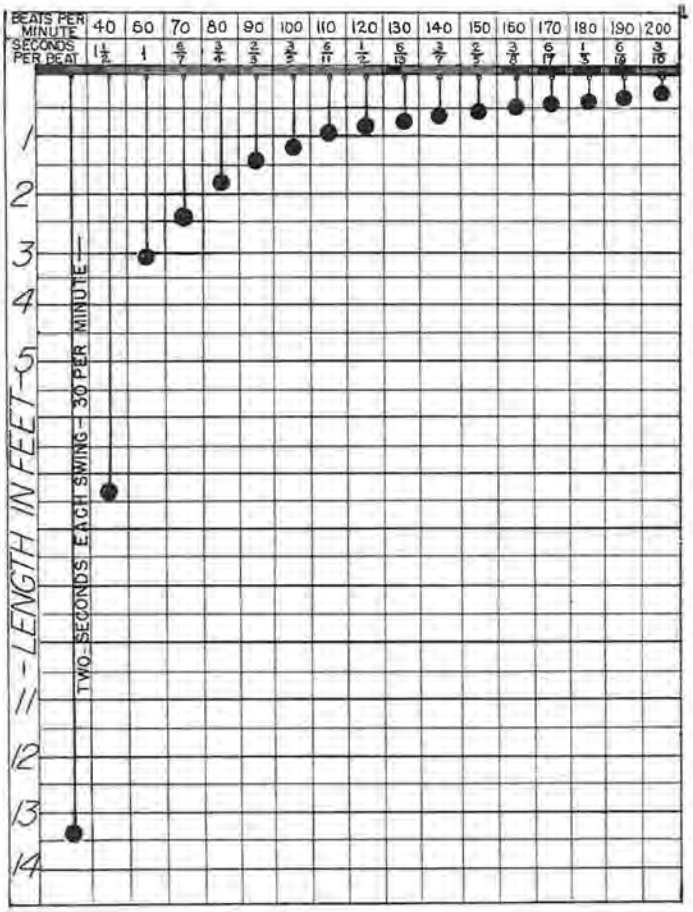


Figure 8. This chart shows the great length of pendulums which must swing very slowly. For example, the 2-second pendulum at the extreme left needs to be about 13-1/2 feet long, while the 1-second pendulum shown here needs to be one quarter as long.

a 1/2 minute, repeat the experiment but let it swing in a very short arc for the 30-second period. We should find that the number of swings for the same period is the same, proof that the widths of the arc have no great bearing on timekeeping.

CALCULATING THE LENGTH

Now that we know a simple pendulum will beat exact seconds if its active length is 39+ inches, we must qualify this rule because the exact length varies according to the distance to the earth's center. For example, a simple pendulum beating true seconds at the equator will be an even 39 inches long. One at the North or South Poles would need to be about a 1/5 of an inch longer, or 39.206 inches. At New York, a seconds pendulum needs to be 39.10 inches long. In London, a more northerly latitude, we must adjust the pendulum's effective length to 39.14 inches. Almost all tables of pendulum lengths are calculated with London as the base.

The clockmaker who must replace a missing pendulum can derive practical answers with basic mathematics. Suppose we again take our metal pendulum and shorten the string so it is now only half the original distance from its point of suspension to the center of the bob, or about 20 inches long. Timing the swings of this shorter pendulum for 30 seconds

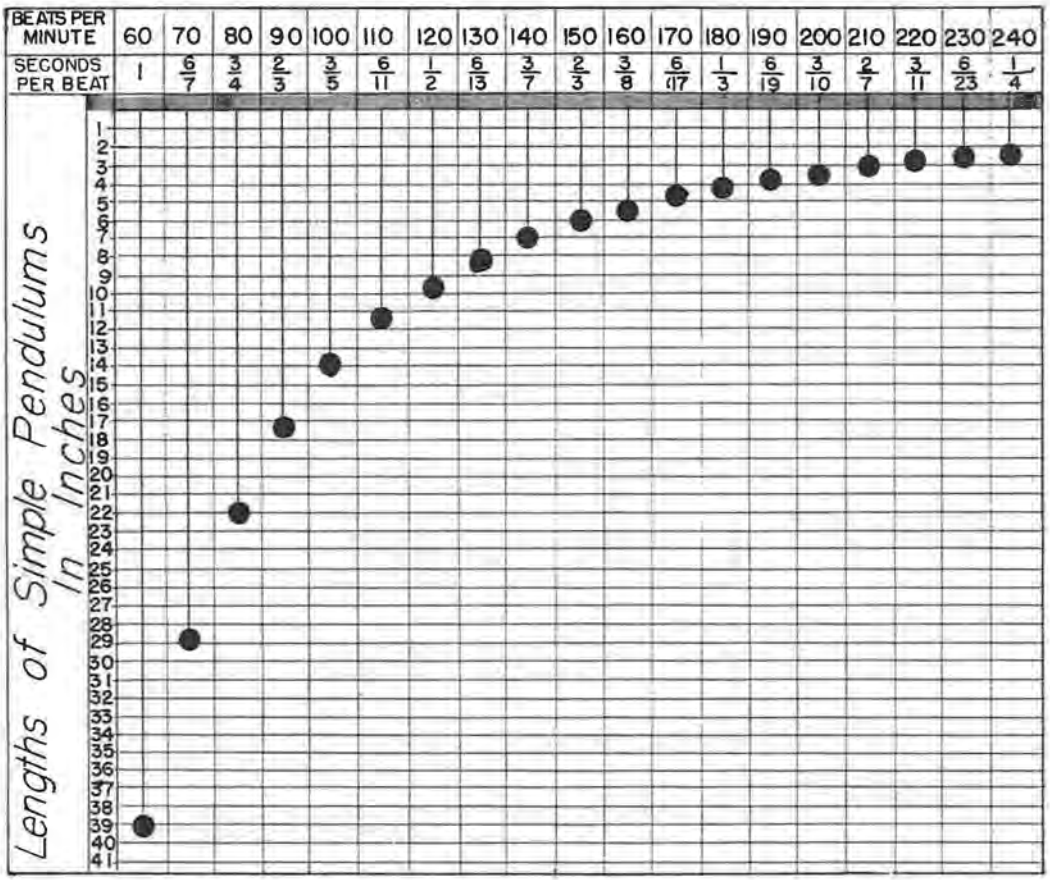


Figure 9. This chart can be cut out, backed with cardboard, and hung up for ready reference. It shows most of the popular lengths of pendulums in use. It also shows that as the time intervals between oscillations get shorter, the actual lengths of the pendulums vary only slightly. This should indicate that clocks with very short pendulums are difficult to regulate; their lengths are so critical that minute variations result in great errors in timekeeping.

will show that it swings about 40+ times in a 1/2 minute, or takes about 3/4 of a second for each swing. This indicates that a shorter pendulum swings much faster than a longer pendulum. However, we cannot make any conclusions about the relationship of a pendulum's comparative length to its period of oscillation on one trial alone.

Therefore, let us extend our experiment and make the pendulum 1/4 the length of the original seconds pendulum. Remembering to measure from the center of the weight to the point of suspension, we calculate 9-3/4 inches. We discover that this pendulum will oscillate 60 times in a 1/2 minute, or 120 times per minute. Thus, by making it 1/4 as long, we have a pendulum which swings twice as fast. When it was 1/2 as long, it beat 1/3 faster. The mathematical rule we need now can be found by simply reversing the logical sequence illustrated above.

Let us review our findings, taking a seconds pendulum as a standard time measurement, and the closest length to 39.10 which can be easily divided or multiplied (40 inches) as a standard length. We discovered that 1/4 the length of a seconds pendulum would produce an oscillation every 1/2 second. Let us turn this around and say that 1/2 second oscillations are produced by 1/4 the length of a seconds pendulum. Thus, *if we take the amount of time we want our pendulum to beat, multiply this by itself, and then multiply the product by our standard of 40 inches, we get the length of our desired pendulum in inches.* For example, suppose we need a pendulum which will beat 3/4 seconds:

3/4 x 3/4 = 9/16 x 40 = 22-1/2 inches

The length of a 3/4 second pendulum is 22-1/2 inches.

In order to find the length of a 3/8 second pendulum:

3/8 x 3/8 = 9/64 x 40 = 5-5/8 inches

We find that a 1/3 second pendulum must be 1/9 as long as a seconds pendulum, and a 1/4 second pendulum must be 1/16 as long as a 40-inch pendulum.

Suppose we want a pendulum which takes two seconds to swing from extreme right to extreme left:

2 x 2 = 4 x 40 = 160 inches or 13-1/3 feet

Some tower clock pendulums are that long; the most notable of course being the Houses of Parliament clock in London.

This rule is good enough for the watch and clockmaker who must supply a missing pendulum.

Regulating nuts on the bottom of most pendulums are sufficiently long to allow finer regulation in both directions to fairly accurate time.

ANOTHER METHOD

Suppose we know the number of vibrations per minute and do not care to discover the fractional oscillations of the pendulum such as 1/4 second or 7/8 second. One of the oldest and simplest methods of determining pendulum lengths from the number of oscillations per minute is to use our original standard, the seconds pendulum. It beats 60 times every minute; multiply this by itself and get 3600; multiply this by the length of the standard pendulum, 39 inches, and we obtain the figure 140,760. Use this six-digit number as a standard in all such calculations.

Now, taking the number of swings per minute our pendulum requires, multiply this by itself. For example, 170 swings per minute:

$$170 \times 170 = 28{,}900.$$

Divide 28,900 into our standard 140,760 and get 4.8, or 5 inches for practical purposes.

Perhaps we need a pendulum swinging 85 times a minute:

$$85 \times 85 = 7225$$

$$140{,}760 \div 7225 = 19\text{-}1/2 \text{ inches}$$

Thus, we are able to determine pendulum lengths without dealing with fractional second beats. ❑

REJEWELING A NEW HAVEN CLOCK

By Robert D. Porter, CMW

A neat little New Haven mantle clock, shown in Figure 1, was brought in for repair with the complaint that it wouldn't run; and, that it was needed as soon as possible for a graduation gift. The movement was taken out of the case, and the dial side is pictured in Figure 2. An examination revealed the tilted balance wheel (Figure 3) which suggested a broken balance staff and/or jewel. Before the hairspring was unpinned, an old watch hand was bent 90 degrees to a length that corresponded to the amount the free end of the hairspring extended beyond the pinning point. This "gage" would save regulating time when the hairspring was repinned during assembly by assuring the correct beat setting and vibrations per hour, assuming it was now pinned correctly. The threaded bearing pieces and balance wheel were then removed from the clock.

Figure 1

Figure 4 pictures the balance wheel, hairspring pin, "gage," and the two threaded bearing pieces which had balance hole and cap jewel settings burnished into a blind hole in each threaded piece. One of the balance hole jewels was broken and would have to be replaced. One of the balance pivots was cut slightly from running in the broken jewel and would be repaired by burnishing and polishing to a slightly smaller diameter.

Figure 2

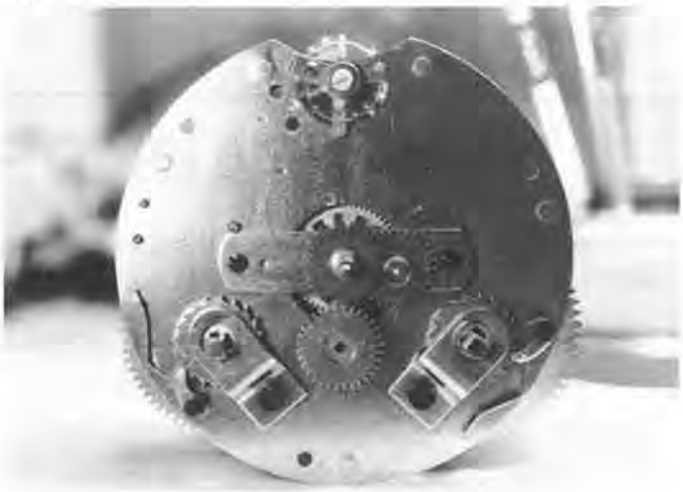
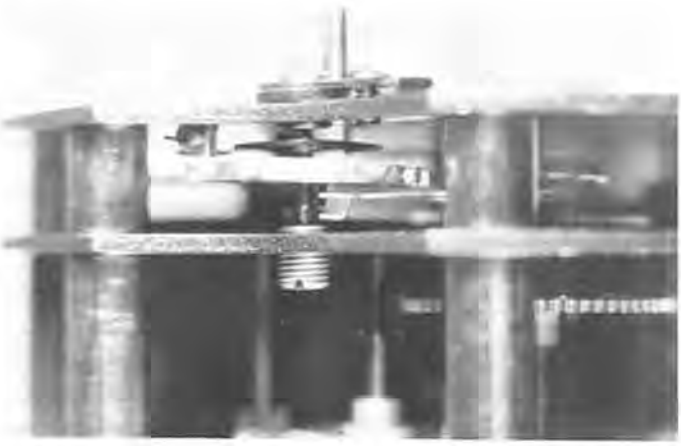


Figure 3



Figures 5 and 6 illustrate the boring out of the old settings in the lathe using a Dremel® cone-shaped burr as a boring bar, mounted in a block on the lathe cross-slide.

Figure 4

Figure 5

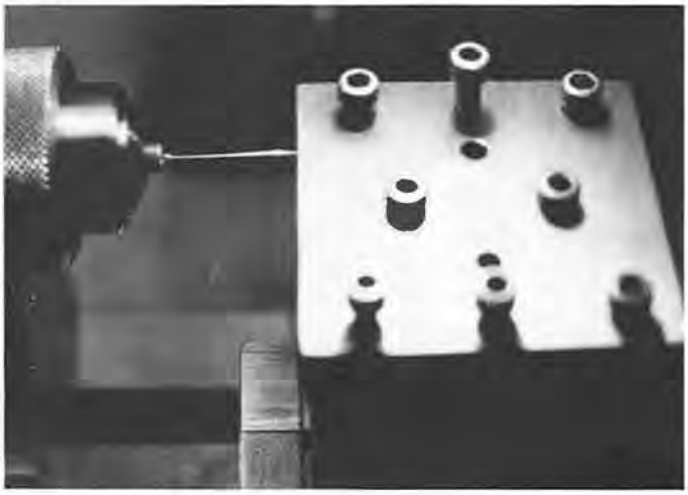


Figure 6

The next step was to rework and polish the balance staff pivots in a balance wheel chuck as shown in Figures 7 and 8. A friction fit balance jewel with a hole 0.01 mm larger than the reworked pivot was selected and a replacement setting started. Figure 9 pictures the testing of the threaded piece onto a turned part of the brass rod being used as a plug gage to determine the internal diameter of the bore. The new setting was then turned 0.01 mm larger than the bore to assure a safe press fit.

A drill that is slightly smaller than the friction jeweling tool reamer is being used in Figure 10

Figure 7

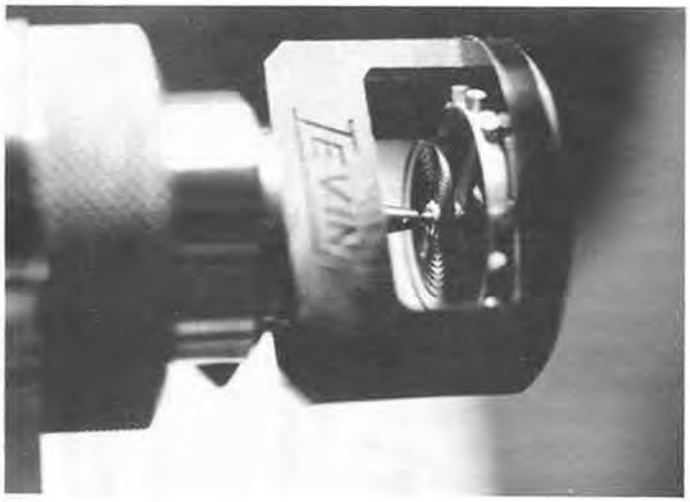


Figure 8

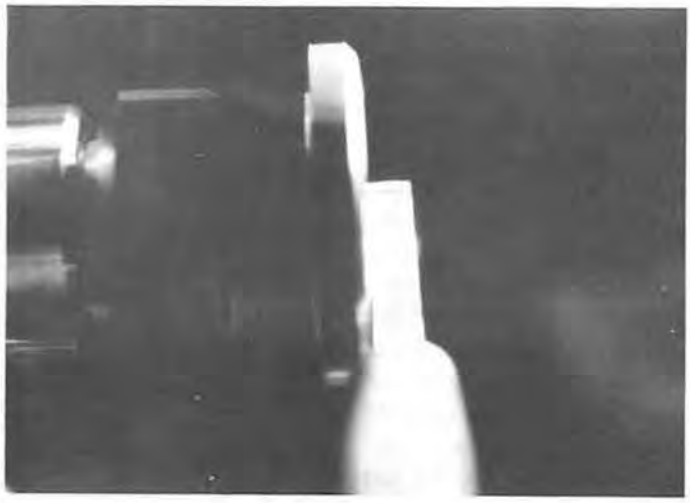


Figure 9

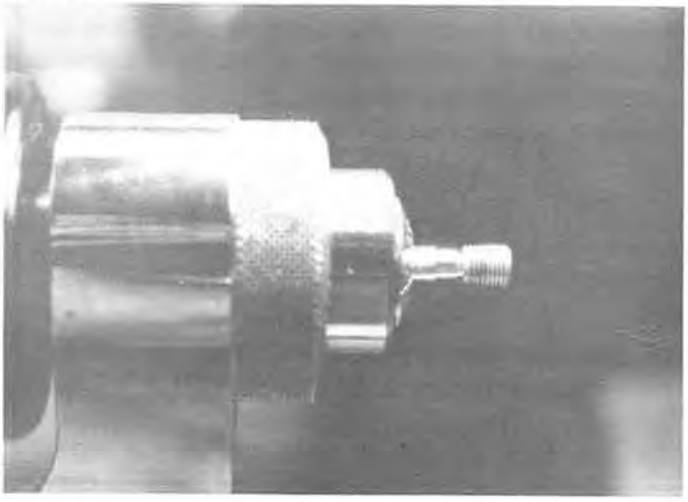


Figure 10

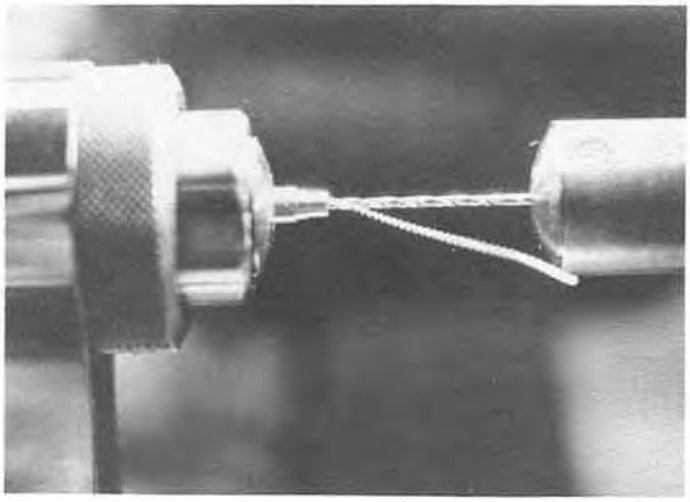


Figure 11

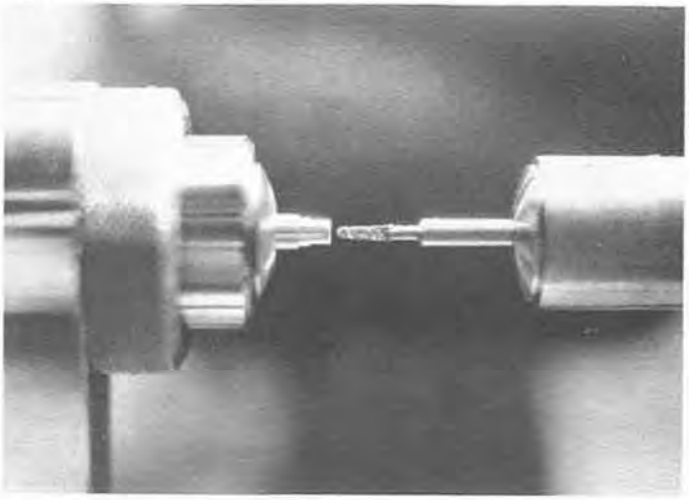


Figure 12

Figure 13

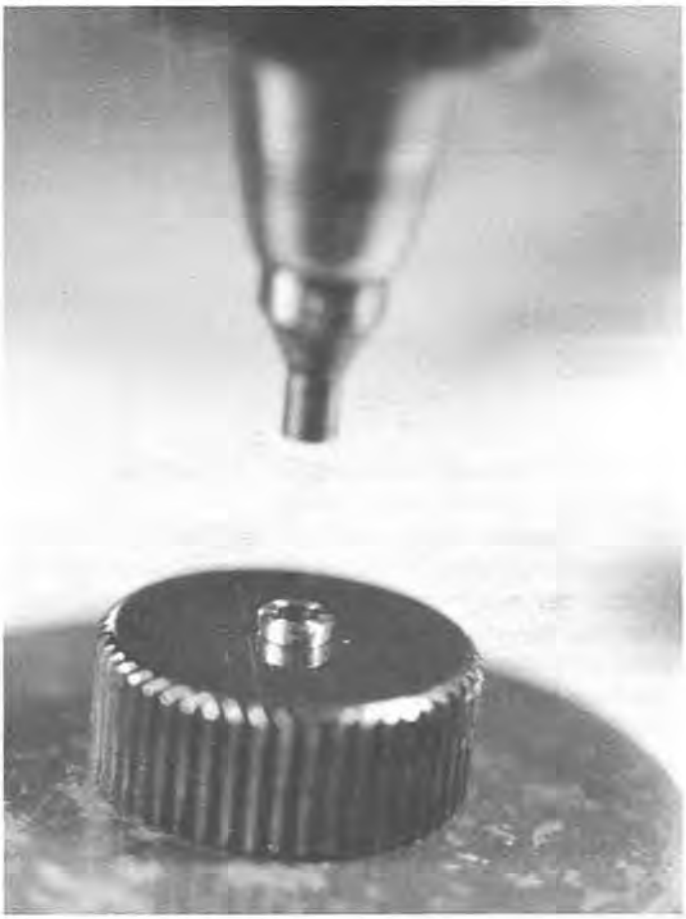
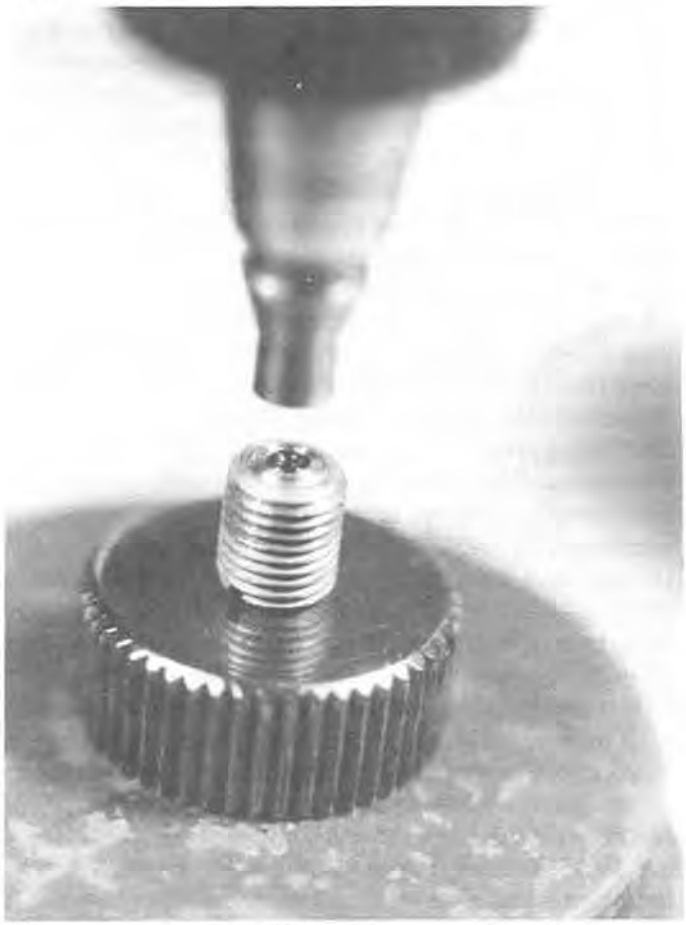


Figure 14



(Please turn to page 25)

SCHOLASTICALLY SPEAKING

Frieda V. Marshall

HOROLOGY CAREERS OF THE FUTURE

Recently a jeweler in our city closed the doors of his store. At the age of 70 and with 51 years of devotion to his customers in selling quality jewelry items and in giving service, he felt he deserved some time of leisure. Where was the younger person who could have continued his business and reaped the benefits of the customer loyalty he had nurtured through the years?

In this same city there is a college that includes a department of horological studies: watch repairing, clock repairing, hand engraving, and jewelry skills. Obviously, the day of the jeweler's apprentice is past. Today a complete training program can be completed under watchful eyes of competent instructors who give encouragement and guidance to the students. It has ever been evident that there are more positions available than there are students trained in these refinements.

At the Gem City School of Horology in Quincy, Illinois, there is a constant and recurrent ambition expressed by the students. "I want to learn everything I can about the jewelers' trade, work for someone else for a while, and eventually own my own business." Students are cautioned against limiting themselves to training in engraving only or jewelry only or even only watchmaking. The complete range of skills will produce a more desirable employee and one more confident to become a business proprietor. Students also have the opportunity to learn parallel skills of accounting, business management, and communications to earn an Associate Degree in Jewelry Store Management or Complete Horologist, and thereby enhance their stature as competitive business persons.

What motivates an individual to seek specialized training of this kind? Often the hometown jeweler, recognizing artistic aptitude and ability, will sponsor a part-time employee through the development of higher levels of technical expertise. So they come from Indiana or Michigan or Utah, or even Japan, complete the program, and return to the former location. Jewelers enroll their sons and daughters in the school where the development of skills is closely monitored and channeled step-by-step to the goal of being able to give service to the customer accurately, surely, and promptly. Some are encouraged by high school art instructors to develop this avenue for creativity. Artistry is a desired attribute, but not a requirement.

There was a prevailing idea a few years ago that all people would be satisfied with "throwaway" watches. That is, throw it away, don't repair; just buy a new one. One might have thought that all jewelry items would be mass produced, and everyone would be satisfied with machine engraving. But the public has high standards. The better quality watch is worth repairing, or it may have belonged to a beloved grandfather. If it is too valuable to be worn, it may be kept as a showpiece in the home. People are sentimentally attached to watches and clocks. The repair of jewelry pieces and watches knows no recession.

The hand-engraved trophy or silver tray gives a richness not to be matched by mechanical performance. Those who perfect the engraving skills recognize that these applications apply to jewelry repairing and the creating of unique, personal items. The apprentice may have the benefit of learning (when there is time) some techniques known by one particular craftsman. In a formal setting of study the student learns from the instructors' years of experience and a carefully calibrated curriculum tuned to answer the questions of the beginners and to cover the basics needed. Later, individual techniques can be developed.

Gem City College School of Horology has a 105-year history, having been founded in 1886 as the Parson's Horological Institute of Laporte, Indiana. In 1892 the school was moved to Peoria, Illinois, where this was the initial program that later developed into Bradley University. Such training seems to have cycles of interest. During a "down" time, the shool in Peoria was purchased by Gem City College and moved to Quincy, Illinois, as a department of the college that also has a 120-year history as a business school with auxiliary programs in fashion merchandising, medical assistant training, beauty culture, and computer programming. At the new location, enrollment grew to a top of 215 with a 15-member staff. New, spacious facilities were provided that are completely handicapped accessible.

In a reasonably short time, a beginning student can acquire the knowledge and develop the skills leading to a lifetime career of pleasant, respected, and lucrative work. One who has a range of jewelry skills

and a selection of appropriate tools can make a choice of locations throughout the country and have excellent opportunities for employment.

Quincy is a medium-sized, friendly city with a wide array of industry, services, medical facilities, parks, museums, and sports events. Students of the college find convenient and pleasant housing, and there are opportunities for part-time employment. For one who will reach out to the community, there is a welcome from the theatre group, rock club, church groups, sports teams; and there are civic festivals that can give the students leisure-time participation.

Established jewelers may not realize that they stand as admired "role models" for young people searching for career opportunities. A word or two of encouragement may set someone on this path who will then be forever grateful for this good advice. And the continuity of a well-respected jeweler's business may be protected and assured.

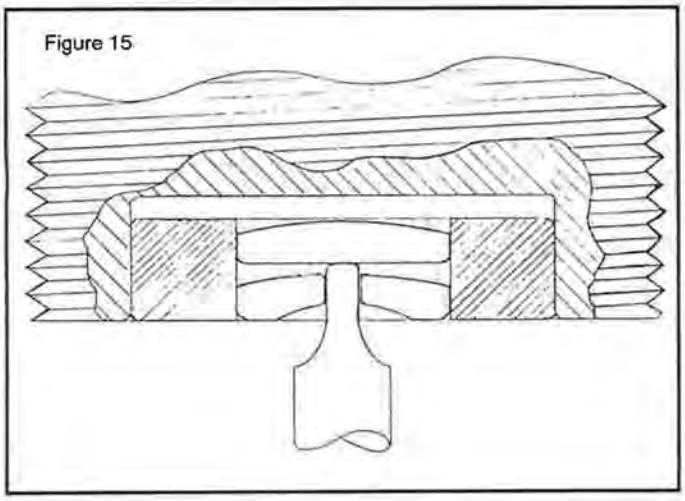
❑

REJEWELLING A NEW HAVEN CLOCK

(Continued from page 23)

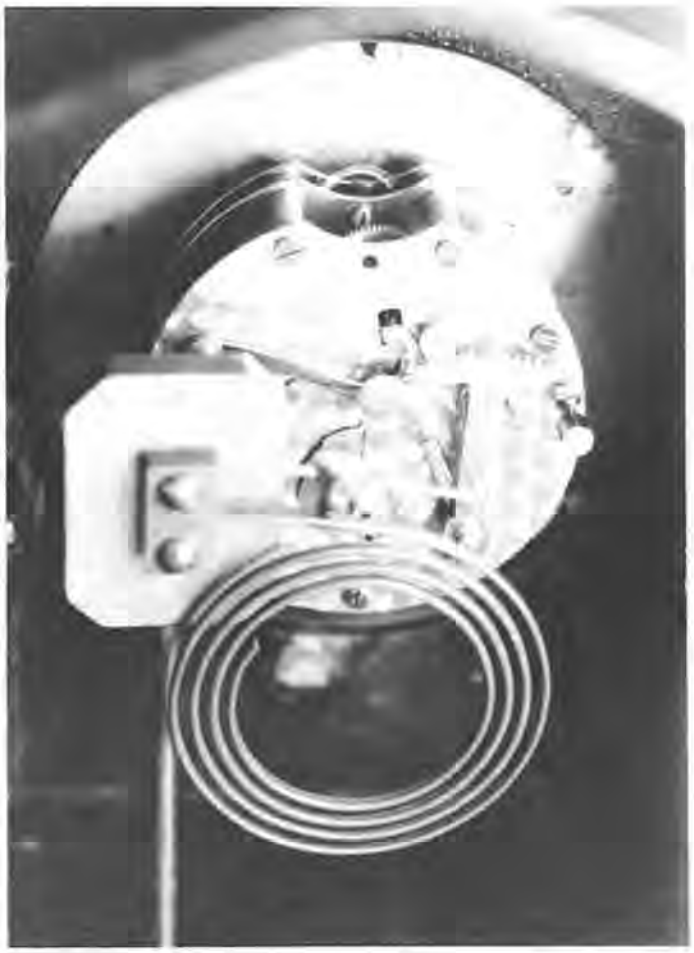
to drill the setting. A reamer has just been used (Figure 11) to carefully hand ream the hole to a size that is 0.01 mm smaller than the outside diameter of the jewel. The setting was then parted from the stock to a length 0.02 mm longer than the combined thickness of the cap and hole jewels.

Figure 15



The threaded piece, brass setting ring, and the stacked hole and cap friction jewels are illustrated in Figure 12.

Figure 16



A jewel has just been pressed into the setting in Figure 13 with a Seitz jeweling tool. The jewels were pressed into the setting from opposite sides of the setting to assure a proper fit. Ordinarily, a balance hole jewel is pressed into a hole chamfered edge first with a pusher that is slightly smaller than the full diameter of the jewel. This would have required pushing the jewel completely through the setting and stretching the metal to the point that the cap jewel would not be secure.

It would have been better from a restoration standpoint to have used two separate settings as originally configured, but they were not on hand and time was of the essence. The thickness of the setting is such that a slight separation (0.02 mm) exists between the cap and hole jewels for proper lubricant retention. The setting containing the hole and cap jewels has just been pressed into the threaded piece in Figure 14. Figure 15 shows the arrangement.

The clock was then cleaned, reassembled, and lubricated. Figure 16 shows the movement back in its case and the New Haven's balance wheel busily ticking away. ❑

Technically WATCHES © 1991

Archie B. Perkins, CMW, FNAWCC, CMBHI

Antique Watch Restoration ©1991

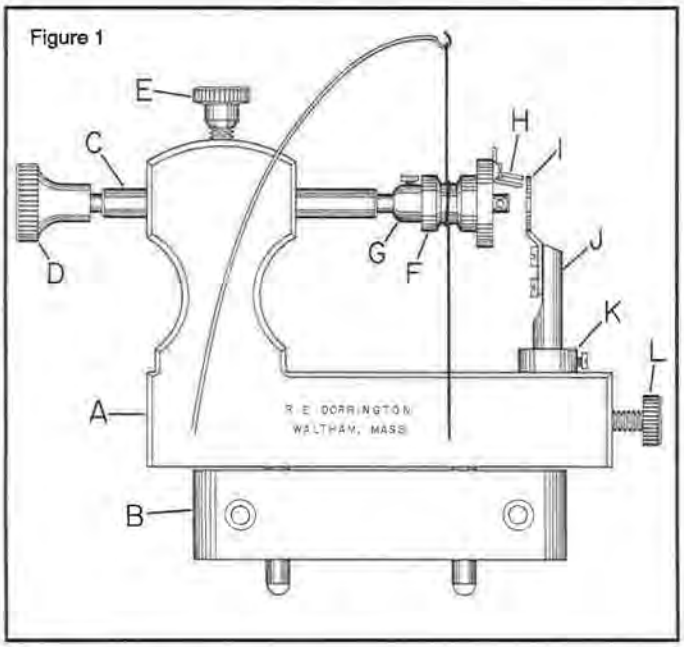
Part LXIX
Polishing Balance Wheel Pivots

Another method that can be used for finishing balance staff pivots is by using a pivot polisher. This method has been used widely in the past by the finishers in the American watch factories. This is a quick and accurate method for finishers and adjusters to use when shaping the ends of balance staff pivots for adjusting the dial position rates of watches. This method is also used by the finisher and adjuster for straightening pivots and removing any burrs from the corner of balance staff pivots. A very important feature of the pivot polisher is that the balance staff being worked on turns between dead centers.

THE DORRINGTON PIVOT POLISHER

Figure 1 shows the Dorrington pivot polisher. The body of the tool is shown at A. Its base is shown at B. This base has two holes for screws so it can be fastened to the front edge of the watchmakers bench. The body of the pivot polisher has two legs which fit into holes through the edge of the base. This is so the pivot polisher can be quickly placed into or removed from the base when being used. View C shows the spindle of the tool. This spindle is double ended. Both ends of the spindle are jeweled. Each jewel has a different hole size to accommodate the pivots on all sizes of balance wheels. The jeweled spindle helps to protect the cone of the pivot of the balance staff being worked on as well as to increase the life of the spindle. The end of the spindle not being used has a removable protective cap shown at D. The spindle is held in position by screw E. The end of the spindle carries a pulley shown at F. This pulley is mounted on its bearing G which has a set screw to allow the pulley and its bearing to be adjusted to different positions on the spindle. View H shows the fork used to straddle the balance arm to motivate the balance wheel as the pulley is turned back and forth during the tool's use. View I shows one of the tool's pivot discs. The tool has three different size discs--large, small, and extra small. These discs are held onto their post J by two screws. The collar that is shown at K is for adjusting the height of the disc for lining up the hole in the disc with the hole in the spindle. Once the collar is set at the proper height, then when the post is removed and replaced, the height will automatically be correct. View L shows the thumb screw used to hold the post tightly into position in the base of the tool. The pulley on the Dorrington pivot polisher is turned back and forth with a bow. The cord on the bow is placed on the pulley as shown in Figure 1. The direction of the cord should reverse at the back side of the pulley. The cord must be loose enough to allow it to be looped around the pulley for one turn.

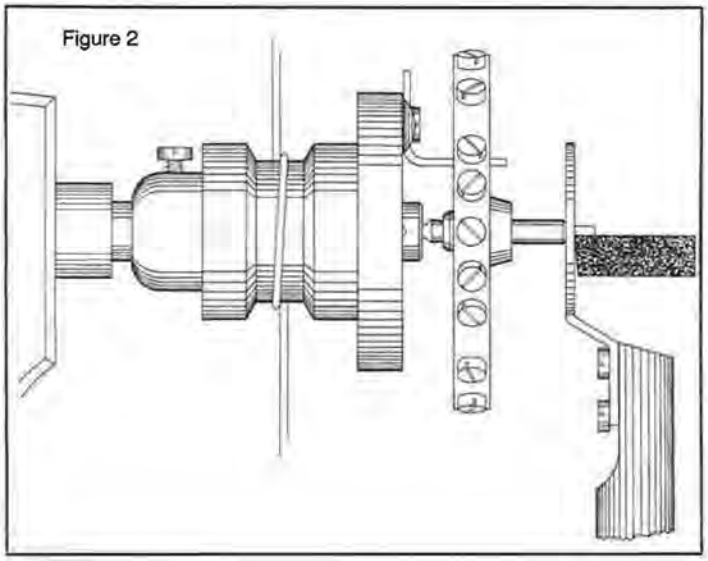
Figure 1



USING THE DORRINGTON PIVOT POLISHER

Figure 2 shows a close-up view of a balance wheel set up

Figure 2



in the Dorrington pivot polisher for finishing the lower pivot. To place the balance into the pivot polisher, one should first place the pivot to be polished through the hole in the disc and then place the other pivot into the hole in the spindle of the tool. Adjust the spindle so the balance wheel is just free between the two centers, then lock the spindle into position with its set screw. Loosen the pulley bearing screw and adjust the pulley on the spindle so the fork is astride the balance arm, then lock the pulley to the spindle by tightening the pulley bearing set screw. Note: Before the balance wheel is placed in the pivot polisher, the cord of the bow should already be in place on the pulley. The balance wheel should be parallel to the pivot disc to be correctly aligned in the tool.

When finishing a pivot with the pivot polisher, as the bow is pulled toward the operator, the burnisher is pushed, and vice versa. The motion of the surface of the burnisher should oppose the motion of the surface of the pivot. Since the burnisher is used underneath the pivot, the cord of the bow is wrapped on the pulley from the back of the pulley and changes directions at the back of the pulley. This is opposite to the way the bow cord is wrapped on the pulley when one is using a Jacot lathe or a pair of turns.

The edge of the burnisher that rests against the pivot disc should be slightly undercut and the corner of the burnisher should be slightly rounded. The rounded corner helps to prevent a sharp line from being formed on the pivot in case the corner of the burnisher is tilted sharply into the surface of the pivot. A sharp cornered burnisher could dig into the surface of the pivot if it is accidentally tilted into the pivot when the pivot is being burnished. The surface of the burnisher should be kept clean and lightly oiled. The holes for the pivots should also be lightly oiled.

The burnisher is held as shown in Figure 2 for burnishing the pivot diameter, then it is brought over the corner of the pivot to remove any burrs. Next, the burnisher is used on the end of the pivot for finishing the end. Note: When using the pivot polisher for straightening pivots, the wheel should be turned very slowly to detect a

Figure 3

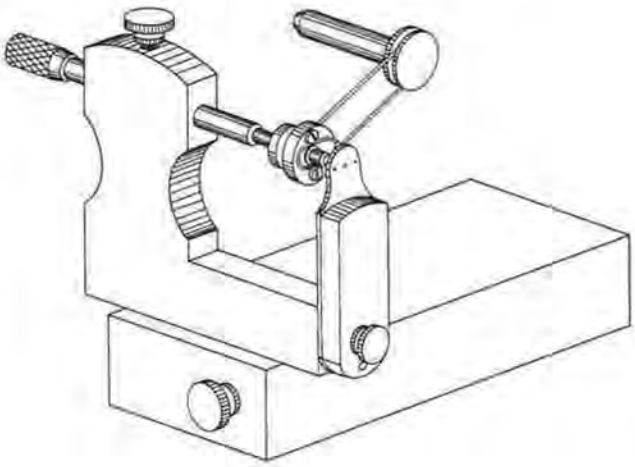
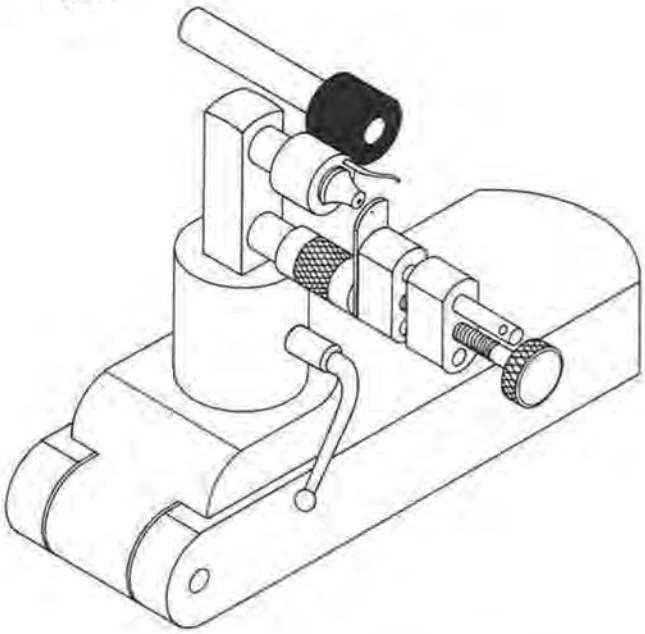


Figure 4



bent or damaged pivot. The pivot straightening tweezer should be made of brass or nickel silver or soft steel to avoid damaging the pivot.

When shaping the end of the pivot, if much material needs to be removed, this can be done with a fine jasper stone before the steel burnisher is used for finishing the surface of the pivot. Note: Grinding and polishing compounds should never be used on pivots that are finished with the pivot polisher. Grinding compounds get into the hole of the pivot disc and cause the pivot to become damaged.

THE LEVIN PIVOT POLISHER

Figure 3 shows a Levin pivot polisher which mounts on the lathe bed and is driven by a belt from a pulley mounted in a chuck in the lathe headstock. A special shoe, which is held on the lathe bed by the T-rest bolt, forms the base for the pivot polisher. The two legs of the pivot polisher fit into two holes in the shoe and are held tightly with a screw which goes against one of the legs. The drive belt can be a rubber band or a small cord. The drive pulley has an arbor which fits a Number 50 chuck. This pivot polisher can also be used in the bench plate that is screwed to the front of the bench. Although this method of turning the pulley of the pivot polisher is an acceptable method, it is not considered as good as the back-and-forth motion created by using a bow. The change in direction of the motion gives a better lapping effect on the pivot by the burnisher.

There is only one pivot plate for the Levin pivot polisher. This plate has three different sized holes which accommodate different size pivots from pocket watch balances to small wristwatch balances. The pivot plate has a hole near its bottom edge which fits on a pin so the plate can be swung for centering any one of the three holes. A thumb screw binds the plate into position.

THE E AND S PIVOT POLISHER

Figure 4 shows another style of pivot polisher which is held in a T-rest on the lathe bed and is driven by a rubber drive-wheel held in a chuck in the lathe headstock. The rubber drive-wheel runs against the solid metal roller on the spindle of the tool. This pivot polisher was made by the E and S Watch Tool Manufacturing Company in the late 1940s. This tool has three different pivot plates for balance wheels from pocket watches to ladies wristwatches. There are also two different sized posts--a 6.50 mm post for a Moseley or Peerless T-rest, and a 7.00 mm post for the Webster-Whitcomb T-rest. These posts screw onto the frame of the pivot polisher. Note: This pivot polisher should be used in a solid, non-tip-over type T-rest for a more positive drive action. If used in a tip-over T-rest, the hinge of the T-rest must be tight to maintain a positive drive. The rubber drive wheel has a shank which fits a Number 50 chuck. The spindle of this pivot polisher is jeweled.

A PIVOT POLISHER FOR THE WATCHMAKERS LATHE

Figure 5 shows a pivot polishing arrangement that can be made and fitted to the watchmakers lathe. The pivot plate is mounted onto the end of an L-shaped block which is attached to a taper that fits the tapered hole in the tailstock spindle. The hole for the pivot is drilled with a drill held in a chuck in the lathe headstock. The tailstock spindle can be turned by hand as the drill is being turned by the headstock. This assures that the hole will be drilled on center. To support the other pivot of the balance staff, a steel rod is used. The rod is held true in a wire chuck while the

Figure 5

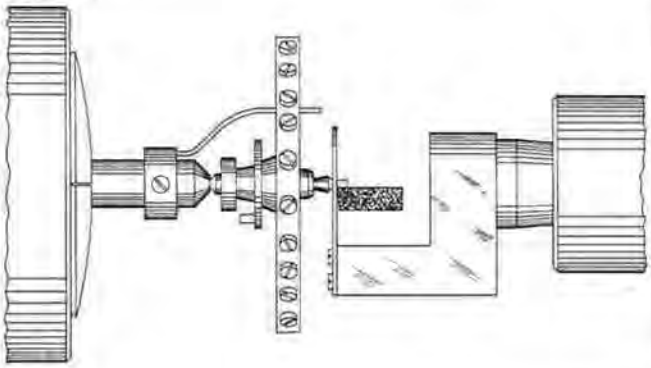


Figure 6

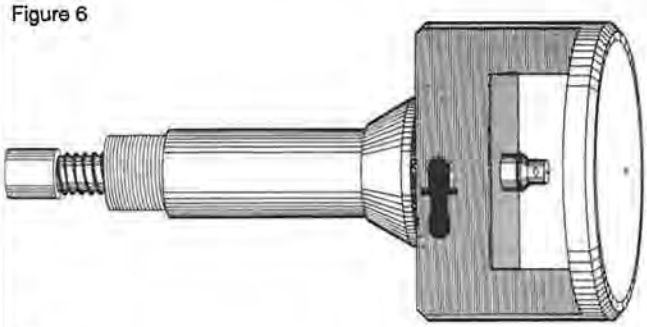
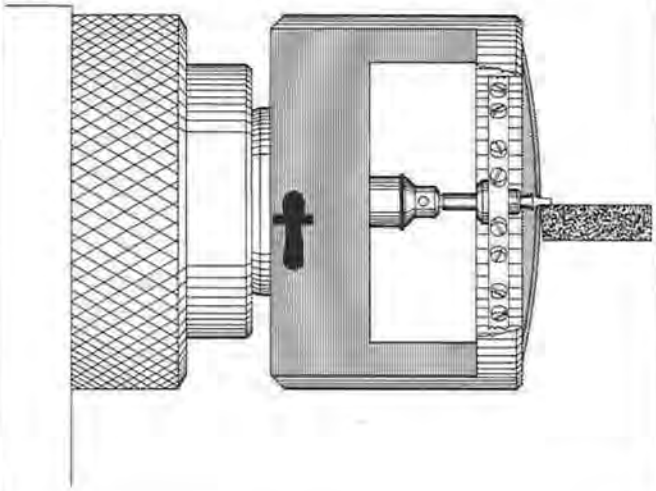


Figure 7



center hole is drilled. The corner of the hole should be chamfered to fit the cone of the balance staff. Note: Instead of having a chamfered hole, one could jewel the end of the rod to form the spindle. For driving the balance wheel, a collar which has two drive pins frictioned into its end is used. The collar should fit the spindle closely and be held in position on the spindle with a set screw. The collar could be fitted to the spindle with a slide friction fit without using the set screw. Note: It takes much practice to become skilled and fast in using the pivot polisher. One should do practice work on some old junk wheels before actually using it on customer jobs.

THE BALANCE CHUCK

Another attachment that can be used to hold balance wheels for working on their pivots is the balance chuck. The balance chuck is shown in Figure 6. In this case, the cage that the balance wheel fits into is mounted onto a blank lathe arbor chuck. This is the most desirable style of balance chuck since it usually runs true each time it is placed in the lathe spindle. Some balance chucks are made with an arbor which fits a Number 50 wire chuck. It is more difficult to get this type of balance chuck to run true when it is used. It is very important that both pivot centers run absolutely true before one uses the chuck for working on balance staff pivots.

The balance chuck shown in Figure 6 has a spring-loaded arbor to support the cone of one pivot while the other pivot is being worked on. The arbor is locked into position with a locking lever. The pivot being worked on goes through a hole in the center of a convexed disc in the end of the cage.

Figure 7 shows the balance chuck mounted in the spindle of the lathe with a balance wheel mounted into position in the balance chuck. The balance chuck is cut away to give a view of the balance wheel and its staff. A burnisher is in position for burnishing the diameter of the pivot extending through the pivot plate. The burnisher is manipulated to other positions for burnishing the end of the pivot and for removing the burr from the corner of the pivot. The balance chuck can also be used when straightening pivots and for holding and working on escape wheels and pallet forks which have conical shouldered pivots.

"Antique Watch Restoration" will continue next month. ❑

SHOP TALK

Wes Door, CMW

HOW TO START AND MANAGE A BUSINESS

PART 1

The subject for this article was suggested by several members who feel there is a need for information on starting and managing a business. It seems like we presume that everyone who has taken any technical courses (through schools, reading technical materials, apprenticeship, or other forms of education) automatically know how to open and run a business.

Although some of the following material (or I should say ideas) is from personal experience, many others have contributed to make this article possible. There are probably as many ideas as there are members reading this article, so with that qualifying remark, I'll go on.

BEFORE STARTING

First, before starting, let's look at our own "life line." No, not the one on our hand that tells our future, but the one shown in Figure 1. Take a minute or two to look it over and maybe make a check mark after each item that you have completed so far in life. You may need to modify the chart. Maybe horology is an avocation and after high school you became a doctor, engineer, mechanic, machinist, etc. We have a lot of AWI members who have made career changes.

We have a check mark after the items that we have done, so now let's put an X after those items that we still wish to accomplish. If we have a lot of X marks on our chart, we may choose to complete these before starting in business for ourselves, or we may want to work in a store or shop who has the personnel with this expertise. This "on-the-job training" is certainly one option worth considering.

DON'T JUMP THE GUN

It is so easy to jump into a store situation when a so-called "once in a lifetime" opportunity shows up. Generally, other opportunities will show up later even though this is difficult to see at the time.

WORK FOR OTHERS

When we are really ready, then we must still decide exactly what we want (Figure 2). Do we want to work for others as an employee? If so, we have some choices to make. Do we seek out a retail store situation to better prepare us for our future, or do we want to work in a repair shop, or should we select one that does trade work? These are all good questions that we must ask ourselves. Another question to ask

FIGURE 1

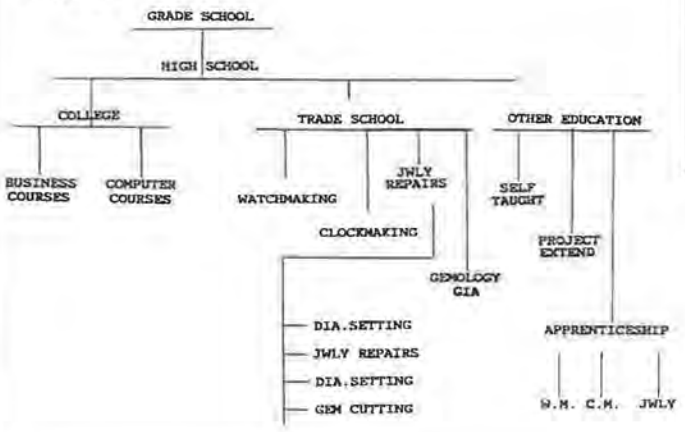
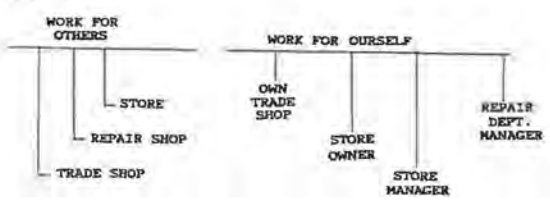


FIGURE 2



is what kind of work will we be doing--watch repairs, clock repairs, jewelry repairs, or what?

WORK FOR OURSELVES

If we choose to work for ourselves, we must make other decisions. Should we open a repair shop and do trade work? If so, what kind of repairs are we equipped to do? Possibly we would consider a repair department manager job, or a store manager job may be our goal at this time. Or should we make that big leap into a store ownership?

STORE OWNER

There are many reasons (including the following) why we may want to start in business for ourselves and thus be a store owner:

1. We are the "boss."
2. We make all the profit.
3. We make all important decisions.
4. Our name is in "lights" or at least on our doors and/or windows.
5. We set our own work hours.
6. We hire the help.
7. We buy from salesmen who compliment us on our fine store.

Next month we will continue and discuss business locations, etc. ❑

Pickle Barrel

Marshall F. Richmond, CMW

JEWELRY CRAFTING AND REPAIR
Problem Jewelry Repairs

Many times we take a piece of jewelry such as a finger ring in for repair or simple sizing, and it turns out to be a problem. It is time-consuming beyond making a good hourly rate of compensation for our time spent.

It has always been my policy to have an agreed-upon, quoted price with the customer, even in some cases where problems are suspected to arise, giving a maximum and a minimum price quotation which I always stay within. Sometimes, however, more time was spent than I estimated at the maximum quotation; this generally evens out because most jobs are completed in much less time than anticipated.

SOLDER DIFFICULT TO MAKE FLOW

Prevention: Make sure the piece of jewelry is clean before applying flux; then solder and heat. This can be done by boiling or soaking in pickling solution, then scrubbing or using the ultrasonic cleaner with a soap and ammonia or commercial solvent cleaning solution, and rinsing in water. Then make sure the flux is not contaminated. Make sure you are using the proper flux and solder for the metal on which you are trying to flow the solder.

Cure: When the steps in prevention have been taken and the solder still will not flow, the problem is possibly in the heat used and how it is applied.

Using too little heat will possibly burn the flux off before enough is used to flow the solder. Enough heat should be used to flow the solder quickly, and then removed before it can boil the solder. Make sure that if the metal being soldered is an alloy of iron (steel or stainless steel), the flux used for gold, silver, or nonferrous metal will not allow the solder to flow, so you must use a special flux such as Aircosil which will let the solder flow on the ferrous metals.

There are many types of solder, and for any job there is a solder that is formulated to make a solder joint for a permanent bond or repair. Most solders are available in easy, medium, and hard flow. This means that the easy flows at a lower temperature, the medium at a higher temperature, and the hard at an even higher temperature, and it is sometimes referred to as welding solder. As the solder that requires the most heat is melting and flowing closer to the melting point of the metal being soldered, care should be taken not to melt the metal being soldered. Also to be considered is that in using the higher temperature melting solders, there is less chance of boiling the solder.

PITTED SOLDER JOINTS

There are possibly three or maybe even more causes for pitted places showing in solder joints. These sometimes do not show up until the polishing is completed. One cause is that the work is not clean. Another cause for this is dirty or contaminated flux. A third cause is that the solder has been overheated and then boils, and when cool, leaves tiny bubbles under the surface of the solder; then when the surface is polished off, the bubbles show as pits.

Another thing that comes to mind that causes pits (and not necessarily in the solder joint) is that the metal in the jewelry is porous. This can be caused by carelessness in casting the metal, lack of cleanliness, or by using metal that has been melted several times after being refined and alloyed to the karat. If it's a solder joint where two pieces of metal have been soldered together, saw through it, which will remove the pitted solder. Then it can be re-soldered using flux that is not contaminated, being careful not to boil the solder. This will usually take care of it, and after polishing, no pits should show. When the gold is pitted or brittle, often the pits will show up about halfway from the stone to the bottom of the shank. This is likely to show up after the ring has been sized. When the ring is made smaller, it is likely to show up on the **outside** of the shank; when made larger, on the **inside**. These cracks or pits can be filled with solder that will match the metal. For 14K yel-

low gold, use 14K yellow solder. First, however, prepare the work by boiling it in pickling solution, then flux with clean flux, apply the solder, and heat until the solder flows completely. After polishing, this will usually fill and cover the cracks and pits. The reason for boiling in pickle is to remove any dirt or foreign substance trapped in the cracks or pits so it will not become covered and cause more pits.

A POLISHING PROBLEM

Occasionally, a ring or piece of jewelry that has had solder work done on it, when polished, will show spots close to where the solder was flowed that will not polish, but the metal around it will. This is usually caused by a spot of crystallized borax which has remained if the piece has not been pickled after soldering. Flux used to make the solder flow is made up of borax, and if any excessive amounts of it have been applied, the heat may melt it, and cause a bubble of crystallized borax to appear. Being harder than the tripoli or other abrasives used in polishing, it will not be removed with the polishing compound. It can be easily removed by either soaking or boiling in pickling solution or in water, as borax is water-soluble. As soaking requires a little time, I usually boil it in a pickle pan over my lighted torch which only takes a few seconds. If stones are involved, make sure they will stand heat before boiling; if they are sensitive to acid, use only water, and soak instead of boil. After the borax is removed, the piece should polish routinely with no trouble.

BROKEN CATCHES OR HINGES ON BANGLE BRACELETS

As bangle bracelets are made of metal tubing which is thin wall, they are very fragile. However, they aren't always treated as such by their owners. We get them in for repair of broken hinges or catches, and even with requests to remove dents.

These are usually karat gold, gold-filled, or gold-plated, so it is wise to determine first if the bracelet is worth the time to repair it, and secondly, if the customer is willing to pay for it. When the bracelets are dented badly, it is next to impossible to repair them to a brand-new condition, so it is wise to turn down this job. It is also wise to refuse any repair if the bracelet is gold-plated, because the piece is not worth the time involved. However, in the case of a sentimental piece, we may accept it for repair at a price comparable to the time involved in making the repair (which may be much more than the replacement cost of a new bracelet).

The hinges and catches are usually fastened to the inside of the tube ends with soft (lead) solder, which requires very little heat to melt for removal or to solder when re-attaching them. If working with gold-filled or gold-plated, it is especially wise to dip the bracelet in a solution of boric acid and alcohol, then ignite and burn

off, leaving a coating of boric acid over the whole bracelet, *before* applying heat to remove or re-solder any catches or hinges. This coating will protect the finish from discoloring when heat is applied.

Often a hinge is just missing a pin, so it is an easy repair just to make a pin from nickel silver or brass rivet wire and rivet the ends slightly when installed to keep it from working out. The catches are often only bent, and can be straightened and aligned without removal; sometimes, however, they must be removed, and even new catches made to replace them. To remove, grasp the end of the catch with tweezers, and while holding over the flame of a torch, apply pressure. As the solder melts, it will slip out. Remember--this is soft solder, and takes very little heat, *so use caution.*

These repairs require ingenuity, so do not attempt them until you have had experience in repairing jewelry. After repairing the catch or hinge, slip it back in the tube and align it. There should be enough solder on it so when enough heat is applied it will flow and make a good solder joint. But before putting it back, it is a good idea to flux both the inside of the tube and the end of the catch or hinge; if there seems to be too little solder on the end, a little can be added before putting it in place. After it is soldered in, it should be pickled and rinsed before polishing.

If this is gold-filled or karat gold, it can be polished in the usual manner with tripoli and rouge. However, if it is gold-plated, it is best to burnish it by using a bronze wire wheel on the polishing motor, which is less apt to remove any of the gold plating, but will leave it bright and shiny. By having used the boric acid and alcohol burn-off and removing the residue before finishing, the gold plate finish will have been saved where otherwise the heat could have discolored it. It then would have to be polished, which could remove the plating. Although repairing bangle bracelets is not a practical repair, charges must be made to compensate for the time and know-how involved. To me, though, it creates a challenge and gives a feeling of accomplishment when a successful repair has been made.

BROKEN POSTS ON EARRINGS/TIE TACKS

These are repairs that also are not very practical on inexpensive pieces, but on the better quality pieces can be highly profitable. Pierced earrings should always have wires or posts made of metal that is not irritating to the ear nor will cause infection. 14K gold has usually been the minimum quality that should be used in them.

In recent years, a stainless steel formula has been developed that seems to work well, and I have heard very few complaints of it causing irritation. For wires that do not have to be bonded to precious metals, this causes no problem for the jewelry repairman or craftsman. However, where stainless steel posts need to be soldered to precious metal earrings, it will not bond unless the proper flux is used. For this, I use Aircosil flux, which can be purchased from most material suppliers. This will allow stainless steel or other ferrous metals to be gold- or silver-soldered to other ferrous metals, or to nonferrous metals such as karat gold, silver, nickel silver, or brass. This is a difficult soldering operation, so it should be practiced on practice materials before using it on a customer's jewelry.

Often the repairs on ear posts are where they break off where soldered to the earring. Therefore, if the length is correct, it need only be fluxed, a little solder added, and then soldered back in place. If stones are involved, and if they are stones that will not stand heat, they must be removed and reset after making the repair. In case the post is missing, replacement posts are available from the findings supplier in 14K white and yellow, cut to the correct length, and with the groove in one end for the clutch back to fit into. These can also be made from .8 mm wire, which can be cut to length. Then the clutch groove can be put in by a fine-tapered round file with the wire chucked in a pin vise so it can be rotated as it is filed.

When earwires are broken, if not where it goes through the ear, it can be more practical to gold-solder it using 14K yellow or 14K white solder. I would not recommend soldering where the wire goes through the ear, because solders contain metal alloys to make it melt at a lower temperature that could be irritating and cause ear soreness or infection. Tie tacks use posts a little larger in diameter, possibly a little shorter, and pointed on one end to go through the tie material. These need not be made of precious metal, but can be made of brass for yellow, or nickel silver for white. These can also be purchased from most findings suppliers in the correct diameter and length, but some clutch backs will fit too loosely, so before installing one it is wise to try it in the clutch back and see if it is a fit. If not, one can be made by finding a piece of rivet wire the correct diameter, cutting it off to length, and chucking it up in the flex-shaft tool. Then with a flat file, file the point to the proper shape. Then take a fine buff stick (4/0 grit) and polish it while rotating it in the flex-shaft tool. The other alternative is to use a clutch back that fits. Also, before hard-soldering, make sure any stones involved will stand heat, or remove them.

We will discuss other difficult repairs in next month's issue.

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PROJECT EXTEND

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1991

Sept. 16-20	**Jewelry Repair**	Marshall Richmond
Sept. 23-27	**Clock Repair III** (restoration)	David Christianson
Sept. 30-Oct. 4	**Clock Repair I** (beginners)	James Lubic
Oct. 7-11	**Clock Repair II** (advanced)	Roland Iverson
Oct. 14-18	**Clock Repair VI** (striking & chiming clocks)	John Nagle
Oct. 21-25	**Quartz I** (beginners)	Gerald Jaeger
Oct. 28-Nov. 1	**Quartz II** (advanced)	Robert Bishop
Nov. 4-8	**Watch Repair I** (staffing, poising, and timing)	James Lubic
Nov. 11-15	**Watch Repair II** (hairspring vibrating and finishing)	Harold Herman

1992

Jan. 13-17	**Clock Repair V** (prep. and completion of CMC exam)	James Lubic
Jan. 20-24	**Watch Repair VII** (prep. and completion of CMW exam)	James Lubic
Feb. 10-14	**Quartz III** (prep. and completion of CMEW exam)	Alice Carpenter
Feb. 17-21	**Watch Repair III** (complicated)	James Lubic
March 2-6	**Lathe I** (beginners)	James Lubic
March 9-13	**Lathe II** (advanced)	Archie Perkins
March 16-20	**Watch Case Repair**	Marshall Richmond
March 23-27	**Clock Case Repair**	James Williams

Peyton Autry

An American Tourbillon

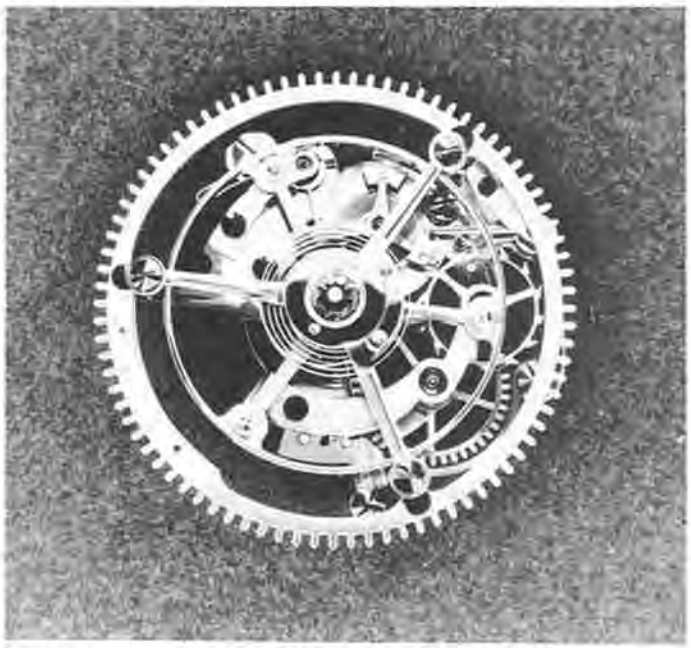
With Constant Force Escapement

I wrote a feature article for the *Horological Times* in the August 1988 issue entitled "An American Tourbillon." This article included eight photographs of a magnificent spring detent tourbillon watch made by Gene Clark of Colorado. It was stated that it was believed to be the first spring detent chronometer tourbillon made as a complete watch in the style and tradition of Breguet by an American. Now, three years later, that still appears to be true. Clark assigned his spring detent tourbillon the serial No. 7, which was so engraved on the movement along with his last name.

Now Mr. Clark has done it again in an even more challenging tourbillon watch he calls his No. 4, actually begun prior to the No. 7. There are two main differences in these two watches. No. 7 was a one-minute tourbillon with a spring detent escapement. No. 4 is a four-minute tourbillon, but with the much more difficult and challenging constant force escapement of which very few have been attempted--even in the 200 years since the halcyon days of Abraham Louis Breguet. This highly sophisticated escapement promises a high degree of accuracy, but demands virtually 100% perfection, long hours of tedium, and no small amount of trial and error in its refinement and regulation. No. 7 required over 4000 hours for the complete watch, while No. 4 appears to have required over 9000 hours, the difference in work hours largely attributed to the difference between the spring detent escapement and the constant force escapement. He first conceived designs for the No. 4 some time before 1983, but did not cut metal or make mock-ups until March 1987. The watch was completed in June 1991.

One other person in the world who has made a number of Breguet style watches is the widely known George Daniels of Great Britain. Daniels is not only a prolific maker of exotic Breguet style, but

Clark No. 4 showing 18K split chain and Breguet style ratchet key.



Tourbillon carriage assembly removed from watch Clark No. 4.

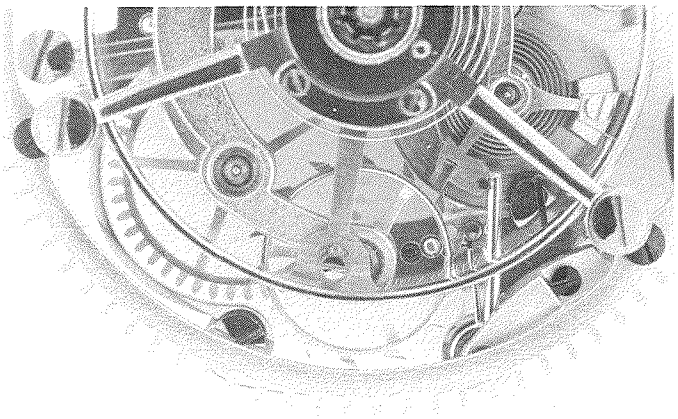
Clark No. 4 with engraving of Clark signature on center wheel cock, "No. 4" on tourbillon cock, and "USA" on mainspring barrel cock.

of highly original contemporary watches, and he is also a prolific author of some of the best horological literature. In his beautiful volume titled *The Art of Breguet* (Sotheby's Publications, New York and London), he defines a *constant force* escapement as follows:

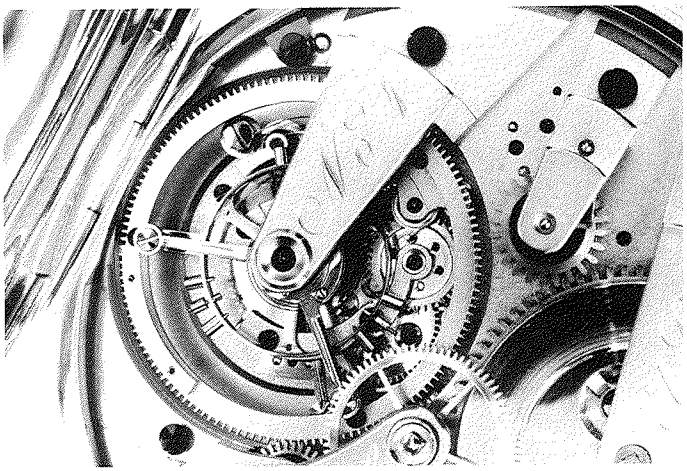
Clark No. 4 tourbillon with constant force escapement.

"An escapement in which the impulse to the balance or pendulum is given by a falling weight or a released spring. On completion of the impulse the weight or spring releases a re-winding train that resets it for the next impulse."

In the Clark No. 4 tourbillon, the constant force escapement is cocked and released for each beat of the watch, the cocking spring being independent of the mainspring. Therefore, the mainspring power is completely independent of the es-



Constant force escapement on No. 4 tourbillon carriage, showing 4th wheel, cocking wheel, constant force lever, primary detent and spring, balance wheel and spring, passing spring, locking detent, constant force lever spring, and governor wheel.



Clark No. 4 tourbillon with constant force escapement installed in the movement.

capement, except to provide power to cock the separate spring supplying even power to the constant force lever for each beat of the watch.

The Clark No. 4 is a rather large watch, having an overall case diameter of 65 mm. Size seems to be a common denominator with accuracy, complexity, and long reliability on these Breguet style tourbillons as made by Breguet 200 years ago and as made in the late 20th century.

There are three degrees of sophistication in a tourbillon watch, all depending on the sophistication and complexity of the escapement mounted on the rotating tourbillon carriage.

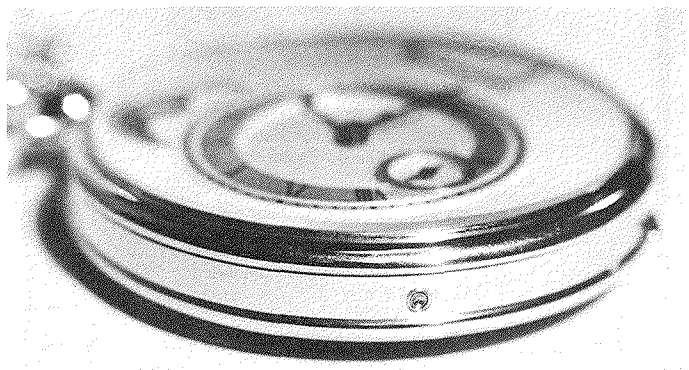
(A) The lever escapement.
(B) The detent chronometer escapement.
(C) The constant force and remontoire escapements.

Tourbillons with lever escapements have even been made so small by watch manufacturing firms in Europe as to be fitted into wristwatches. But in the latter two escapements the finished watch tends to be a much larger pocket watch.

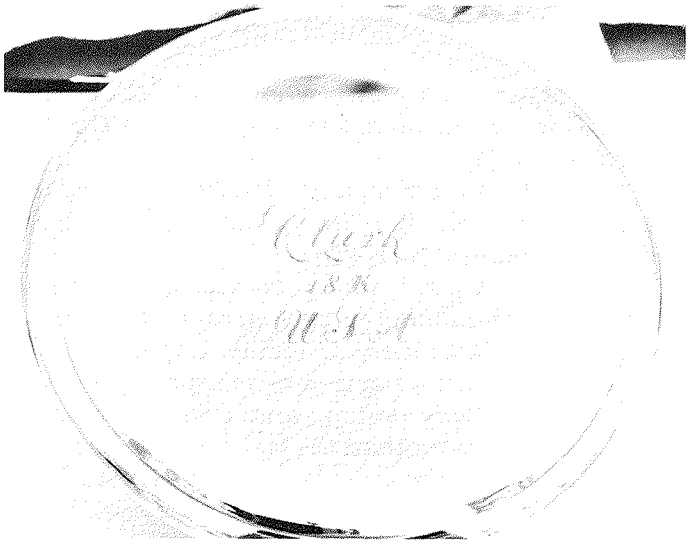
Original Breguet watches are rapidly getting out of reach to even the advanced collector. In a recent auction of 204 Breguet timepieces by Habsburg's in Geneva, April 14, 1991, a *sympathique* combination mantle clock and tourbillon watch brought one million dollars. Others fetched nearly as much. Thus, contemporary versions of Breguet's horological art by the likes of Gene Clark have become highly collectable. The great prestigious watch firms in Switzerland have for many years produced custom-made tourbillons and other exotic watches in the style of Breguet. It should also be said that the Breguet firm in Paris still exists, along with their production records dating back to Abraham Louis Breguet's origin of the firm. Their watches are all in the original style of Breguet--even wristwatches. These firms probably employ a small coterie, or group, of specialists whose work goes into each watch, which is a principal difference with the individualistic approach of Clark, who does the complete watches all by himself.

Clark signs all of his watches with his last name, the serial number, and "USA." These are engraved for him by his friend and master engraver Lynton McKenzie. This engraving is essentially the only thing Clark did not do on the watch himself.

Note that where Clark's No. 7 had twin mainspring barrels, his No. 4 has one barrel. No. 7 has a one-minute tourbillon, No. 4 being a four-minute tourbillon. No. 4 is wound by inserting the male end of the ratchet key into the square next to the spring barrel and turning counterclockwise. The watch is set by inserting the female end of the key over the square on the center wheel cock. The split gold chain and ratchet key are both typical original Breguet--the type he supplied with his watches 200 years ago. It allows the watch to be wound in short repeated fractional turns, much like an ordinary ratchet wrench. It is a vast improvement over an ordinary key which wraps up the chain with each full revolution and increases the chance of snagging the chain into the movement and balance wheel. Even removal of the ordinary key from the chain is not always a solution. Often there is not sufficient room for the owner's fingers and knuckles to clear the case covers to ro-



Moon phase setting button on case band, Clark No. 4.



Engraving inside back cover of the Clark No. 4 tourbillon. "Clark, 18K, USA."

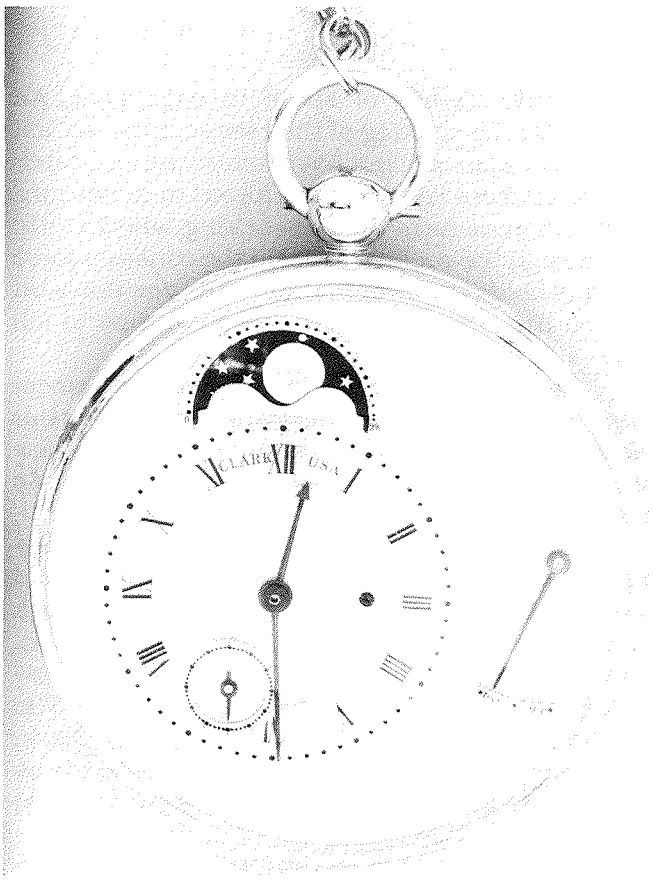
tate a full revolution repeatedly, which often requires the watch be wound in half turns and removal and resetting for each half turn--a slow, painstaking, and annoying daily process. No wonder that keyless watches were invented! It is also amazing that keywind watchmakers did not widely adopt the Breguet ratchet key, which nearly equals the keyless watch for winding convenience.

The bridgework and back plate of the No. 4 are handsomely gilted in gold in a special chemical process eliminating the need for fire gilting. The entire case--back cover, band, bezels, hinges, pendant, and bow--are all 18K gold-alloyed and rolled by Clark himself for consistency, malleability, and color.

The dial face consists of a time dial, subsidiary seconds, lunar moon phase, and an "up-down" winding indicator, made entirely of silver. The time chapter frame and lunar aperture frame are of silver turned directly on the main dial plate. The wind indicator sector frame is also turned silver, but applied to the dial plate. All of the white background is engine-turned. The engine turning consists of microwidth grooves circular turned inside the time chapter and radially turned in the other areas. The surface is finished in a whitening process that gives the dial the look of fired porcelain, even though it is silver. Lynton McKenzie did the dial engraving and movement engraving, including the Clark name and signature.

The lunar moon phase disc is set by a small button in the outer case band at the 8 o'clock position. Setting or correcting the lunar disc, the hands are first set anywhere between 4 and 8 o'clock and the button punched in and out using the tip of the ratchet key, the hands, then reset again to the proper reference time.

Watchmaker Clark is the first person on earth to deny that a complex timepiece like a constant force escapement on a tourbillon is not beset with challenging problems. The greatest problems were associated with the speed of the components



Clark No. 4 time dial, moon phase, and wind indicator. Dial is all engine-turned sterling silver.

and the high *change* of speed in each beat. An example was the cocking of the escapement--so fast the primary detent did not have time to fall and catch the constant force lever. He was forced to re-design a slightly different form on the cocking wheel teeth, and re-design the cocking jewel in the constant force lever. This holds the lever in the cocked position a bit longer so the primary detent has more time to fall safely.

Clark made everything in the watch, except Lynton McKenzie did the engraving. Sergio Brecher of New Jersey made the high-quality glass for the case. Clark fitted but did not make a Swiss-made hairspring.

Clark made the entire case himself. Everything in the case is rolled stock which he alloyed and rolled himself. There are no castings. Rolled stock makes for a very tough, springy case, in his opinion. A wood presentation box was made by John Bevins with the French fitting and lining by McKenzie. The 18K gold hinges and latches were made by Clark. And, of course, the 18K gold split chain was made by Clark, as was the ratchet key, the latter being gold and steel.

The dial silver is sterling silver. It is chemically treated to bleach the surfaced in the engine-turned portion, and then lacquered. Clark made a rather simple engine-turning machine to cut the radial lines in the surface. There are 360 radial lines in the surface of the dial. It takes several passes to get the lines to proper depth . . . all done with a single tooth cutter.

The bridges, cocks, and plate are gold-gilted in a rather time-consuming process using chemicals, but is not a mercury fire gilt. The plates, cocks, and bridges are made of various brass alloys, but usually a somewhat hard-leaded brass alloy for components. The main tourbillon carriage, the balance, and the constant force lever are all of stainless steel (303). The other mechanical parts are brass, nickel, carbon steel, and gold.

Clark says there are about 28 jewels in the No. 4 watch. There are 22 in the carriage and 6 in the wheel train. He made the jewels himself of synthetic ruby. The cocking jewel is clear sapphire.

He says a 4-minute carriage has a bit fewer inertia problems in locking and unlocking than a one-minute, such as his No. 7. However, they are also heavier, and he feels it would take a book to describe the pros and cons of each. He personally favors a one-minute carriage, and has even contemplated a one-minute constant force tourbillon, but also fears he must be "crazy" to have even thought of it!

Clark alloys his own gold from fine gold for several reasons, but the main one is the complete control he has over his own creation in "workability" and color matching of each component.

I asked Gene Clark what traits, skills, and tools a watchmaker must have to produce a No. 4 or a No. 7. His reply:

(1) A bit of insanity can be very comforting at times. (The man has what I would call a dedicated sense of humor.)

(2) A good library is necessary on fine watches, watchmaking, repairing, *and tools.*

(3) Machinery is rather important, but the most important thing is *patience* and *experience.*

(4) Every watch, and every piece of a watch, *must* be better than the last one. The desire to *improve* has to be the most important aspect of all.

The framework of this advice is obviously one that could well be applied to any field of endeavor--whether you are a world-class watchmaker, or whatever. It strikes me as the mark of a man who has thought and done well in achieving a pinnacle of success that only comes about by tenacious, but patient, pursuit.

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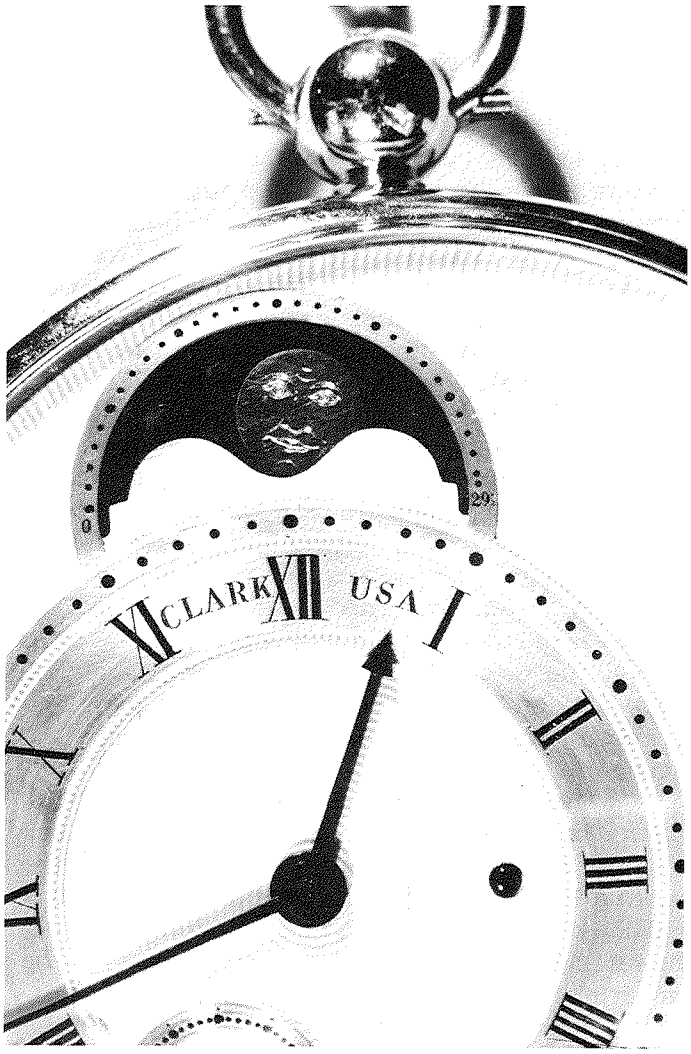
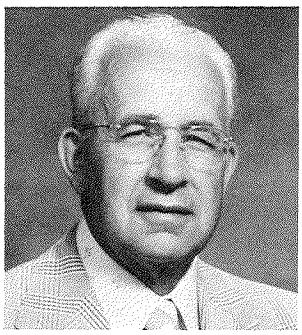


Time dial and moon phase chapter rings of silver. White backgrounds are also engine-turned sterling silver.

MILITARY TIME



Marvin E. Whitney, CMW, CMC, FAWI

An Introduction of the Ship's Chronometer to Naval Use *and the* U.S. Naval Observatory *Part I*

As early as 1530, Gemma Frisius, a Flemish astronomer and mathematician, in a paper entitled *De Principes Astronomiae et Cosmographiae*, proposed the use of a timekeeper for determining longitude. However, at that time there were very few portable mechanical clocks, none of which were accurate enough to be used on board ship.

Navigators with some knowledge about astronomy could determine which hemisphere they were in and their approximate latitude, but not their longitude. Thus, they were reluctant to lose sight of land. The problem was compounded when it was necessary for them to undertake long sea voyages and have to resort to the dead reckoning method of determining their position. When Magellan sailed in 1519, his navigational equipment consisted of charts, parchment skins to be made into charts enroute, wooden and metal quadrants and astrolabes, compasses, terrestrial globe, their rutter, log, and hour glasses. Time measurements aboard ship were determined by hour and half-hour sand glasses. Hence, in the 16th century, the navigator had only crude charts of the known world, a compass to steer by, instruments with which he could determine his latitude, a log to estimate speed, and some solar tables. The main obstacle still to be resolved was an accurate method of determining longitude.

The first method widely used at sea to determine longitude with some accuracy was the lunar distances, by which the navigator determined GMT by noting the position of the moon among the stars. However, the movement of the moon was not fully understood and thus this method was far from satisfactory, resulting in the loss of many lives, ships, and cargoes. After the loss of lives, when a British armada ran aground on a foggy night in 1707, officers of the Royal Navy and Merchant Marine petitioned Parliament to take action. As a result, Parliament passed The Act of 12 Queen Anne, "An Act for Providing a Public Reward for Such Person or Persons as Shall Discover the Longitude at Sea." As provided for in the Act, the Board of Longitude was established in 1714, empowered to reward anyone who could devise a method of solving the problem of determining longitude at sea. The Board stipulated that a test to deem whether the method was seaworthy was to be a voyage between England and the West Indies, where the longitudes were fairly known. The discoverer of a system which could determine the longitude within 1°, 60 miles by the end of the voyage was to receive £10,000; within 40', or 40 miles, £15,000, and within 30', or 30 miles, £20,000.

The Act did not stipulate that it had to be a "portable timekeeper," only a method. Thus, an array of astronomers, mathematicians, and clockmakers began to devise and experiment with various ideas, hoping to be the first to deliver a practical solution. Since the story of how John Harrison, a Yorkshire's carpenter's son, being the first to produce an accurate seagoing timekeeper is well known and documented, little else needs to be said regarding this ingenious craftsman.

Although the search for longitude had ended, understanding the movements of the sun, moon, stars, and planets and the preparation of astronomical data and tables and their application to celestial navigation presented other challenges that had to be reckoned with. As more and more mariners began to accept the chronometer, astronomers had to develop tables which could be used to calculate local time. Such tables informed the navigator that on a particular date and time, certain celestial bodies, particularly stars, assumed certain positions on the face of the sky. With this information and applying the appropriate corrections, a navigator could determine his local time.

Thus, by means of observations, astronomers were able to pinpoint the location of various celestial bodies, enabling ships embarked on long voyages to always have in their possession the accurate location of the sun, moon, and stars noted for every day of the year. Professor William A. Rogers, in his address at the dedication of the Ladd Observatory in Providence, Rhode Island, stated it so conclusively when he said, "It thus appears that the work of observatories blends so intimately with modern

Figure 1. Views of the movement and dial of John Harrison's No. 4 timekeeper, constructed in 1759. On exhibition at the U.S. Naval Observatory, 1963, through loan by the British Admiralty. Forerunner of the modern marine chronometer, this timekeeper gained for Harrison an award of £20,000, offered by Parliament in 1714 for finding longitude at sea (U.S. Naval Observatory, Washington, D.C.).

navigation, that no cargo can be exported or brought home except through the agency of astronomical results."

Such data and tables were first published in the British *Nautical Almanac* in 1767. Nevil Maskelyne, Britain's Astronomer Royal (Compulations), provided the navigator with the best available information, and thus the chronometer became a very important navigational piece of equipment.

For nearly a hundred years, the British *Nautical Almanac* was the one used by American navigators. But in 1852, the Depot of Charts and Instruments, the forerunner to the Naval Observatorry, published the first *American Ephemeris* and *Nautical Almanac* for the year 1855. In 1933, the *Air Almanac,* designed by Lieutenant Commander Paul V.H. Weems, was published, giving the Greenwich Hour Angle for all bodies included. The *American Ephemeris* and *Nautical Almanac* provided the fundamental data that was necessary for the preparation of the *Nautical Almanac* and the *Air Almanac,* and for astronomers in making observations and conducting astronomical investigations; it was also the basic source of annual astronomical data for surveyors, legal purposes, commercial calendars and almanacs, and the general public. The *American Nautical Almanac* was for the navigation of ships, and the *Air Almanac* was designed for the special needs of air navigation.

Since the navigator's dependence on time (chronometer) was so essential to the ship's well-being, and time was determined by (astronomers) measuring the transit of various stars, the marriage of the two was consistent in the furtherance of navigation. Harrison's first timekeeper, H1, was compared at the Greenwich Observatory before being placed aboard the *HHS Centurion* in 1736 for its sea trial to Lisbon. H4 (Figure 1), Harrison's fourth timekeeper, upon its return from Jamaica, was placed on trial at the Royal Observatory during May 1766. Thus, the practical application of astronomy to navigation dictated that the agency responsible for astronomical corroboration be placed within the department controlling the nation's ships. Such was the course followed in England, where the Royal Greenwich Observatory was placed under the British Admiralty. This course of action was also followed in Spain and France whereby an admiral was placed in charge of its observatory. In Germany, where many great observatories were attached to the universities, it was later found necessary to establish separate Seewarte or naval observatories. And, so it was with the U.S. Naval Observatory. Hence, the precedent was set that chronometers be tested under observatory conditions and supervision.

Once Harrison's timekeeper was proven seaworthy, others took up the challenge. Expectations rose, trade secrets were guarded jealously, and competition among makers begot rivalry, all in the quest for a more accurate and superior instrument. Consequently, the design was altered, various experiments were conducted, and horology literally became a science.

In order to have the finest instruments aboard naval ships, the British Admiralty notified makers that favorable consideration towards purchase would be given only to those chronometers whose performance met a criteria established by the Astronomer Royal. Makers wishing to have their instruments considered were directed to submit such a piece(s) to the Royal Observatory, Greenwich, where it would be placed on trial for a period of nearly 30 weeks. During this period, the instruments

were subjected to varying conditions and a daily rate was established; the outcome was a trial number, arrived at algebraically, which attested to its performance, and was used to rank chronometers. Hence, First Prize became a very prestigious award, and the winning makers were envied by their peers. Also, any chronometer maker whose instrument was purchased for use by the Royal Navy was permitted to sign his chronometers "Maker to the Admiralty" or "Maker to the Royal Navy," another prestigious perk. During the ensuing years, a rivalry developed among many of the makers, even to the point that some became enemies.

In the United States, chronometers for the U.S. Navy were tested at the U.S. Naval Observatory, Washington, D.C., which began December 12, 1830, as the Depot of Charts and Instruments for the care of chronometers, charts, and other navigational equipment, and was located not too far from the White House. The Depot had a small transit instrument for comparing and rating chronometers. Lt. L.M. Goldsborough, U.S.N. was the Officer in Charge, and remained in that position until February 1833, when Lt. Charles Wilkes, U.S.N. took command. Shortly after Lt. Wilkes took command, the Depot was moved to a place located just north of the U.S. Capitol, where he erected a small observatory with his own funds.

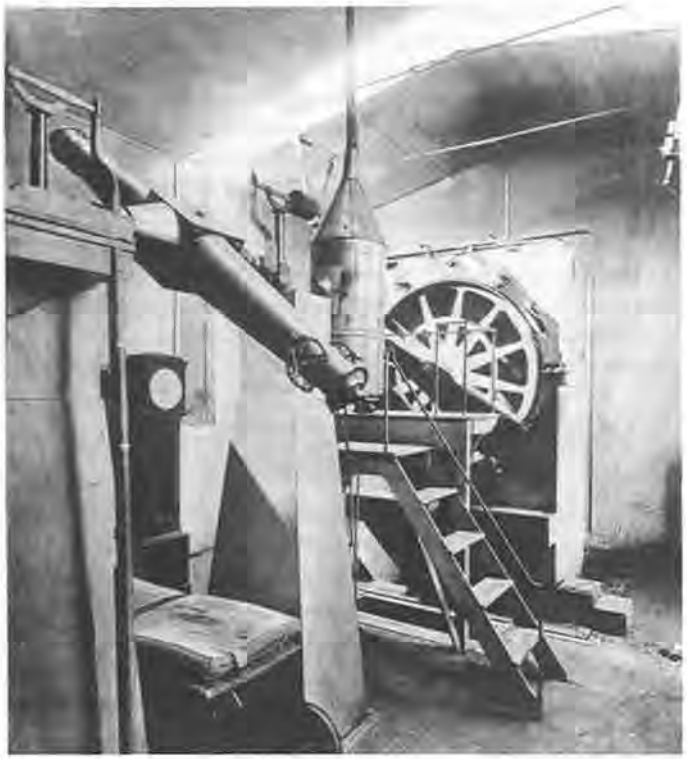


Figure 2. The 5.33-inch Transit Instrument, built by Ertel and Sons for $1,480, and 4-inch Mural Circle by Troughton and Simms, costing $3,550, mounted side by side at 23rd and E Street, N.W., site with a sidereal clock mounted against the south wall. The observer would note the time a star passed each cross-wire in the eyepiece. The Transit Instrument determined the star right ascension by the exact timing of the star's passage across the meridian. The Mural Circle could only determine declinations (U.S. Naval Observatory, Washington, D.C.).

In 1842, Congress appropriated $25,000 for a new Depot to be built on land that George Washington had originally proposed as the site of a National University, located on a knoll at 23rd and E Streets N.W., just north of where the Lincoln Memorial presently stands (Figure 2). In 1844, when the Depot was moved to the above location, it was re-established under the name of the Naval Observatory and remained there for nearly 50 years. During this period, many new pieces of astronomical equipment were purchased, including the 26-inch Clark refractor telescope in 1873, the largest telescope at the Observatory (Figure 3).

Figure 3. Clark's 26" Refracting Equatorial Mounted Telescope. The largest telescope at the Washington site of the Naval Observatory. It is primarily used for observing multiple star systems. The dome is 45 feet in diameter and can be rotated so that the shutter opening is exposed to the desired portion of the sky. Regular observation of the stars and other celestial bodies began November 20, 1873 (Official U.S. Navy Photograph).

The location eventually became unsatisfactory because the smoke and the lights from the ever-expanding city diminished celestial observations. In 1893, the Observatory was moved to its present site at 34th Street and Massachusetts Avenue N.W. (Figure 4), which was set aside by Congress as an astronomical reservation. At that time, the *Nautical Almanac* Office, which was established by the Navy in 1849 at Cambridge, Massachusetts, became part of the Naval Observatory. For many years, the residence of the Chief of Naval Operations was located on the grounds. Now it's the official residence of the Vice President of the United States.

A visitor's handout states that "the mission of the U.S. Naval Observatory is to provide means for safe navigation and accurate time, as well as to contribute to

Figure 4. U.S. Naval Observatory--main building. The dome on the left houses a 40-foot Photoheliograph having a 5-inch lens to obtain a sunspot record. Since sunspots often affect radio and telegraphic communications, pertinent information about current conditions on the sun is relayed daily to the Bureau of Standards, the Naval Research Laboratory, and other agencies, in order that predictions on the effect of radio communications may be made. On the far right is the library, containing some 75,000 volumes, and it is one of the leading astronomical libraries of the world (U.S. Naval Official Photograph).

Figure 5. Six-inch Transit Circle. This telescope is so named because its lens is six inches in diameter, and because the east-west coordinate (the right ascension) of a star is measured by timing when it crosses, or "transits," the meridian due to the earth's rotation, while the north-south coordinate (the declination) is measured with a very finely divided circle. In both coordinates, precise measurements are made with respect to a system of wires placed in the focal plane of the eyepiece. The astronomer views these wires through the eyepiece and tracks the star with respect to them. These measurements, accurate to a few hundredths of a second of time, are immediately recorded by a computer for later analysis. After many observations, a catalog of star positions is produced, and in addition the positions of solar system objects are forwarded to the Nautical Almanac Office at the Observatory, where predictions are made of future positions (U.S. Naval Official Photograph).

the general advancement of navigation and astronomy. The Observatory serves as the sole authority in the United States for astronomical data required for navigation, civil affairs, and legal purposes. It discharges this primary function through the publication of the *Nautical Almanac*, the *Air Almanac*, the *Astronomical Almanac*, catalogs of positions and motion of stars, numerous scientific publications, and the dissemination of accurate time through comparisons of clocks around the world with the Master Clock.

The U.S. Naval Observatory is the only observatory in the Unites States, and one of only two in the world, with an ongoing program for determining fundamental positions and motions of the sun, moon, planets, and selected stars. These observations, made with transit circle telescopes, are utilized in the establishment of a fundamental celestial coordinate system (Figure 5). This is absolutely essential for navigation, since it is required for the determination of the position of fixed and movable objects on the surface of the earth and in space. Moreover, these observations provide the basis for much of our current knowledge of the solar system and the structure of our galaxy and the universe.

At the U.S. Naval Observatory's Flagstaff Station in Arizona, distances of stars and precise relative positions of celestial objects are measured with accuracies surpassing those expected from the space telescope (Figure 6). The position determinations are also used in order to predict positions of planets and stars for many years in the future, requiring the most precise orbit calculations of the planets and their satellites.

The U.S. Naval Observatory has developed the world's most accurate atomic clock, a composite clock which also has achieved supreme reliability. Increasingly accurate and reliable time information is required in many aspects of military operations. All modern navigational systems, as well as certain areas in astronomical research, depend on the availability of highly synchronized clocks. The U.S. Naval Observatory also measures the variations in the rotation of the earth, using optical and radio telescopes as well as artificial satellites.

Until 1916, the repair of ship's chronometers was done by several well-known American chronometer manufacturers--namely, William Bond, John Bliss, and T.S. and J.D. Negus. Upon completion of repairs, the chronometers were delivered to the Naval Observatory where they were placed on trial for a period of six months, none being accepted with a trial number greater than 25.0. However, depending on need, the Superintendent could

Figure 6. U.S. Naval Observatory Flagstaff Station, Arizona. The Observatory's largest optical telescope is located here. It is a 61-inch astrometric reflector, used for measuring the distances of faint objects, and to measure the brightness and color of stars. Also at Flagstaff is a 40-inch Ritchey-Chretien reflector, which has been extensively used to observe comets and minor planets (U.S. Navy Official Photograph).

Figure 7. Naval Observatory Chronometer Trial Room prior to 1940. Generally, trials were held twice a year for a duration of six months. The trial number and temperature rate curve, showing the effect of temperature on the chronometer, was computed in five-minute increments from 50°F to 90°F by a special formula (U.S. Navy Official Photograph).

waive the rule and accept those instruments whose trial number was one or two digits above the 25.0 figure (Figure 7).

On the tenth of January, 1916, a watch/clockmaker was added to the Nautical Instrument Repair Shop force of seven instrument makers. By 1934, the shop had grown, consisting of one quarterman instrument maker, eleven instrument makers, five watch/clockmakers, two packers, one laborer, and four clerical employees. Although the overhauling of some chronometers continued to be done by commercial firms, the phasing-out process had begun. Thus, an added responsibility was given to the Observatory which continued until 1950, when the Chronometer Shop was moved to the Norfolk Navy Yard. The Nautical Instrument Repair Shop was not only responsible for the repairing of chronometers, but also for binoculars, barometers, clocks and watches, compasses, sextants, stadimeters, etc. Instrument repair work was being done for the Hydrographic Office, the Bureau of Aeronautics, the Bureau of Standards, the Coast Guard, the Bureau of Ordnance, the Bureau of Naval Construction and Repair, Maritime Commission, Naval Research Laboratory, David Taylor Model Basin, and Army Engineers, to name a few.

We will continue with Part II in the November issue of *Horological Times*.

❑

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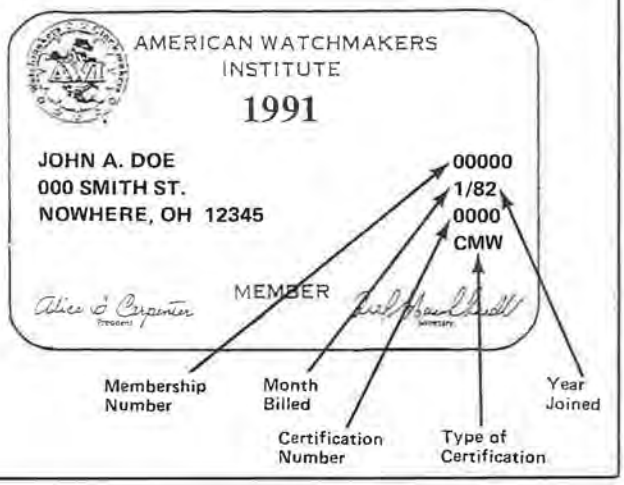

TIMELOCKS

David A. Christianson, CMW, CMBHI

The Yale #1 Timelock

and the Stockwell Patent of 1875

Part I

After the introduction of the safe timelock concept and the application of the first successful timelock mechanism in 1871, it took quite a while for the banking industry to accept the idea that their vault doors would be controlled by a mechanism buried deep within the vault itself, accessible to no one until the mechanism itself allowed the vault to be opened. But when the idea did take hold, the industry's appetite for these revolutionary devises was almost insatiable. Numerous inventors and manufacturers devised a plethora of timelocks to fill this real need for more vault protection than just a combination lock could provide.

One of these many inventors, a genius by the name of Emory Stockwell, was granted a patent for a timelock design on September 21, 1875 that would set the standard for nearly all timelocks to come (Figure 1).

The Stockwell Patent presented several innovative features not found on previous timelock mechanisms, yet are still found on all timelocks even today:

1) He used two high-grade clock movements to regulate the accuracy of his mechanism, and could be expanded to three or more movements if desired.

2) The clock movements functioned independently of each other so that only one was needed to unlock the timelock in case the other movement failed.

3) He designed the timelock so that the clock movements would continue running even when the timelock was unlocked.

4) He designed the timelock so that the opening and closing times could be easily set and readily changed by bank employees.

5) He provided an indicator to show how much running time was left on each movement as well as how much had already elapsed.

6) He provided a stopwork on each movement so that a reserve power would always remain on its mainsprings (for ease of starting each movement).

7) He designed spring-loaded mounting screws that would absorb the shock in case the vault doors were to be slammed shut, or in case someone might try to destroy the clock works by hammering on the outside of the door.

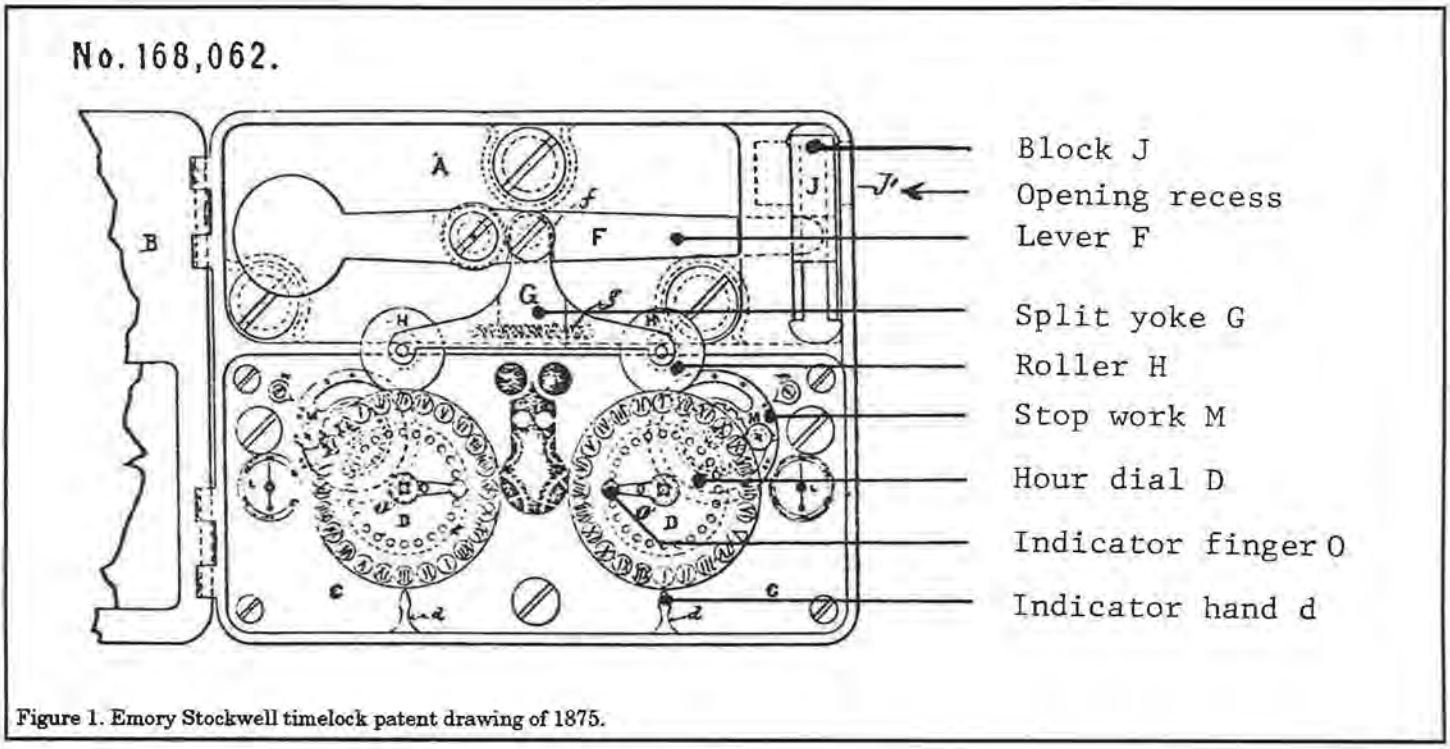

Figure 1. Emory Stockwell timelock patent drawing of 1875.

8) He designed a means to prevent the clock movements from being destroyed should the vault's boltwork be purposely jammed.

As soon as the patent was granted, the Yale Lock Company of Stamford, Connecticut began the manufacture of the Stockwell Patent timelock and dubbed it the Yale Model #1 (Figure 2). A close scrutiny of the patent drawing and the actual timelock shows that the company followed the patent design quite faithfully, making only two notable modifications:

1) The stopwork for reserve poiwer was designed into the running time indicator in the patent drawing (Figure 3). Yale, instead, used a conventional stopwork on the mainspring barrel (Figure 4), obviously in order to save complicated design and manufacturing costs.

2) The indicator fingers and indicator hands on the dials were eliminated, relying instead on using the top of the dial to show current time (O and d in Figure 1).

Figure 2. The Yale #1 timelock.

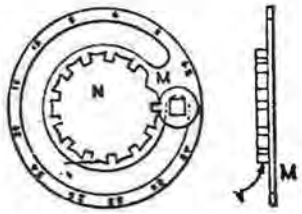

Figure 3. Stockwell's original (and very complicated) stopwork for reserve power retention.

Figure 4. Conventional stopwork on the Yale #1.

The Yale Lock Company, through its founder, Linus Yale, was the inventor of the combination lock for safes and vaults and was the leader in combination lock design and manufacturing worldwide. Although Yale didn't invent or design the vault timelock mechanism, through its use of the Stockwell Patent, the Yale Lock Company propelled itself into the forefront of timelock manufacturing as well. Just as the Emory Stockwell timelock design set the standard for all future designs, the Yale #1 became the standard in the banking and vault protection industries well into the twentieth century.

THE YALE #1 CASE

The Yale #1 case is a rectangular shaped, nickel-plated, bronze box designed to house the timelock mechanism and movement. The case has a hinged door cover with a lock to prevent unauthorized persons from tampering with the mechanism once it is set up, yet its glass aperture allows a person to view the time dials and "hours to run" dials without opening the case door. Holes in the door glass allow a person to wind the movements, again without opening the case (Figure 5).

This timelock case itself is mounted to the inside of the safe or vault door with three mounting studs and springs. The springs were used to "help obviate damage" to the timelock from "any sudden concussion or percussion," according to Mr. Stockwell's patent.

THE TIMELOCK MECHANISM

When a person unlocks the combination lock of a vault door, he can now turn the handles on the door. Turning these handles allows a series of levers and bolts (the "boltwork") to retract from the door frame back into the vault door, thus making the door free to open.

The timelock mechanism is positioned in the vault door in the path of one of the vault's internal bolts (see the May '89 and July '91 issues of *Horological Times*). When the timelock is *unlocked*, this bolt is allowed to enter the timelock case (Figure 6), allowing the door to be opened. If the timelock is *locked*, a "block" prevents the bolt from entering the timelock case. When this bolt cannot move, neither can any of the other boltwork, and the handles will not turn. The boltwork

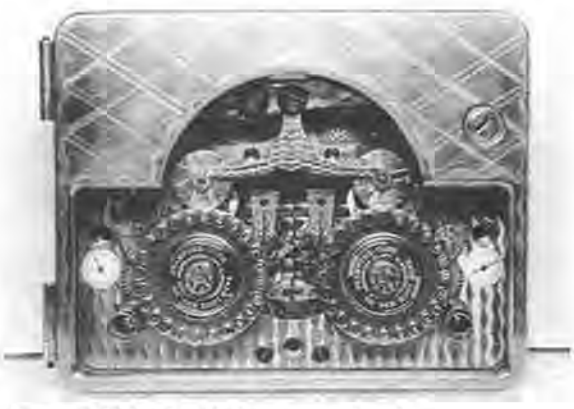

Figure 5. Yale #1 with front cover closed.

remains protruded into the door frame, and the door cannot open.

Referring to Figures 1 and 6: The "block" *J* that controls entrance *J1* into the timelock case is attached to a counter-balanced lever *F* and pivots at *f*. Operating this lever assembly is lever *G* and its rollers *H* and *H*. When the dials *D* and *D* permit one of the rollers to drop down at a specified time, this dropping causes lever *F* to fall, pulling down block *J* and unblocking the hole *J1*. With the hole unblocked, the bolt from the doors' boltwork can enter; the boltwork is now allowed to retract and the door opened (Figures 8a and 8b).

To protect the clock movements from stopping if the vault's boltwork is jammed or forced against the block *J*, Mr. Stockwell designed a split yoke *G* (Figure 7), held together by a spring *g*. If the upward motion of the counter-balanced lever *F* is impeded, the spring *g* permits the two sections of yoke *G* to separate and the rollers rise up and down on their friction pins without stopping the clocks. When the obstruction or impediment is removed, the operation of the spring *g* will raise the lever *F* and block *J* to the locked position.

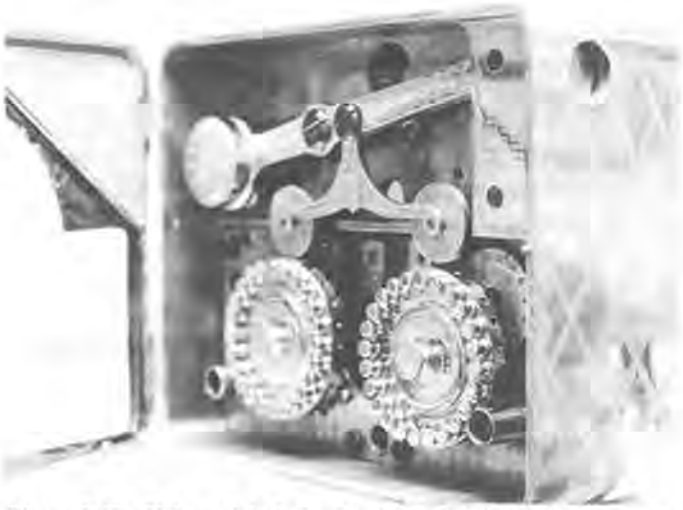

Figure 6. The Yale model #1 showing blocked hole in which a tongue from the vault's boltwork would try to enter, preventing the boltwork from functioning until the time movements unblock the hole.

Figure 7. The "rollers" of the timelock mechanism, referred to in Mr. Stockwell's Patent (Figure 1) as the "rollers H & H," pivotting on a "split yoke G."

THE TIMELOCK HOUR DIALS

The most unique features of this timelock are the hour dials (Figure 9). With these dials the times for locking and unlocking may be set and changed easily. They are made to revolve by the clock movement and to indicate the correct time of day.

Each dial contains 24 friction stop pins. The hours are indicated on the head of each pin from 1 to 12 in white numerals and from 1 to 12 in black numerals to indicate a.m. and p.m. respectively; or, as Mr. Stockwell suggested in his patent, the dials could be divided 7 a.m.to 6 p.m. in white and 7 p.m. to 6 a.m. in black to indicate day and night, respectively.

These dials revolve in a direction outward from the center of the movement, one to the right and one to the left.

TO SET OR ADJUST THE TIME OF DAY

Loosen the retaining thumb nut on the dial arbor and revolve the dial until the stop pin with the correct hour is positioned at the top of the movement. Re-tighten the thumb nut on each dial after setting. Fractions of an hour are indicated on the minute dials (next to each dial). These are set by moving the pointer to the correct fraction of an hour (correct minute).

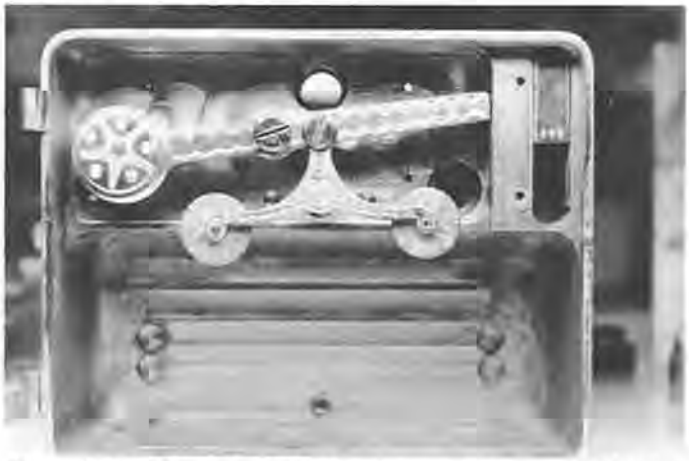

Figure 8a. The timelock mechanism (movements removed) showing the "rollers H & H" on its "split yoke" and the counter-balanced lever (F in Figure 1). Note the "block J" at the right end of the lever is in a raised position, blocking the access hole that is in the side of the case (J1 in Figure 1). Refer also to Figure 6.

Figure 8b. The "block" in this photo is now lowered by the lever, thus unblocking the access hole.

TO SET OPENING AND CLOSING TIMES

The friction (or stop) pins are movable by pushing inward toward the dial or by pulling outward from the dial (Figure 10). When not withdrawn (or pulled away from the dial) they provide a spuport or bearing trace for the friction rollers *H* and *H* to travel upon. As these rollers travel upon these pins, the block *J* remains in front of the bolt access hole *J1* (Figure 6). Refer also to the section "Timelock Mechanism" above.

To set the opening time, pull out each friction pin between the hours that you want the timelock to be available for opening. For example: The vault is to be available from 8 a.m. until 5 p.m. Pull out the friction pins starting with number 8 (white) through number 5 (black). As the roller *H* passes the 7 a.m. friction pin, it begins a slight descent; at 8 a.m. it has reached its maximum depth, triggering the block *J* release mechanism (described previously). Although the timelock is now unlocked, it is not necessary to unlock and open the vault, but can be done during this period. As 4 p.m. approaches (in this example), the roller *H* begins its ascent to the top of the 5 p.m. friction pin, at which time the block *J* is back into its position in front of the hole *J1* in the timelock case, effectively preventing the movement of the vault door's boltwork until 8 a.m. the next day.

Figure 9. One of the two hour dials on this movement with 24 numbered friction pins upon which the rollers ride.

Figure 10. When extended, the hour wheels' friction pins provide a higher track for the rollers to follow (as shown by pins #4, 5, 6 (Figure 9). When pushed in they provide a lower track (pins #7, 8, 9), thus providing enough change in roller height to lever the block from closed to open position (Figure 8).

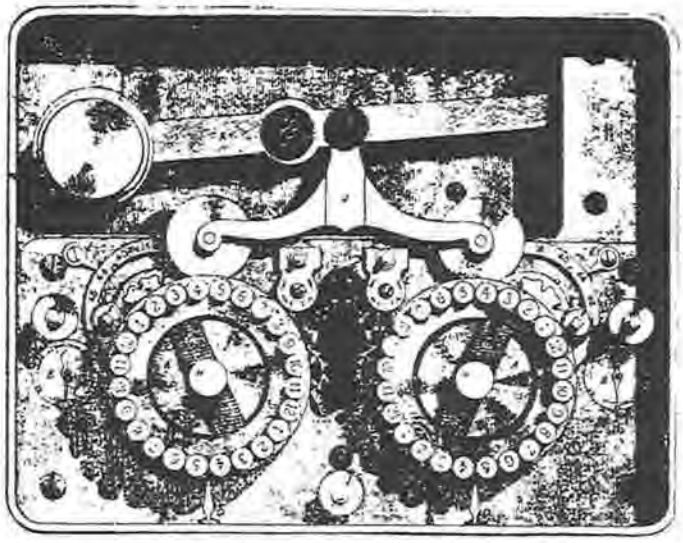

Figure 11. The original Yale #1 timelock used movements by Seth Thomas. They proved unsatisfactory and were replaced by the more reliable E. Howard & Company movements.

It may sound, from this example, that the rollers *H* and *H* are travelling around the dials *D* and *D*; in actuality, the dials are doing the travelling and the rollers are riding over the "trace" formed by the pushed-in friction pins, dropping down when encountering a pulled-out pin.

Next month we'll take a look at the E. Howard clock movements that control the Yale #1. As an interesting historical note, the Yale #1 timelock was originally powered by movements made by the Seth Thomas Clock Company (Figure 11). However, these proved "unsatisfactory and were subsequently exchanged for Howard movements."[1]

❑

1 "Horological Treasure Guardians," by James W. Gibbs. BULLETIN of the National Association of Watch & Clock Collectors. April 1965.

Timely Tips for Clockmakers

J.P. Kenyon, CMC

Calculating the Time Between Windings

Information determined by calculation of the time between windings is useful in the computation of several possible unknown values that might emerge at the bench. As mentioned before, an analytical approach to these bits of puzzling information can eliminate frustration, save time, and even be fun. For this exercise we will be concerned with computing the number of turns required to wind the trains of an 8-day German chime clock. From this data we can determine how long the train will operate for each turn of the barrel, thus for each turn of the key. This procedure will be used as a basis for some compound calculations in future columns.

TIME TRAIN

In the time train we start with the center wheel since the revolution per hour of one is a known value. We can therefore conclude that this arbor will turn 24 revolutions in a day, and (8 x 24) 192 turns in an 8-day period. Referring to our train count in Table 1 A, the first wheel with 72 teeth drives the second pinion of 10 leaves. This means that the second wheel on the second arbor will turn 7.2 times for each turn of the first wheel:

$$\frac{72}{10} = (X) \text{ or } 7.2 \text{ turns}$$

The second wheel with 55 teeth drives the center pinion of 10 leaves. This means that the center wheel on the center arbor will turn 5.5 times for each turn of the second wheel:

$$\frac{55}{10} = (Y) \text{ or } 5.5 \text{ turns}$$

To determine (Z) the number of turns of the center wheel for each turn of the main wheel:

$$(X) \times (Y) = (Z)$$
$$7.2 \times 5.5 = 39.6 \text{ turns}$$

Since the center wheel turns 192 revolutions in 8 days, to calculate the revolutions of the barrel in that period:

$$\frac{192}{39.6} = 4.8 \text{ turns}$$

Therefore we can conclude that winding the time mainspring 4.8 turns will cause the clock to run for 8 days, 2.4 turns for 4 days, 0.6 turns for 1 day, etc.

STRIKE TRAIN

In the strike train the logical starting point is the star wheel which is attached to the third arbor and has 9 points. From this design, we can deduce that this wheel makes one revolution every time the clock strikes 9. Each 24 hours the clock strikes 156 times, and 1248 in 8 days. This means that the third wheel will turn 138.7 times in an 8-day period:

$$\frac{1248}{9} = 138.7 \text{ turns}$$

Referring to our train count in Table 1 B, the first wheel with 72 teeth drives the second pinion of 10 leaves. This means that the second wheel on the second arbor will turn 7.2 times for each turn of the first wheel:

$$\frac{72}{10} = (X) \text{ or } 7.2 \text{ turns}$$

The second wheel with 52 teeth drives the third pinion of 9 leaves. This means that the third wheel on the third arbor will turn 5.8 times for each turn of the second wheel:

$$\frac{52}{9} = (Y) \text{ or } 5.8 \text{ turns}$$

To determine (Z) the number of turns of the third wheel for each turn of the main wheel:

$$(X) \times (Y) = (Z)$$
$$7.2 \times 5.8 = 41.8 \text{ turns}$$

Since the third wheel turns 138.7 revolutions in 8 days, to calculate the revolutions of the barrel in that period:

$$\frac{138.7}{41.8} = 3.3 \text{ turns}$$

Therefore we can conclude that winding the strike mainspring 3.3 turns will cause the clock to run for 8 days, 1.7 turns for 4 days, 0.4 turns for 1 day, etc.

CHIME TRAIN

In the chime train the logical index point is the locking plate which is attached to the third arbor and makes 1 revolution every hour. Each 24 hours the wheel turns 24 revolutions, and it turns 192 times in an 8-day period.

Referring to our train count in Table 1 C, the first wheel with 71 teeth drives the second pinion of 12 leaves. This means that the second wheel on the second arbor will turn 5.9 times for each turn of the first wheel:

$$\frac{71}{12} = (X) \text{ or } 5.9 \text{ turns}$$

The second wheel with 60 teeth drives the third pinion of 10 leaves. This means that the third wheel on the third arbor will turn 6 times for each turn of the second wheel:

$$\frac{60}{10} = (Y) \text{ or } 6 \text{ turns}$$

To determine (Z) the number of turns of the third wheel for each turn of the main wheel:

$$(X) \times (Y) = (Z)$$
$$5.9 \times 6 = 35.4 \text{ turns}$$

Since the third wheel turns 192 revolutions in 8 days, to calculate the revolutions of the barrel in that period:

$$\frac{192}{35.4} = 5.4 \text{ turns}$$

Therefore we can conclude that winding the chime mainspring 5.4 turns will cause the clock to run for 8 days, 2.7 turns for 4 days, 0.7 turns for 1 day, etc.

TABLE 1
GERMAN CHIME CLOCK
WHEEL TOOTH & PINION LEAF COUNT

A - TIME TRAIN

Arbor	Wheel Teeth	Pinion Leaves
First	72	-
Second	55	10
Center	64	10
Third	48	8
Fourth	50	8
Escape	15	8

B - STRIKE TRAIN

Arbor	Wheel Teeth	Pinion Leaves
First	72	-
Second	52	10
Third	63	9
Fourth	63	7
Fifth	63	7
Fan	-	7

C - CHIME TRAIN

Arbor	Wheel Teeth	Pinion Leaves
First	71	-
Second	60	12
Third	80	10
Fourth	72	8
Fifth	93	8
Fan	-	7

PRACTICE CALCULATIONS

(Answers on page 72)

1. Calculate the number of times the first wheel must turn to make a regulator clock with the following train count run for 8 days and 1 day:

Arbor	Wheel Teeth	Pinion Leaves
First	120	-
Center	96	16
Third	90	12
Escape	30	12

2. Calculate the number of times the first wheels must turn to make a 30-day mantel clock with the following train count run and strike for 8 days and 30 days:

A - Time Train

Arbor	Wheel Teeth	Pinion Leaves
First	96	-
Second	60	8
Center	-	16
Third	42	8
Fourth	42	7
Escape	48	7

B - Strike Train

Arbor	Wheel Teeth	Pinion Leaves
First	96	-
Second	64	8
Third	54	7
Fourth	48	7
Fan	-	7

The third wheel has two strike hammer lift pins.

Next time we will apply this and other information to calculate the length of a missing mainspring. In the meantime, you should be getting the information organized in a file that you can easily refer to for later computations. ❑

Clock Timers

Getting Started

Part I

by

Tom Dorman, CC

This article is for first-time users of a clock timer, and for those who have given up using the one they got. Timers for watches have been staples of the well-equipped shop for years, but the clock trade has been slower to follow suit. Two reasons account for this: (1) The wide variety of pendulum lengths and train designs result in thousands of different beat rate standards, and (2) Clocks are inherently noisy, which makes the isolation of escapement sounds much more difficult.

All clock timers use an acoustical pickup, a microphone, as a sound sensor. These devices "hear" and pass on to the timer all the sounds that occur as a result of mechanical contact in the clock. Any sound that is the same or similar volume as the escape tooth hitting the pallet will be registered as a "tick." The sound of the true ticks and the other sounds are not transmitted to all parts of the clock at the same level. We can use this fact to minimize the interference of other sounds by moving the point of sensor attachment to various locations on the movement, the case, or even a tool resting on the clock. Don't use the hands, as this will affect the rate.

The gain control, or volume control, determines how loud a sound will have to be to turn on the beat light and be registered as a tick. Turning up the gain will result in softer sounds being heard by the unit. Recent timers have incorporated circuits that cut off sounds that are just slightly softer than the gain control is set for. This helps isolate the ticks from the noise. As a rule, the best practice is to turn the gain control down until no beats are heard. Then turn it up until the escapement sounds are turning on the beat light most of the time. About 1/32" more will give you the best chance of getting all the ticks.

It will also give you the chance of sensing other sounds that are not ticks. Adjusting the gain control further will not help, and if no location can be found for the pickup where these sounds are minimized, the source of the sound will have to be treated. Some of the more common sources and their treatment are:

Crutch Slap--The sound made when the pallet is impulsed causing the crutch to suddenly change from being driven by the pendulum to driving the pendulum. Minimize the gap between the crutch and the pendulum rod (good practice, anyway) and add a little extra oil to the gap. The oil will dampen the sound until you are finished with the timer, and then should be cleaned out and re-lubed with a very small amount of oil.

Chains, Cables, and Weights--Settle everything down after making adjustments so that no metal parts are hitting each other. Make sure the pendulum is not hitting anything.

Loose Pendulum or Suspension Spring Parts--These can affect the operation of the clock, so finding them is a help.

Banking Pin Slap--In floating balance or hairspring clocks, a fairly loud sound is heard when the roller pin hits the lever and when the lever hits the banking pins. Move the sensor as far as possible from the balance and still be able to hear the ticks. This is one of the most difficult escapements for the timer. It may be necessary to put a small, even number in the counter and only use the numbers that come up which are close to the expected value. More about this later.

Strike or Chime Operation in Progress--It is very annoying to nearly reach the end of a timing period and have it spoiled by the sound of a strike warning. Do all timing just after the hour. This will also avoid the slowing influence of a heavy lifting action in some clocks which occurs just prior to the hour.

There are as many noisemakers as there are clocks, but this gives the idea. The best way to find out what the timer is hearing is to use the earpiece provided with most timers. Watch the beat light as you listen to the sounds the timer is hearing. Some are very difficult to isolate, but often these are mechanical events which will affect the quality of the clock repair and should be fixed for their own sake, not just to aid the use of the timer.

Many of the sounds you can hear will not turn on the beat light and will not affect the readings. It is very unusual for the sounds of other clocks to be registered in the beat light. If in doubt, stop the clock you are timing and see if the beat light comes on when a nearby clock is making noise. Even turn up the gain to see if you can get the timer to register the noise. In most cases, it will not.

The manuals that come with the timers have some very helpful tips and should be read several times. One point that seems to get overlooked is the number of beats counted in each average reading taken. An escapement has many variations,

each one of which is repeated every time the wheel turns. It is **vital** to sample each of those variations and roll them into the average rate calculated by the timer. The only way to get them all, and to avoid getting one of them twice, is to take the average readings for rate with a number in the beat counter equal to **twice the number of teeth in the escape wheel.** Because each tooth is visited twice, this will give you a reading which is the average rate exactly **once** around the escape wheel.

PRELIMINARY SETUP

Before you try to get an average rate for the clock, get an idea of how well the gain control is working and at what rate the clock is probably running. A minute spent on a preliminary assessment of your setup will reduce frustration and avoid false interpretation of results.

If the timer has both even and odd numbers that can be put in the counter, use the even numbers. Odd numbers in the counter will introduce variations caused by the clock being out of beat, which are not helpful at this point. Beat will be discussed in a later article.

Put the lowest even number available in the counter. Look at the numbers flowing past. (On a short pendulum clock they may come too fast to see. If so, put a little larger even number in the dial.) If the gain and sensor placement are OK, the numbers will be similar to each other. If occasional numbers differ greatly from the rest, it is an indication that the gain is too low, or that other sounds are being sensed. The point is that it is not necessary to wait for one complete revolution of the escape wheel to assess the setup.

Also note the numerical value of the numbers flowing past. These are the numbers that will be averaged by the timer, a task you can approximate in your head. This information will allow you to reject crazy averages that are caused by unwanted noises that can still spoil some readings. If the nominal average you come up with at this stage is divided by the number in the counter, you will have an idea of how much the reading can be affected by one missing, or one extra, tick or sound. In other words, the timer's average rate calculated for once around the escape wheel has to vary by that amount if it is to be blamed on the setup. Variations less than that amount are true variations in the rate of the clock and should be taken as true information about the behavior of the clock.

If the setup just can't be refined at the preliminary stage, if the readings occasionally give much smaller or much larger values, then don't even try to get a reading once around the escape wheel. Divide the number of beats in half or in quarters so you can reject the bad values and keep the good readings. If the counter should have a 60 for a 30-tooth escape wheel, then put a 20 or a 30 in the counter. If two of the readings with a 20 in the counter make sense and one doesn't, then average the two readings and ignore the deviant. This isn't accurate, but it will be close if there is no fundamental malfunction going on in the escapement. In such cases, a good test run is needed to verify that the clock is running at a good rate.

MEASUREMENT

Now put the correct count in the dial to measure once around the escape wheel. A lot of time can be lost waiting for a clock to stabilize into the amount of pendulum motion it will sustain. Until the pendulum has stabilized, the average rate will vary with the amplitude of the pendulum. It is a good idea to run the clock a little to verify that all is in basic working order. Note the maximum pendulum swing point against a wall or case reference mark after the clock has been running for a few minutes. Take the pendulum to that point for each restart and let it go from there. Take at least three readings to be sure the clock is stable.

If the second value is smaller than the first but the third is larger than the second, this is the clock taking control of the rate. If the third is smaller than the second, take a fourth reading (and so on) until the direction of change from one reading to the next reverses. When it does, the last two readings and all subsequent readings can be used as valid data.

If the clock has a standard rate published on the list that came with the timer, then this value can be used to regulate the clock. If not, counting the train can be done to obtain a standard.

Next month we will discuss the regulation process and how to arrive at a good rate using an error correction factor.

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BULLETIN BOARD

A. NEW REQUESTS

WATERBURY TIME & STRIKE MOVEMENT

Howard Wiseman, Norfolk, VA, has a Waterbury Clock Company Time and Strike movement which is 3-3/4 inches round and 1-1/16 inches thick (wide). He describes his problem as follows:

The gathering pallet has two pins to pick up the rack, and this gathering pallet is attached to the two-pin strike wheel arbor. The problem lies in the fact that the gathering pallet will stop between the teeth of the rack regardless of the position or adjustments made.

Needless to say, the clock will not strike properly for at least one or two hours, then it will stick again as the time train moves it forward. This movement has a groove on the side of the hour pipe for the hour hand to be attached. There are no markings or numbers on the plates or wheels to identify the correct way to reassemble the movement properly.

If you are familiar with this movement and can offer suggestions for solving this problem, we would like to hear from you.

MISSIONARY'S CLOCK

Robert Trainer, Waverly, OH, has a customer who has been a missionary in India for many years and purchased the clock pictured here in India. Can anyone identify the manufacturer of the clock and give its approximate age?

On the back plate of the clock is engraved the name SOLDANO just below the hands setting stem. In the extreme lower left hand corner is engraved the number 1118. The strike select lever provides for silent, grand strike, strike.

LENZKIRCH A.U.G. CLOCK

Arnold McCloud, Newton, KS, has the clock pictured here for repair. If anyone has experience with this clock, Mr. McCloud would like details on setting up the strike and chime mechanism.

LORCH LATHE

Murray Falk, Calgary, Alberta, Canada, has a very old "Lorch" 6 mm lathe set with many accessories and attachments, but to complete the set he still needs cone chucks set and collets #13 to 17. If collets larger than 41 were made for this instrument, he needs them too. Donald de Carle's book *The Watchmaker's Lathe and How to Use It*, 1st Edition, 1952, describes this tool (pages 131-134). Falk would like to correspond with anyone who has parts, accessories, or attachments. Mr. Falk has tried for several years on this. Several times references have been made that Lorch has disappeared, but surely not all its products have also. If anyone has or can name a source for these items, we would like to hear from you.

PIERRE BIDAUX WATCH

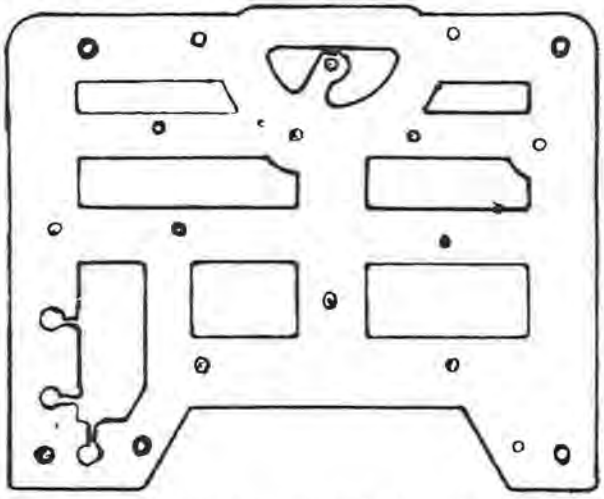
Jim Stanley, Ft. Wayne, IN, seeks the name and address of the distributor for Pierre Bidaux watches.

CUCKOO CLOCKS

R.W. Dietzel, Albuquerque, NM, has two questions both relating to cuckoo clocks.

1. Is there a parts source (new or used) for outdated cuckoo clocks? Quite often only a chain wheel is terminally worn and the remainder of the clock is in excellent condition. It seems a shame to let these old beauties die because a single part is no longer available. The suppliers that we usually depend on no longer support many of these cuckoos. Those companies are: S. LaRose, Timesavers, and Cuckoo Clock Mfg. Co., New York, NY.

2. Is there a publication for identifying cuckoo clocks from the layout pattern of their rear plates as one finds in the ***400-Day Clock Repair Guide*** *by C. Terwilliger? To illustrate this problem, here is a tracing of a cuckoo rear plate. There are no other marks whatsoever on the clock plates, front or rear. How does one identify?*



The 7-point star wheel is located between plates.

B. RESPONSES

EARLY AMERICAN CLOCK CASE

We have had a number of additional responses to the request of Kenneth West for information about this case. Many have gone to the trouble to take good photos of their clock or give detailed descriptions of it. The interesting thing is that although the same basic design reappears in all of the clocks, there are some variations on most of them. The following details were supplied by Dell Littlefield, Ft. Walton Beach, FL. We appreciate the efforts of the many readers who responded to this request.

Enclosed are some pictures of a similar clock. This clock is also incomplete in that a small finial originally protruded from the top center of the centerpiece but has been broken off. The movement in this clock is marked CALEDONIAN CLOCK CO. It is a lyre-shaped movement and I have been told they were made by Seth Thomas. I have been unable to confirm this.

I have restored several types of this clock and have found New Haven movements as well as unmarked movements in them. The cases were manu-

(Please turn to the next page)

BULLETIN BOARD
(Continued from the previous page)

factured by a Birmingham, England firm using American movements. There was an article in one of the early issues of the English magazine ***Clocks*** *detailing the history of this company. I lost my copy but believe it was one of the 1979 issues. This article stated the company was founded in 1867 and produced until 1937.*

Close examination of the case will show the manufacturer's lack of detail in building the cases. Columns or finials are never very well matched, the inlay is put on without regard to matching strips or even insuring all inlays are vertical, the fretwork is nonsymmetrical, etc. I feel this is part of the charm of these clocks.

The English clockmaker friend who introduced me to these clocks referred to them as "Cuthberts." He couldn't explain the origin of this name and, as I recall, had no connection to the name of the company mentioned in the ***Clocks*** *article.*

CLEANING WATCH DIALS
Tamara McCall, Royston, GA, writes that they use a pencil eraser to clean dials. The eraser should be used exclusively for this purpose and not for anything else. Perhaps what we used to call "art gum" erasers in school would also work quite well and be a little easier on the dial.

GREINER MM-1 OPERATOR'S MANUAL
Gerhard Hutter, Palm Beach, FL, sent a copy of the operator's manual for the Greiner MM-1 in answer to Dewey Clark's request.

C. ITEMS STILL NEEDED

ADMI QUARTZ WATCH TIMING MACHINE
Steve Bingham, Denton, NC, has an Admi quartz watch timing machine, model TAC II, serial #0204-B. He is seeking an instruction manual and wiring diagram as well as a source to purchase a power supply. If you can supply a manual and wiring diagram we will copy it and return your original to you. If you do not know a source for spare parts, perhaps you can provide the name of a service agent who will repair the unit.

SONCEBOZ CHART DRIVE TIMEPIECE
David Brown, Sr., Zachary, LA, has a chart drive timepiece for a General Electric recorder which records electrical current fluctuations. The movement is marked:

Societe Industriel de Sonceboz SA
For General Electric

It has four mainsprings in line and runs on either balance (slow) or governor (h. speed), which are features different from anything Mr. Bingham has seen before. He is seeking any repair information anyone might have.

UNITED METAL GOODS MFG. CO.
James Campbell, Lowell, NC, is seeking a replacement motor and movement for any electric clock made by United Metal Goods Mfg. Company, Brooklyn, NY. The movement in question is housed in a case containing a horse, carriage, and lamp post. It was made in either May 1965 or 1966 and is identified as model 701. A useable replacement is sought.

ELGIN WATCH SERIAL NUMBER 00,000,002
Chester Gilbert, Morens Valley, CA, has a 20/0, 15 jewel Elgin, First Model 492 ladies' wristwatch cased in an 18K case. This watch has the following markings on the movement:

Elgin USA: 15 jewels: 00000002

The case is marked:

Cased and Timed by Elgin National Watch Co.
J. Milhening Inc.
m
18K

Speculation is that this was an early "test market" piece. Can anyone, perhaps a former Elgin employee, explain this extremely low movement number?

Do you have information regarding this month's requests?

Do you need information about one of this month's responses?

If so, send a self-addressed, stamped business-size envelope and your request to: "Bulletin Board," c/o AWI Central, 3700 Harrison Avenue, Cincinnati, OH 45211. ❑

ROCK QUARRY et tu

Fred S. Burckhardt

Getting a Round Tuit

Most all watchmakers and clockmakers are procrastinators. Many even put off today what they can do tomorrow.

For example, what about that watch or clock you've been pushing aside in the hopes that it will go away? If you take in a repair job, it should be with the idea that you'll get it out as soon as possible. This is something I always strive to do, even though it may be taking more time than I figured it would. Or if I find I'm losing money on the job, I still take it in the order it came in. Many's the times I stayed till all hours of the night working on one of those jobs just so I could keep a customer happy . . .

I'll never forget the time I was visiting another shop when a customer came in to pick up her watch. The watchmaker told her it wasn't ready yet because the parts he needed hadn't yet arrived. I couldn't help but notice that the job he was talking about was still in the box. I brought it to his attention and told him there wasn't any mention on the envelope about the thing needing any parts, so he must have been thinking of another job.

The customer said, "That's right. You told me all it needed was to be serviced. Give it back to me and I'll take it somewhere else."

After she left, he turned to me, without saying a word, and pointed to the door. I had to leave anyway. For some reason I haven't heard from him since.

Of course, I have to admit, some customers are very unreasonable. The other day a clock repair customer called to inquire about his clock. I told him it would be ready soon, as all I had to do was to make several more adjustments. He wanted to know what I meant by 'soon', as I already had it for a year and a half. This got me upset . . . I can't stand it when a customer lies. I haven't had it for a year and a half. It's only been 17 months. I thought to myself, "Just for *that*, wiseacre, I'm not going to start on it for *another* 17 months!!"

On the other hand, there are those customers who will play along with you. Several years ago I had one of those jobs you wonder why you ever took it in. You know what I'm talking about? It actually got to the point where I was running out of excuses. This doesn't happen very often, but in this particular case I was scraping the bottom of the barrel. Have you ever used this one?: "My Grandfather in Albania had to have a lung transplant, so I gave him one of mine. The doctor told me it would be at least two years before I could do any more work."

Now you have to admit, this would bring tears to the eyes of a member of Hell's Angels. *I* even got choked up when I told her. Do you know what her answer was?:

"I'm from Albania too. What's his name and whereabouts does he live in Albania?"

Most people would stop there, but I wasn't about to let her get the best of me. I told her he lived on 12th Street in the town of Tirana, and his name was Stanislaus O'Reilly.

She said, "Oh, yes, I remember old Stan. We used to go to different schools together."

I could tell I was beaten. I told her I would have it ready for her very soon. She said, "I want to pick it up in one month. I don't want to hear any more excuses. If it isn't ready when I come in, you won't have to have an operation, because I'll *tear* out your lungs!!"

The moral of the story is: Never let a customer intimidate you. If you let one get by with it, word will get around, and before you know it, others will try it too. It could even get to the point where your customers won't believe anything you tell them. Just think what a revolting situation *that* could be. Not only will it mean you'll have to get things out on time, but you may have to work overtime getting it done. Worst of all, you could get a reputation of delivering things when they are promised. This could lead to big trouble and could ruin everything you've worked for through the years. Think of the consequences: You may have to work all week long; you will have to keep promises that were never meant to be kept; you will have to start to tell your customers the truth; and, as much as I hate to say it, your Grandfather in Albania will have to get somebody else to give him a lung.

As I see it, we must all stick together so this will never happen. I recommend we form an organization called "*Watchmakers and Clockmakers Anonymous for the Protection of Procrastination.*" If you want, I will be happy to serve as Chairman, but I won't be available until sometime after Christmas.

Think this over and let me know how you feel about it. I'll expect to hear from you sometime after the first of the year.

❑

LATHE WORK

Making a Difficult Job Easy

By J.M. Huckabee, CMC, FBHI

The most difficult part of a repivoting job is locating and drilling the arbor in its exact center. Likewise, any job that requires an exact center location is not easy. Early students of lathe work find this task almost impossible on small pieces of their exercise.

The machine tool industry has methods of accomplishing center location in large pieces, which is really not feasible in our trade. Is there a solution for the clockmaker? Indeed there is, and it is relatively simple. However, the tools must be handmade.

Let's explore the situation. Would you believe the exact center can be located with a starting hole in five seconds? It can!

Turn your attention to Figure 1. We have a group of tools I call "center locators." These are made in a family of sizes, with those shown being suitable for mid-range sizes of clockwork. These little gems work like magic!

The business end of the tool is shown in Figure 2. It is a drill with three cutting edges with a tip angle of about 60 degrees. The locator is a cup center with a wider angle and is illustrated in Figure 3. It is imperative that the drill and locator have essentially zero clearance in their fit.

How does the tool work? This is a one-hand operation; it is important that the tool fit the user's hand and that it is held properly. Refer to Figure 4 for the holding method. The knob is sized such that it can be held without inhibiting finger and thumb motion. Our drill bit length should correspond to the ball of your thumb and finger. The reason is shown in Figure 5. The drill tip should be easily extended or retracted from the locator in a one-hand operation.

Now for an exercise with our center locator: Place a piece of brass rod-stock in the lathe. A piece of 1/8 inch rod fits your #32 chuck and is suitable. Chuck the piece true, face the end, and cut a small

Figure 1. A group of center locating tools for lathe work.

Figure 2. The drill has three edges with an included angle of 60 degrees.

edge-chamfer at about 45 degrees. We are now ready to locate our five-second center starting hole. Figure 6 gives the idea of our setup. This could be an arbor to be repivoted or brass stock to make a bushing. The arbor to be repivoted should be supported by a steady-rest, any burr machined away, and the chamfer cut just enough to break a possible sharp edge.

Observe the technique in Figure 7. Place a drop of oil in the locator cup and press it hard onto the work piece. Now feed the drill into the work piece. It's just that simple! Our next step is related in Figure 8. With the work piece continuing to run, retract the locator and feel the bit running in its newly cut center. If there is an error in location, you will immediately detect it. Repeat the drilling if necessary.

Now for some thoughts on drilling: I use the technique depicted in Figure 9. The small drill bit is

Figure 3. The drill locator has an 80 degree centered cup mouth.

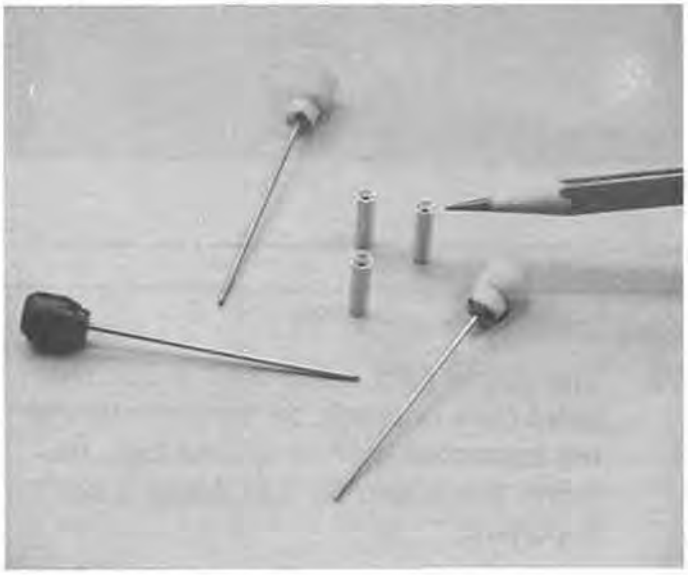


Figure 4. Here is how to grasp the tool.

Figure 5. Hold the locator with thumb and finger.

Figure 6. Face and chamfer the work piece.

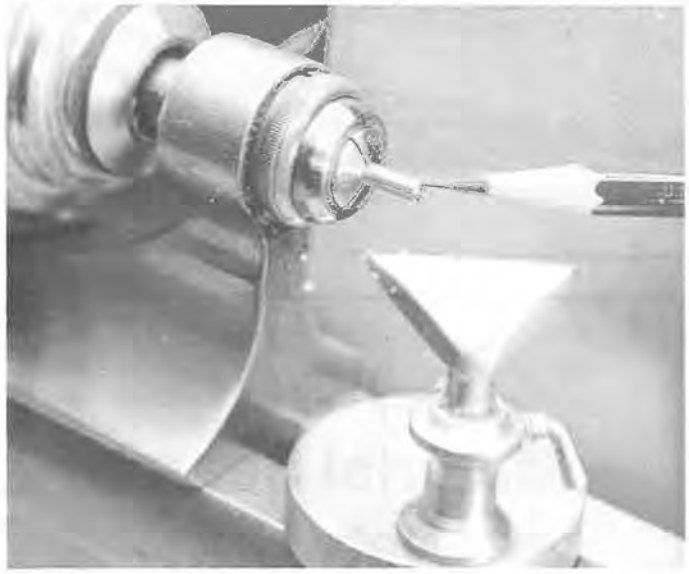
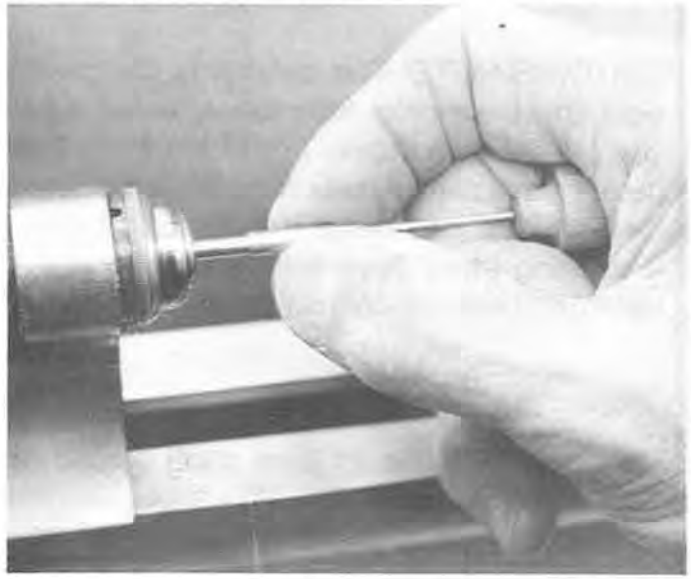


Figure 7. Hold the locator firm on the running work piece and begin drilling.



supported on a finger that is rested against the running work piece. Keep the bit sharp, use a lubricant, avoid chip buildup in its flutes, and don't let it skid. If the bit skids on the hole bottom, it work-hardens the material and wipes the cutting edges away. I like to drill an arbor 4-6 pivot diameter deep. A fluted bit will drill a slightly tapered hole which really aids in fitting the new pivot.

Next month we will continue with "Construction of the Center Locator Tool." ❑

Figure 8. Retract the locator and feel the drill in its center. Center error is detected by feel.

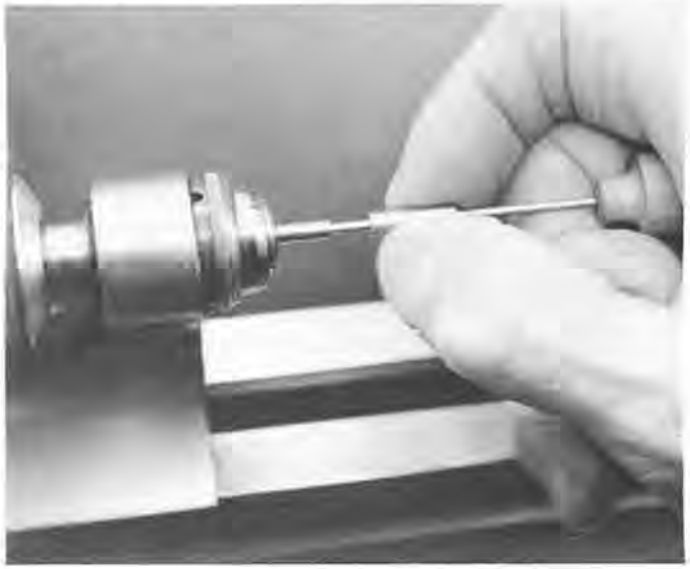
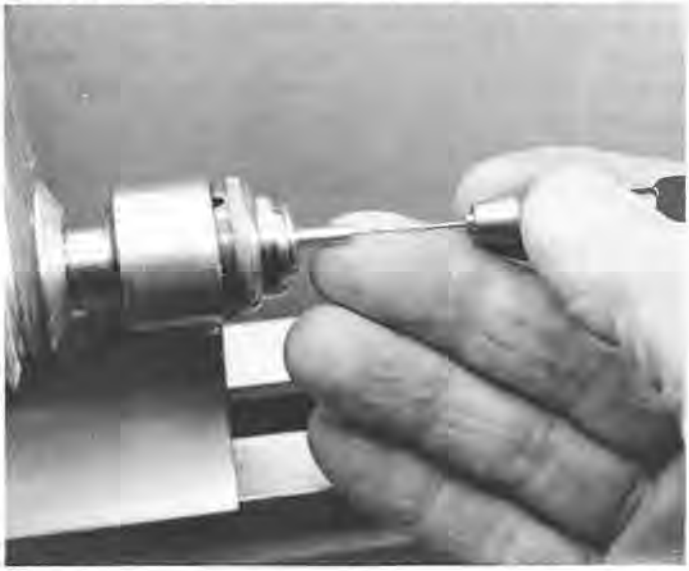


Figure 9. Drilling in a perfect center. Use your finger to support small bits.



AWI Material Search Network

EDITOR'S NOTE: This column is designed to work in conjunction with the AWI Movement Bank. If you can supply any of the items listed here, please send details to the Material Search Network. **Do not send the items.** Members requesting these items will be advised of their availability and will contact you direct.

V8 Ball-Hamilton, 21 jewel, 999B railroad dial, 24-hour, mint.

W5 18K yellow gold watch case and move ment (new or used), 16 mm wide (length not important), with or without lugs, diamond trim is also all right, make is not important.

W6 Longines 11.62 clutch lever and intermediate set wheel.

W7 Replacement movement for one shown here in good or repairable condition.

If you can supply any of these items, please contact: ***AWI Material Search Network, AWI Central, P.O. Box 11011, Cincinnati, OH 45211; Fax (513) 661-3131.*** ❑

NEW MEMBERS

AVILES, Mihuel Angel--Corozal, PR
BEATSON, Trevor--Calgary, Alberta, Canada
Sponsor: Archie B. Perkins--Denver, CO
BERTRAM, Gene--Kirkwood, MO
COUSINS, E.J.--Sussex, England
CRNIC, Paul--Rock Hill, MO
DAYKIN, Graham Edward--Vacaville, CA
DODRILL, A.V., Jr.--Huntington, WV
GENUNG, Kathy--Hampton, VA
GOLDFINCH, Brian R.--Port Orange, FL
HOCKMULLER, Hubert F.--Longmont, CO
Sponsor: Archie B. Perkins--Denver, CO
HOLLY, Patrick B.--Tualatin, OR
LAMBOY, Larry--Vista, CA
LA SPADA, Robert R.--Westlake Village, CA
LOPEZ, Jose J.--Jayuya, PR
MENDES, Joseph E.--Auberry, CA
MIDDENDORFF, Fred--Lakeport, CA
MULLINS, William M.--Campo, CA
NERGER, Paul V.--San Diego, CA
PAK, In Yang--Glen Burnie, MD
PARCEL, Rodney, Sr.--Perris, CA
PINE, Mary High--Great Falls, MT
RAMSEY, Roy B.--Odessa, FL
SAWYER, Steven W.--Ben Lomond, CA
SCHNELL, Ida Iolha--Grass Valley, CA
SHIFRIN, Isaac--Louisville, KY
SPARKS, Hugh--Minneapolis, MN
STRONG, Benjamin--Saratoga, CA
SUSSMAN, Gerald Jay--Arlington, MA
Sponsor: John Kurdzionak--Stoneham, MA
TALLEY, Eric--Allentown, NJ
TEETS, Bert P.--Sonora, CA
VAN ORSDEL, James--Charlotte, NC
VON KROHN, Stephen--Toronto, Ont.,Canada
WALKER, Sandra--Harrison, TN
WOOD, Jeffery D.--Rome, GA
WOODARD, Brenda K.--Smithfield, NC
YENT, Donald--Palo Alto, CA

❑

Affiliate Chapter Column

Joseph L. Cerullo, CMW, CMC

Notes on the Recent June Meeting

From June 28th-30th the American Watchmakers Institute and the affiliate chapters held their annual business meetings. As your newly elected affiliate chapter chairman, I would like to summarize the events for those who were not able to attend.

Before I begin, I would like to thank Paul Wadsworth, on behalf of all the affiliate chapter delegates and alternates, for a job well done these past two years. Paul has helped make our annual meeting an organized session for constructive work. I hope I can continue to make the affiliate chapters an important part of the function of the American Watchmakers Institute and its committees.

I have served as vice chairman of the affiliate chapters for three years, and I am looking forward to serving this group as its chairman. I have been attending the affiliate meetings since 1983 when a fellow New Jersey member, Walter Riegler, was chairman.

I first came out as an alternate to our delegate, Henry Frystak. As the alternate, I remember remaining fairly quiet through the entire weekend. I met many distinguished people whom I had heard about and whose articles and books I had read. I listened and watched to see how this process worked. At the end of the weekend, I went back to the New Jersey Watchmakers Association with all kinds of new ideas and a new sense of commitment.

At this time I was beginning my three-year term as president of our chapter. I can honestly say that after nine years of attending these meetings I still come home with a new outlook on all that's before me. These meetings help to serve as a "pep rally" for the year to come.

I have also noticed, in looking back over the past nine years, that the affiliate chapter meeting itself has changed significantly. This in part is due to very active chairmen in the past.

I can recall delegates and alternates arguing for hours over topics or proposals which had already been beaten to death for two or three years in the past. The meetings would drag on through the evening on Friday with very little being accomplished. Delegates would recess and leave the meeting room holding their heads and rubbing their faces in total frustration. As a result, when it came time for our chairman to present our proposals to the AWI Board of Directors on Sunday, the results were sometimes dreadful.

One by one, the Board would reject our proposals, or pass them off by saying, "We've done that already," or "It's already being done."

Well, the fact was that not a lot of the delegates attending and raising these proposals really knew what the AWI was providing for them and its members in general.

Over the past few years, I have seen the affiliate chapters come together more and more, becoming more organized and focused. I've noticed that several state chapters have sent the same person to represent them for two or three years in a row. I believe that this continuity is helping to bring about a change for the better.

I am a firm believer in working up through the ranks; I believe a person becomes more effective as a leader or representative by doing so. I myself served as an alternate for two years before becoming a delegate. I then sat as a delegate for four years before becoming vice chairman, which I served for three years. This is a learning process. You are learning about everything and everyone around you, and everyone else around you is learning about you at the same time.

There comes a time when you say something, and the people you are addressing begin to listen, and maybe even agree. Then you have accomplished something, both for yourself and for the group you are representing! It's then that this experience becomes rewarding, and you begin to feel a sense of accomplishment. And at this time you become enthused . . . As a dear friend of mine, Ewell Hartman, always says: "Enthusiasm makes the difference."

More on our annual meeting next month.

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Association News

CALIFORNIA

The San Diego Horological Society would like to welcome any and all visitors to California to join them at their meetings which are held the last Tuesday of each month. When in the area, call for additional information: Carl (619) 461-7046, Don (619) 425-7196, or Rick (619) 435-6443.

ILLINOIS

The Illinois Watchmakers Convention will be held on October 18, 19 and 20 at the Thelma Keller Ramada Inn Convention Center in Effingham, Illinois.

The program schedule includes Larry Blanchard, "Retrofit Program;" Alice Carpenter, "Troubleshooting Watches;" Buddy Carpenter, "Clock Repair;" Warner Theobald and Larry Hustedt, "Jewelry Repair;" and Ken Leeseberg, "Repivoting Watches, Clocks, and Polishing Pivots."

For more information contact Duane Laramee, 101 N. Water, Decatur, IL 62523.

INDIANA

The Horological Association of Indiana will hold their 1991 Fall Workshop and Annual Meeting on September 21 and 22 at the Anderson Holiday Inn in Anderson, Indiana (located at the intersection of Interstate 69 and Indiana State Road 9, exit #26).

A complete line-up of seminars and workshops is planned. For the clockmaker: "Restoration Techniques on Antique American Clock Movements," Roy Hovey; "Servicing the 400-Day Clock," Jon Alexander; and "Understanding the Brocot Deadbeat Escapement," Jon Alexander.

Programs for the watchmaker include: "Quartz Movement Diagnosis and Troubleshooting," Ray Vance; "Watch Dial Refinishing," Robert Miller; "Cleaning Methods for Plastic Watch Movements," Larry Blanchard; and "Custom Crystal Cutting with the Kronoglass Machine," Barry Baker.

Scheduled for the business side are: "Advertising Analysis," Dianne Settle; and "DOS for Dummies," Steve Settle.

Speaking on the future of horology will be Alan Linkey on "Watchmaker and Clockmaker Education" and Jim Lubic with a report on AWI's Project Extend.

For more information contact: Horological Association of Indiana, P.O. Box 614, Greensburg, IN 47240.

OHIO

The Watchmakers Association of Ohio will hold their third annual auction on Sunday, October 13, 1991, 12 noon, at the American Legion Hall, Southway Post 144, 3253 South High Street, Columbus, Ohio.

Any item you wish to sell should be brought with you the day of the sale. Bring these items early so that potential bidders will be able to look them over prior to sale time. The hall will be open at 9:30 a.m.

Auction items may include: watchmakers' tools, benches, bench lamps, clocks, clock cases, watches, watch and clock parts, jewelry repair tools, ring sizers, electric soldering machines, air compressors, and just about anything connected with the trade.

For more information contact Karl Farnlacher, 1404 Neva Dr., Dayton, OH 45414; (513) 275-3172.

OPEN HOUSE

The Watchmakers Association of New Jersey extends an invitation to all watchmakers, clockmakers, hobbyists, and collectors to attend one of their monthly meetings of September 10, 1991/October 8, 1991.

The monthly technical programs and discussions will keep you abreast of the latest advances and servicing techniques. Have your questions answered by experts in all phases of horology.

They meet in the First Presbyterian Church on the corner of Springfield and North Union Avenues in Cranford, New Jersey.

For further details, call Paul Richter (201) 797-1620.

UPCOMING CONVENTIONS

Horological Association of Indiana
Fall Workshop and Annual Meeting
September 21-22, 1991
Anderson Holiday Inn -- Anderson, IN

New York State Watchmakers
Annual Convention
October 4-6, 1991
Waterloo, NY

Illinois Watchmakers Association
Annual Convention
October 18-20, 1991
Thelma Keller Ramada Inn -- Effingham, IL

Florida State Watchmakers Association
Annual Convention
October 25-27, 1991

BOOK REVIEW

CHRONOMETER MAKERS OF THE WORLD by Tony Mercer. 5-1/2 x 8-1/2, 301 pgs., hard covers, 76 illustrations. Published 1991 by N.A.G. Press @ $50.00.

The most prolific maker of marine chronometers spread over the years is that of the Mercer family. Over three generations, spanning 128 years, they produced close to 31,000 of these ultra-precise mechanical timepieces. Tony Mercer, the author of this book, is the grandson of Thomas Mercer (1822-1900), founder of that company. Tony's father, Frank, evidently was well-taught by Thomas. I remember our meeting at Barny's clockshop in New York prior to his lecture to the Horological Society of New York. At Barny's he leisurely dismantled one of his chronometers and deftly assembled it with greater ease and expert simplicity than any skilled worker at the Waltham Watch Factory.

Frank Mercer is credited with regenerating the English chronometer industry by importing American and Swiss horological machinery. Tony, the third generation of this family of chronometers, was literally born into this industry. He was further trained thoroughly having been sent to hone his skills and knowledge, graduating from the Ecole Nationale d'Horlogerie et Cluses in Haute Savoie in France. For five years he served as a chronometer springer. More than that, he became quite active in all aspects of horology and has served in many prime positions of his industry. Among these were: President of the British Horological Institute, Master of the Clockmakers Company, Chairman of the Watch and Clockmakers Association, as well as Chairman of the British Instrument Trade Association.

Few living horologists have been immersed in chronometry construction, its technology, and history as Tony Mercer. His earlier book, *Mercer Chronometers--Radical Tom Mercer and the House He Founded*, is a standard reference.

This new book by Mr. Mercer is a splendid addition to the library of information on the mechanical marine chronometer. It might be rightfully compared to Baille's *Watch and Clockmakers of the World*. Of this current book's 301 pages, 171 are devoted to "Lists of Makers and Craftsmen." Five pages are devoted to "A Concise History of the Royal Observatory at Greenwich." Thirteen pages list "British Regional Craftsmen and Movement Makers." A single page, "The Principal Museums Displaying Chronometers," omits the American Watchmakers Institute, the Maritime Museum at Haifa, as well as similar displays in maritime museums in America, Portugal, and other good collections.

The 171-page list of makers and craftsmen is unlike the matter-of-fact listings in Baille's. Tony Mercer, in cataloging each name, has included a detailed biography of the maker, his known addresses, the years he or she worked, his apprentices, awards granted, accomplishments, and his trade affiliations. Also included are serialized production numbers of watch chronometers bearing his name. (Tony Mercer, incidentally, discriminates a maker from the real maker by capitalizing that term.) One sample listing is that of Henry Hughes and Son which requires just over a page of such details. The keyed-in lettered listings indicate that he was supplied by Parkinson and Frodsham, a great many by Mercer, balances from Kullberg, some of the entire number were 8-days, others were bought unsprung.

The first part of this book contains a Preface which establishes the book's theme and aims. There is also a short history of the chronometer and identification marks found on many of them. Dating instructions are given together with some remarks on the origins of the detent and, of course, the purpose of the chronometer.

Deservedly, John Harrison is given homage and the 1801 plan of the British Admiralty is recounted. Lord Kelvin and the Hughes family are included as "Two Great Names of the Nautical Sciences" in a 7-page illustrated chapter.

Mercer, who made the most (detented) chronometers, has 8 pages devoted to "Serial Numbers and Personalities," an intimate and illustrated chapter. There are also 24 photos of chronometers by well-known makers with an introductory line drawing by David Penny which includes its chief nomenclature. Eight important and historic chronometers are pictured in color with separate views of some of their movements.

As might be expected, Mr. Mercer may be indulged when he makes a statement: "Hamilton, at the end of their spectrum and who were by far the most productive maker, produced 11,239 as their total output between 1943-1957, an average of 802 per annum, which, if spread over 200 years, gives a figure of 56 (per year)." This brings to rise a quote from an earlier fellow Englishman, W.S. Gilbert in his *Mikado*: "I am so proud, if I allowed my family pride to be my guide . . ."

Continuing in Mercer's rationale, "So in considering all the great makers with a modicum of assumption, we have Mercer with 31,000, Hamilton with 11,239, Kullberg 5000, Johannsen 5000, Poole 4000, Dent 4000, Frodsham 4000, Nardin 4000, Lange-Wempe-GUB 4000, Arnold 2000, Earnshaw

2000, plus others 10,000, making a total of 90,000, bearing in mind that several other makers made for other makers."

By the same logic, one might add that Hamilton's production virtually ended in 1946. Their greatest production was in December 1944 with 663 chronometers. So by the war's end, they had tapered down considerably, and by 1946 they had produced 8902 chronometers (only 53 for that entire year) for the U.S. Navy alone. For the U.S. Maritime Commission they produced 1500, for the Army and Air Force they made another 500, and 2170 for various other agencies, institutions, and private buyers, for a grand total of 13,072 detent-escapemented chronometers. Added to this could be those with lever escapement, gimbaled and non-gimbaled (35 size) chronometer watches (which Hamilton termed), and as noted in Marvin Whitney's *The Ship's Chronometer*, kept as good time as many detented marine chronometers and better than some.

Hamilton made 13,531 of these gimbaled "chronometer watches" and 9780 non-gimbaled such watches. Quoting further, Ernest Drescher of Hamilton remarked that these watches could very well be the (mechanical) chronometer of the future. Thus, if all these figures were to be totaled, it would make 36,391 "chronometers" in Hamilton's short history of producing these.

In all, Mr. Mercer's new book is certainly a fine addition to his earlier family chronicle and should take a deserved place along with Gould's *Marine Chronometer*, Whitney's *The Ship's Chronometer*, Ditisheim's *Pierre LeRoy et la Chronometries*, also those by Dr. Audrey Mercer and Von Bertele, among others. The book's contents show a great deal of reserch and contains information not found anywhere else. It is highly recommended.

LA DANZA DELLA ORE (The Dance of the Hours) TWENTIETH CENTURY WRIST WATCHES by George Gordon. 9-1/4" x 12-1/4", 376 pages, 271 color photos, hardbound with sleeve, bilingual (English and Italian). Published December 1989 by Timeless Elegance @ $180.00.

This quality-produced book, with its catchy title of the most often played piece of opera music ("The Dance of the Hours" from Ponchielli's *LaGlocanda*), is from the pen of George Gordon. Mr. Gordon has made a reputation as a researcher and chronicler of the wristwatch products of the world's makers of such watches, some of which fall in the category of being termed "vintage." These books specialize in the products of Rolex-Timeless Elegance; Cartier a Century of Cartier Wristwatches; as well as one on cigarette lighters bearing the Dunhill label.

The contents of this current publication are divided into six short chapters, a preface, and an introduction. The chapter headings are: "The First Steps, 1900-1920;" "From Harwood to Rolex, 1920-1930;" "The Successful Years from Hollywood to the Olympics, 1930-1940;" "The War Years Reconstruction and Chronographs, 1940-1960;" "The Mythical Fifties--A New Golden Age, 1950-1960;" "The Twenty Most Difficult Years, From Crisis to Boom, 1960-1980."

In this first section there are 22 facing pages of full color reproductions of vintage advertisements of wristwatches by well-known companies such as Rolex, Ulysse Nardin, Movado, Hamilton, Universal, Bulova, and a generous sampling of fine Elgin vintage ads.

All the above is contained in 60 pages of text which is equally apportioned to the same text in Italian. The remainder of the book is devoted to the wristwatch products of Patek Philippe, Rolex, Vacheron & Constantin, Cartier, LeCoultre, Movado, Longines, and "assorted" devoted to the products of many other wristwatch makers. Each watch is described succinctly. In some models the photos are enlarged to page size in very clear quality photographic reproduction. Strangely, in this whole section of over 200 pages, only three views of movements are shown. One is the three-angled Polyplan of Movado, excellently viewed; another is a chronograph movement "manufactured" by Cartier; and a skeletonized Vacheron & Constantin.

The largest section is a full-color catalog of wristwatches by the six major quality makers. Other models are from Hamilton, Croton, Recta, Universal, the Accutron "See-through," Eterna, Bulova, Gruen, Omega, Audemars Piguet, Jaeger LeCoultre, among others, which occupy the last section of this book.

The historical sections are well constructed with authentic accounts well recorded. However, Mr. Gordon quotes Harvard's Prof. David Landes' name to read "Landos." Although the Table of Con-tents at the front of the book denotes page numbers of each chapter, none of the 376 pages are numbered.

In the author's fine recounting of the Cartier history, he mentions "The Tank in 1917," as well as an earlier reference to this frequently referred to but not shown first model. To quote Mr. Gordon, however, "It was an unusual model in which the two biggest components of the watch casing were assigned numbers right from the beginning and then worked as a pair. At the end, the two so-called 'twins' made up the final case, fitting perfectly together." This statement still doesn't render a clear image of what the first model might have looked like.

This volume is similar in format to the other *Timeless Elegance* editions. These are of very high quality. To the sophisticated collector and dealer, this new edition should be a worthwhile addition.

Henry B. Fried

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News in the Trade

ENERGIZER BATTERY COMMERCIALS RECEIVE AWARDS

Eveready Battery Company's Energizer® Bunny campaign received accolades at the 25th Annual Belding Awards.

The Belding Awards, sponsored by the Advertising Club of Los Angeles, honor superior work in the Southern California advertising community. Chiat/Day/Mojo, creators of the Energizer® Bunny campaign, accepted the three awards.

Best 30-second TV spot went to "Hips," a promotion for a new television series about women cops which is interrupted by . . . you guessed it . . . the Energizer® Bunny. Two Beldings also went to "Dance With Your Feet" for best 60-second and best-packaged goods. This fake movie trailer ran in theaters and on TV. It promotes the epic (but fictitious) movie "Dance With Your Feet" until the Bunny cuts through the scene.

The Energizer® Bunny is no stranger to the spotlight. Since his birth two years ago, he has received many awards, including: 1990 Beldings, *TV Guide*'s Cleverest Commercial Series, *Adweek*'s America's Favorite Campaigns, and *Advertising Age*'s Best Ad of 1989. You never know where he'll turn up next!

Energizer® brand batteries are produced by the Eveready Battery Company, the world's largest manufacturer of dry cell batteries.

JA MOVES TO NEW HEADQUARTERS

Jewelers of America (JA) has relocated to its new headquarters. Their new address is: **1185 Avenue of the Americas, 30th Floor, New York, NY 10036.**

The Association will be located on Avenue of the Americas and 47th Street. The new telephone and fax numbers are: **Tel: (212) 768-8777; Fax: (212) 768-8087.** JA's Tel: **(800) 223-0673.**

L&R NAMES ROBERT GELLER NEW REGIONAL SALES MANAGER

L&R Manufacturing Company, a leading supplier of ultrasonic cleaning systems and solutions, named Robert Geller new Regional Sales Manager for their West Coast operations. L&R manufactures a wide range of ultrasonic cleaning machines from a standard line of portable systems called Quantrex to custom systems for specific uses.

The company recently celebrated its 60th anniversary of manufacturing devices for cleaning. In addition to the machines, L&R produces specially formulated solutions for cleaning applications pertaining to the jewelry field, the medical and dental professions, laboratory apparatus cleaning, industrial and technical product cleaning.

Mr. Geller will be responsible for overseeing the sales and marketing for West Coast customers. L&R sells its products in all 50 states and some 22 countries throughout the world. Renowned for quality and warranty leadership roles, L&R products can be found in almost every conceivable industry where products or components need to be cleaned to exacting specifications. Contact: **L&R, 577 Elm St., Kearny, NJ 07032.**

GIA OFFERS TRAINING IN COLORED STONE GRADING

The Gemological Institute of America (GIA) is offering a learn-at-home colored stone grading course that gives today's jeweler skills to buy, sell, and appraise with confidence and speed.

In this course, students master GIA's widely acclaimed Colored Stone Grading system, including techniques for grading gems quickly, confidently, and consistently. The course presents complete grading procedures for 30 of the most popular transparent, faceted gems, including amethyst, citrine, emerald, ruby, sapphire, topaz, tourmaline, and tanzanite.

Emphasis is placed on the practical grading of basic quality factors in colored gemstones, their combined effect on overall quality, and on relating quality, beauty, and durability to value.

For more information, contact: **GIA Registrar, Dept. PR01, P.O. Box 2110, Santa Monica, CA 90407-2110; (800) 421-7250; Fax (213) 828-6589.**

Robert Geller

CARTIER-PIAGET DONATES $2 MILLION TO RED CROSS

The Cartier-Piaget Group is presenting the International Red Cross with just over two million dollars, it was recently announced. Funds collected in 17 countries will be sent to assist the Kurd refugees, as well as to the victims of the cholera epidemic currently spreading in Latin America.

"We are very proud to participate in a humanitarian act of this magnitude," said Simon J. Critchell, president and CEO of Cartier, Inc.

A significant portion of the donation ($300,000) came from the United States, and was presented by Mr. Critchell to American Red Cross President Elizabeth H. Dole at a recent conference.

Elizabeth H. Dole, President of the American Red Cross, and Simon J. Critchell, President and CEO of Cartier, Inc.

NEW APPOINTMENTS AT TWIN CITY SUPPLY

Twin City Supply is pleased to announce the appointments of Bob Schwartz and Earl Grenson to head their recently expanded tool division. Their combined experience in the industry is sure to provide their customers with quality service and merchandise.

Maureen Stewart, formerly of J & S Jewelers Supply, has also joined the staff at Twin City. She will be in charge of the Seiko and Pulsar band department.

Another change for Twin City is the addition of the watch material system formerly owned by the Niagara Jewelry Supply Company to Twin City's exensive inventory of watch material.

Twin City Supply is located at **6150 Wayzata Blvd., Minneapolis, MN 55416-1239; (612) 545-2725.**

SOVIET WEALTH IN PERESTROIKA GEMS

While Mikhail Gorbachev seeks financial support to shore the sagging Soviet economy, he needs only to look at the country's vast gem and mineral wealth to find one source of potential revenue. However, according to Chilton Company's *Jewelers' Circular-Keystone (JCK)* magazine, Perestroika has done little to bring some of the astounding number of the USSR's natural minerals and gemstones to Western markets.

There are diamonds in Siberria, emeralds in the Ukraine, spinels in the Pamir mountains, and countless other minerals of great value peppering the countryside. But few are finding their way to the West.

Perhaps the biggest impediment to getting this gemological wealth to world markets is one familiar to Soviet watchers: bureaucracy. Squabbling over who controls what, and who is entitled to jurisdiction over the minerals, greatly inhibits free trade. And controlled selling appears to be a continuing rule. Soviet regulations require stones and minerals to be purchased from the Ministry of Geology and Finance. In addition, regional unrest in various Soviet republics has hampered the development of new and old gem sources.

But some gems are available. A few remarkable pieces are coming out of the Soviet Union, coming from old, in part privately held gem and mineral collections.

Chilton Co., based in Radnor, PA, is one of the Diversified Publishing Companies, a part of Capital Cities/ABC. For more information, contact George Holmes, **(215) 964-4463.**

New Products & Literature

NEW FINDINGS CATALOG FROM ESSLINGER

Esslinger & Co. has introduced their brand-new findings catalog. Completely updated to include today's most popular findings, the catalog features line drawings, an easy-to-use format and thorough index. Clearly marked headings and subheadings make items easy to find. Helpful tables put measurement comparisons and other vital information at the user's fingertips.

To receive a copy of this new findings catalog, call Esslinger at **1-800-328-0205** (in MN call **1-800-392-0334**).

Esslinger

NEW TUBE PRESSING TOOL FROM GUENTHER & SONS

This new tool is specifically designed for watchmakers who work with and repair Rolex-type watches. The front end of the tool is made to fit the Rolex Ø600 mm tube. The back end is like a screwdriver with a revolving head. The pressing tool is made to easily screw in these tubes to watch cases when waterproofing. The pressing tool has been made available at an introductory price of $39.50. It is a *must* tool for any watchmaker.

For further information and help with all Rolex genuine parts, crystals, tubes, crowns, gaskets, including the 2130 clutch wheel, contact: **Guenther & Sons, 404 W. 7th St., Suite 408, Los Angeles, CA 90014; 1-213-892-8033; 1-800-462-1962; Fax 1-213-892-8035.**

Guenther & Sons

WATCH BAND COMPANY ANNOUNCES NEW PHONE NUMBER

The Watch Band Company has announced their new toll-free number for their customers. It is **1-800-927-7832.** The company is located at: **702 Overlook Ave., Cincinnati, OH 45238.**

BATT-TRONIC ADDS NEW 14K FINDING

The secure lobster claw clasp is now available from Batt-Tronic Corporation. The Italian-made lobster claws are quality-constructed, beautifully finished, and include a jump ring for easy attachment. The clasps are available in four sizes ranging from 3x9 mm to 5.3x13.5 mm. Batt-Tronic offers a quantity discount price for purchases of three or more pieces, and includes a 3-1/2x17" point-of-purchase promotional banner with each order.

Prices are based on the gold market, and may be obtained by calling the **Batt-Tronic Corp., 1-800-431-2828** nationwide, or **1-800-942-1944** in NY.

CARTIER'S LIMITED EDITION TWO TIME ZONE CINTRE MECHANICAL TANK WATCH

Cartier International, one of the world's leading luxury watch firms, has announced the creation of its new two time zone cintre mechanical tank watch.

Each year, Cartier produces a number of limited series watches which have become favorites among watch collectors and connoisseurs. The Cartier two time zone cintre mechanical tank is part of a limited edition, and is ideal for collectors of rare and precious timepieces.

This watch features two faces and two winding crowns fitted with faceted sapphires. The "cintre," or curved case, is crafted of 18K polished gold. The back of the case is engraved with the serial number and date, making each watch a collector's item. It operates on two mechanical movements and is technically and aesthetically top of the line.

Cartier International designs, manufactures, and distributes all of Cartier's products. For more information, contact **Cartier, Fifth Ave. and 52nd St., New York, NY 10022; 1-212-PL3-0111.**

Cartier tank watch

JEWELER'S LAMP FROM ART SPECIALTY

The jeweler's lamp from the Art Specialty Company show merchandise in its true colors with a hand-blown blue faceted glass reflector unique to the industry that eliminates yellow cast.

Each reflector is individually hand-blown with a technique developed over 60 years ago which combines a mirror backing with diamond ridges on the blue glass.

"The blue glass makes whites whiter and colors brighter, providing outstanding color value for any jewelry product," says Win Waterman, marketing manager at Art Specialty.

The Art Deco style lamp with a hand-polished, bright chrome finish makes it an attractive addition to display areas.

Available with eight-inch and ten-inch diameters, the lamp stands 22 inches tall, swivels 270 degrees, and weighs 18 pounds. The lamps include 100-watt blue bulbs and carry a 25-year guarantee.

Art Specialty Company is a leading American manufacturer of high-quality fluorescent, incandescent, and halogen portable task lighting. Based in Chicago, the company has over 50 years of experience producing reliable and attractive lighting fixtures. Their products are available through jewelry supply distributors, including Jadow & Sons and I. Kassoy, Inc., dealers and catalogs, electrical and industrial supply distributors, and home accessories stores.

CONCORD'S NEW "DELIRIUM"

The Concord Delirium collection welcomes a new model this year, containing one of the thinnest mechanical movements made. Boasting a power reserve of 40 hours, it is visible through the platinum case's transparent sapphire back. Only 50 of these designs will be produced, each individually numbered.

For more information, contact the **Concord Watch Corporation, 125 Chubb Ave., Lyndhurst, NJ 07071; (201) 460-4800.**

Concord

When contacting these companies for their products and literature, tell them you saw it in the Horological Times!

Art Specialty Co.

Classified Ads

REGULATIONS AND RATES

Ads are payable in advance $.60 per word, $.70 per word in **bold type.** Classified display ads are $25.00 per column inch, 2-1/4" wide. Ads are not commissionable or discountable. The publisher reserves the right to edit all copy. Price lists of services will not be accepted. Confidential ads are $4.00 additional for postage and handling. The first of the month is issue date. Copy must be received 30 days in advance (e.g. June issue closes for copy on May 1st).

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TRADESMAN

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CLOCKS: gearcutting, repivoting, jeweling, rebushing. REPAIRING: timers, aircraft clocks, pocket watches. ROY H. NIEGEL, CMC, CMW, 101 E. Saint Joe Drive, Spirit Lake, Idaho 83869. SASE or CALL (208) 623-4330.

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7-8--Advanced Quartz Watch Repair Bench Course (AWI); Robert Bishop, instructor; Des Moines, IA.*

14-15--400-Day Clock Repair Bench Course (AWI); John A. Nagle, instructor; Denver, CO.*

15--Servicing ETA Quartz Chronographs Bench Course (AWI); James Broughton, instructor; Pittsburgh, PA.*

15--Introduction to Quartz Watch Repair Bench Course (AWI); Buddy Carpenter, instructor; Minneapolis, MN.*

21-22--Repair of the Atmos Clock Bench Course (AWI); Gerald Jaeger, instructor; Salt Lake City, UT.*

21-22--Horological Association of Indiana Fall Workshop and Annual Meeting; Anderson Holiday Inn; Anderson, IN.

22--Useful Techniques: Mechanical Watch Repair Bench Course (AWI); James Adams, instructor; Portland, OR.*

28-29--400-Day Clock Repair Bench Course (AWI); John A. Nagle, instructor; San Diego, CA.*

OCTOBER 1991

4-6--New York State Watchmakers Annual Convention; Waterloo, NY.

4-6--Advanced Lathe Bench Course (AWI); Roy Hovey, instructor; Atlanta, GA.*

5-6--Advanced Quartz Watch Repair Bench Course (AWI); Robert Bishop, instructor; Boston, MA.*

5-6--400-Day Clock Repair Bench Course (AWI); John A. Nagle, instructor; Richmond, VA.*

6--Introduction to Quartz Watch Repair Bench Course (AWI); Buddy Carpenter, instructor; Kansas City, MO.*

18-20--Illinois Watchmakers Association Annual Convention; Thelma Keller Ramada Inn Convention Center; Effingham, IL. For more information: Duane Laramee, 101 N. Water, Decatur, IL 62523.

18-20--Introduction to Clock Repair Bench Course (AWI); James Lubic, instructor; Marquett, MI.*

20--Useful Techniques: Mechanical Watch Repair Bench Course (AWI); James Adams, instructor; Boston, MA.*

25-27--Florida State Watchmakers Association Annual Convention; Ramada Hotel; Fort Myers, FL.

27--Servicing ETA Quartz Chronographs Bench Course (AWI); James Broughton, instructor; Minneapolis, MN.*

NOVEMBER 1991

9-10--400-Day Clock Repair Bench Course (AWI); John A. Nagle, instructor; Charlotte, NC.*

9-10--Repair of the Atmos Clock Bench Course (AWI); Gerald Jaeger, instructor; Houston, TX.*

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25-26--400-Day Clock Repair Bench Course (AWI); John Nagle, instructor; Austin, TX.*

26--Servicing ETA Quartz Chronographs Bench Course (AWI); James Broughton, instructor; San Diego, CA.*

***For more information on AWI Bench Courses and Regional Seminars, contact AWI Central, P.O. Box 11011, 3700 Harrison Avenue, Cincinnati, OH 45211; (513) 661-3838; fax (513) 661-3131.**

ANSWERS FROM PAGE 51

1) 8 days = 25.6 turns;
   1 day = 3.2 turns
2a) 8 days = 4.3 turns;
   30 days = 16 turns
2b) 8 days = 5.7 turns;
   30 days = 21.4 turns

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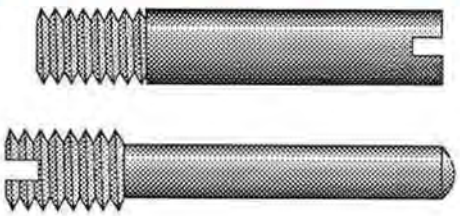

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22--Useful Techniques: Mechanical Watch Repair--Portland, OR
28-29--400-Day Clock Repair--San Diego, CA

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9-10--Repair of the Atmos Clock--Houston, TX
10--Servicing ETA Quartz Chronographs--Atlanta, GA
10--Introduction to Quartz Watch Repair--Oklahoma City, OK
16-17--Cuckoo Clock Repair--Albuquerque, NM
16-17--Introduction to the Watchmaker's Lathe--Kansas City, MO
30-Dec. 1--400-Day Clock Repair--Savannah, GA

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19--Introduction to Quartz Watch Repair--Atlanta, GA
19--Useful Techniques: Mechanical Watch Repair--Albuquerque, NM
25-26--Cuckoo Clock Repair--Phoenix, AZ
25-26--400-Day Clock Repair--Austin, TX
26--Servicing ETA Quartz Chronographs--San Diego, CA

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22-23--Cuckoo Clock Repair--Orlando, FL
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