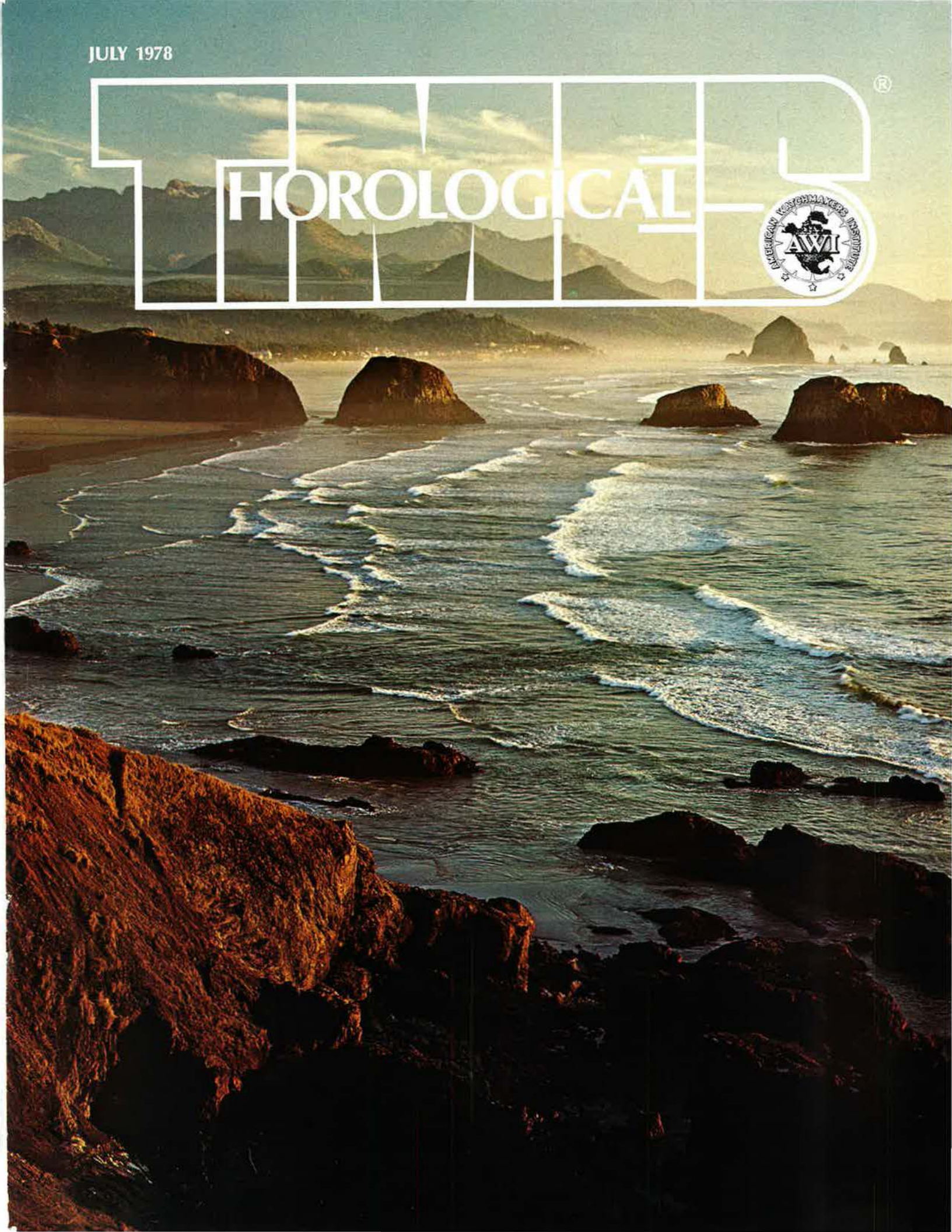


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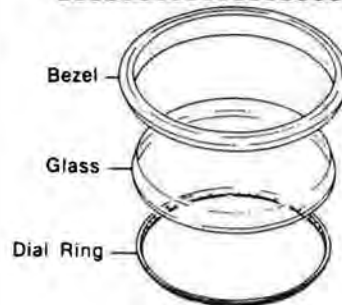
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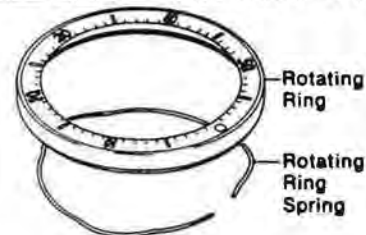
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Editorial

About ten years ago, a representative of a state organization attended the American Watchmakers Institute annual board meeting. His sincere purpose there was to be vocally critical of the operation and purpose of the organization. The meeting was called to order and this man sat quietly and patiently for the time at which he would be recognized by the chair. After hours of committee reports, finance reports, reports of past accomplishments and future plans, the time had arrived for state and local representatives to be recognized by the chair. This representative did not voice any criticism, but sat silently impressed by the efficiency and professionalism of this organization.

Eight years later he was elected president of the American Watchmakers Institute. During his tenure he continued close watch over the Material Cost Study Committee, which he initiated while a Director. Just a few accomplishments after being elected President were: the Solid State Guide, Bestfit material supplements, the Sources book, and the beginning of Horological Times. During this period, he worked toward and succeeded in creating an excellent working alliance with the Watch Material and Jewelers Distributors Association.



For his dedication, strength, and good judgment, we all say, "Thank you, Jim Broughton."

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The President's Message

by James H. Broughton

I am one of the most fortunate of AWI members. I was given the opportunity to serve as President of the American Watchmakers Institute. I consider this an honor, an honor each member of AWI should have. I can truly say I have gained much more than I have given. There isn't any way a person can serve as President of this Institute without gaining.

Knowledge is priceless and this is what I have gained. I have gained this knowledge from you, the AWI member. I have met several of you personally, have received letters from others, and many have telephoned me. Regardless of which type of communication we had, I gained knowledge from all of them.

I have said that for years I was a taker from AWI and lately I found myself in a position to give a little in return. This is what I have been trying to do. In so doing I have found that I have been receiving much more than I have been giving, so I still consider myself a taker. This just proves a point, that by being a member of AWI you will always receive more than you can give.

My term as President of the American Watchmakers Institute has been one of the most rewarding times in my life. It is an experience I can happily look back on for many years to come.

What little success I may claim as President was made possible by many people. Our Executive Secretary, Milton Stevens, would have to head this list. I will not attempt to list any other names; the list would be too long and I would not want to take a chance in missing one. I do want to say thank you for your assistance and kind words of encouragement.

The growth of the American Watchmakers Institute is one of the big concerns of every President, and I am no different. I am satisfied with all the accomplishments that have come about these past two years.

I made a statement when I was elected President that our goal would be to turn all our stumbling blocks into

stepping stones. With the aid of the Board and Directors and the Executive Board, I feel this has been done.

My heart is not saddened for leaving this office, instead, I am proud to have had the opportunity to serve as President of AWI.

Thanks to each of you for your support these past two years. □

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Dr. Darab B. Unwalla, Director of Executive MBA Programs and Professor of Management and Marketing—Florida Atlantic University, and Gary A. Luing, Dean, College of Business and Public Administration and Professor of Accounting and Finance, jointly monitored panels of members and masterfully developed real life situations from the member audience participants. Among subjects reviewed were: Controlling your destiny through planning, Budgeting, Cash flow management, Inventory management, Credit & collection management, Performance review—personnel selection—motivation and promotion, Perpetuation of the business through heirs—sales and mergers, How to handle family personal relationships, Techniques of transferring power, Taxes and business perpetuation.

Leonard Theran, insurance specialist from Theran & Theran, Boston, Massachusetts, covered the many facets of insurance and coverages necessary to carry on a successfully protected business.

Dr. Darab B. Unwalla, Director of Executive MBA Programs and Professor of Management and Marketing—Florida Atlantic University.



An event which is gaining more popularity each year was the "Associates' Tables" which provided an opportunity for manufacturers to meet with wholesalers and distributors to discuss their product lines, distribution policies, etc. A record-breaking thirty-five Associate Member companies participated in this all-day event.

The educational portion of the meeting was complemented by golf and tennis tournaments, spouses tour and luncheon, trip to Dania Jai Alai, cocktail party sponsored by Associated Members, and the Annual Awards Banquet and Dance.

Attendance was at a high with 174 participants made up of 40 Active distributing companies and 42 supplier members. Summing it up, one of the supplier members who attended all the sessions stated, "It was complete and had to be valuable to all of us!"

The gracious Arizona Biltmore, Phoenix, Arizona, will be the site for the 1979 Annual Convention, March 21-25.

For further information on membership in WMJDA or future meetings, contact: Caryl J. Olson, Administrative Assistant, WATCH MATERIAL & JEWELRY DISTRIBUTORS ASSOCIATION, 435 North Michigan Avenue, Suite 1717, Chicago, Illinois 60611, 312/644-0828.

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Annual Awards Banquet.

Officers and Directors



Pictured from left to right: First row (kneeling): Skip Apple, Ed Soergel, Edward Endman (standing), Art Bush, Karl Esslinger, John Cassidy. Second row: Denis Gaber, Mike Langert, Ken Weil, Ray Harris, Morris Beresh, Max Fargotstein, Bob Mahar, Robert Kilb, Mark Borel. (Not pictured, Bernie Nest).

“It was complete and had

WILBUR E. CURETON 1978 MAN OF THE YEAR IS HONORED AT WMJDA LUNCHEON

Wilbur R. Cureton, President of The Newall Mfg. Co., Chicago, Illinois, was named Man of the Year by the Watch Material and Jewelry Distributors Association at their Annual Luncheon held in conjunction with the Annual Convention in Boca Raton, Florida, Friday, March 31, 1978.

Edward Endman of Marshall-Swartchild Co., Chicago, Illinois, traced the history of Cureton's entrance into the business when he began with The Newall Mfg. Co. in 1937 to his present position of President, which he had held since 1958. He recounted the many years of support given WMJDA by Cureton as an Associate Member since the organization was founded, attendance at all the conventions and his active participation in bringing in new members.

Over 130 friends were in attendance to honor Bill Cureton and offer their congratulations to a man who truly has earned the honor of "Man of the Year."

Edward Endman toasting Wilbur R. Cureton, WMJDA Man of the Year.



Officers and Wives



Officers and Wives, left to right: Ken Weil, Marcy Weil, Mickey Beresh, Morris Beresh, Marilyn Cassedy, John Cassedy, Teresa Esslinger, Karl Esslinger.



Associates Tables Day.

Tour Date Correction

Members of WMJDA will tour The CAS-KER Co., The E & J Swigart Co., and the central offices of the American Watchmakers Institute on July 15-16. The announcement that we printed in the June issue, stating that the visit would be on July 7, 8, 9 was in error.

to be valuable to all of us!"

MAN OF THE YEAR ACCEPTANCE SPEECH

by Wilbur Cureton

"After the shock had worn off from getting the letter advising me that I had been made Man of the Year, I realized that an acceptance speech would be necessary and I started to worry about what to say. I had planned a half-hour speech but everyone said to keep it short, so I guess they want to get out for golf, tennis or shopping.

"I looked into our old files to see what I could find and one of the first things I found was a letter from Don Richards, then Executive Secretary, asking me to be on the June 1948 program, and as I remember, I was petrified that I was going to have to speak. I got through it then, so maybe I'll make it today.

"The second thing I found was a Membership Directory and as far as I know, this was the first Directory printed. On the back, it is dated May 1949. As I thumbed through the old Directory, it brought back many pleasant memories of the last 30 years.

"After attending the Conventions for 30 years, I began to realize that I was not really with competitors and customers, but that I was with friends. Looking through the old membership list, I began to realize how long I had known a lot of the people listed there. I then checked and found that among the original members that 25 Active Members and 16 Associate Members are still listed in the 1978 Directory.

"In looking through this year's Directory, on page 10 I found a list of the Past Men of the Year and I felt very proud to be included among such a wonderful group of men who have been leaders in our industry and in the Association.

"I feel it has been a great honor for me not only to be the 1978 Man of the Year, but to be the first to receive the honor at the Annual Convention, before such a large group.

"At this time I want to thank the Committee for electing me this year and to thank all of the members for their congratulations and for accepting me as the 1978 Man of the Year."

L to R: Morris Beresh, President of WMJDA, presents Man of the Year Award to 1978 recipient, Wilbur R. Cureton.



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Questions and Answers

by Henry B. Fried

CMW CMC FBHI

HOLE AND CAP JEWEL ASSEMBLY

Q. I have a 5BD Bulova and the lower escape wheel pivot has rusted off, and now there are rust particles between the hole jewel and cap jewel. The problem I am having is getting the rust from between the cap and hole jewel. On this particular model the cap jewel is set in with a bezel. What I want to know is: does the cap jewel come out? If not, how do you suggest I get the rust out? I tried just putting the pillar plate in the ultrasonic cleaner to see if it would come out but that doesn't work.

Bradham's Jewelry
Paris, Illinois

A. You say you're having a problem removing rust particles from between the hole jewel and cap jewel, and you ask if the cap jewel is removable. No, that jewel assembly is not made to be taken apart, but there are spaces around the edge of the hole jewel and the setting where cleaning fluid under ultrasonic cavitation can wash out any foreign matter. If, however, the rust is dried and impacted, it is sometimes a little more difficult to remove same. I have found that by putting a drop of penetrating oil into the jewel and letting it soak for a few hours, it usually washes out. I presume your ultrasonic cleaning machine is working properly, and you are using a good cleaning fluid.

If this method fails, and if you have doubts whether it is totally clean, I would suggest replacing the jewel assembly because it could cause the new pivot to be cut off again. (Answer provided by Henry Frystak, Bulova Watch Company)

Seth Thomas

Q. I bought some old clock parts recently and among them is a movement I'd like some information on.

It's a Seth Thomas, two m/s, stamped 86U, 5 x 8

plates, second hand, 17 inch pendulum.

Could you tell what type case this movement came out of?

I've asked several people and they can't help me. Thank you ever so much.

Bill Faircloth
Sanford, North Carolina

A. Your Seth Thomas movement is listed as a 30-day, extra large, pendulum, time, spring, double spring, solid front plate. From center of movement to the end of rating screw 16 7/8 in. with No. 22 ball; diameter of ball 3 11/16 in., width crown 44, deadbeat; center 1 1/8 in. Length 7 13/16 in., width 7 1/16 in., depth 4 1/8 in. Mainspring No. 137, 10 ft x 3/4 in. x .015. The case was a wall regulator type.

(Answer provided by Orville R. Hagans, Curator, AWI Museum)

Cleaning Solutions

Q. I am no newcomer to the art of clock and watch repairing, having served an indentured apprenticeship in my native Scotland over 40 years ago. I have worked at the bench as a watch and clock repairer ever since.

In all these years, cleaning of clocks (I refer particularly to large clock movements) has never presented much difficulty, as the cleaning has always been done by hand, but of late I purchased a large ultrasonic cleaning machine. I am at a loss to know which of the commercial cleaning solutions and rinsing solutions I should use. None of these, I realize, is inexpensive, but this is not the primary concern. The end result is, to me, the important issue. Perhaps you would be so

(Continued on page 12)

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Tick Tock Talk

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kind as to offer me the benefit of your vast experience. I would much appreciate this.

I am also interested in wheel and pinion cutting and wondered whether you know of any book which covers the subject in depth, yet starts with basics. I am afraid that during my apprenticeship I failed to pay as much attention as I ought to have done to this aspect and I now regret it.

I have been a member of AWI for a good number of years but have never had occasion to seek advice until now . . . this speaks highly of your technical columns.

Donald D. Campbell
Manchester, Connecticut

A. I am flattered that you've asked us for advice. Now to get to your questions. As for ultrasonic cleaning, I would suggest the clock cleaning solutions of the L&R Mfg. Company. Use both their cleansing fluids and the rinsers in sequence, as these are chemically compatible and have used by thousands of clockmakers with satisfying success. Some clockmakers will attempt (some with a modicum of success) to use a "kitchen formula" of various parts of oleic acid, ammonia, acetone and water. However, when followed by incompatible rinses, this will cause more temper-raising work getting rid of the gooky chemical consequences than it is worth. Yet some do well with these. Without some experimentation, it is best to use the commercial cleansers.

Now as to wheel cutting. For me to tell you here how to go about cutting wheels will take up more time than I can spend or can be allotted. Since so many authors have done well in explaining and illustrating how wheels can be cut, it would be best to refer you to these books which, as a paid up AWI member, you can borrow free. Obtain the books by John Wilding on How to Make a Weight Driven 8 Day Wall Clock or other How to books of Wilding—books which explain in detail how to cut wheels and pinions without elaborate equipment, and shows this, well illustrated in photos and detailed line drawings. This too should fill all your needs and wants, starting as you desire from basics. Also, read the series of articles on wheels and wheel cutting by William O. Smith, Jr. in the Horological Times. These articles will help you understand wheel cutting and sizing much better.

Slate or Marble?

Q. I wrote you a letter requesting information on cleaning and polishing black marble clocks. I received a letter from Sean (Pat) Monk on polishing of marble clocks, in which he mentioned to be sure they are marble and not slate. How do you tell the difference and if they are slate clocks, how do you clean and polish them?

Robert R. Diltz
Burbank, California

A. Slate is a silicate and is inert chemically. Put a drop of dilute hydrochloric acid on a hidden part of the stone and if it is slate, nothing happens. However, if the stone is marble (limestone) it will fizz.

To correct the finish on slate, all you can do is rehone it with fine-grit sandpaper. It will not take a polish. If it is marble, it will take a polish.

(Answer provided by Sean C. (Pat) Monk)

Pendulum Amplitude

Q. I enjoy your articles immensely in the *Horological Times*; I also have your watch manual and wish you would write one for the repair of clocks, as that is what I primarily am doing.

I have a couple of English shelf clocks that are very difficult to keep running because the amplitude of the pendulum is so short that the slightest movement (in house cleaning, etc) that gets them off level will cause them to stop. This clock has a 35 tooth escape wheel and the verge covers 6½ teeth. I read an article a year or so ago, possibly one you wrote, that had a cure for this exact problem. As I remember the corrective action was to remove the escape wheel and replace it with another one giving the pendulum a greater amplitude and that solved the problem. Of course there was some other work besides replacing the escape wheel, but I can't find the article now and would like to know what you would suggest for this problem.

I have a system of referencing articles by subject matter so I can go back and reread an article when I desire, but this time the fail-safe system failed.

Keep up the good work, we novices benefit greatly from your articles.

I am also a member of the Watch & Clock Collectors Association and thought it might have been in one of the Bulletins, but couldn't find it there either.

Leo M. Dawkins
Daytona Beach, Florida

A. I am flattered by your remarks regarding my writings. I enjoy hearing good things about them. If time and the good Lord permit, I'll write one on clock repairs in the style of my other books.

English shelf clocks that use the dead beat escapement are supposed to have a very short arc. If the clocks have the recoil escapement, then the arcs should be rather wide. Most of these bracket clocks do have the recoil escapement. If yours is in this category, then you have to examine the escapement.

The depthing should be such that the arcs necessarily will be wide in order for the escapement action to perform. If they do not have this escapement adjustment, then probe for worn pivot holes, bent or worn pivots, weak mainsprings, etc. Some even try to avoid adjusting the escapement and repairing worn holes by removing weight from the pendulum bob. This sometimes works, but is a crutch, not a cure. Do not remove the escape wheel for any other reason, else you'll not be able to regulate the clock at all, since the number of teeth in the escape wheel, etc., allows the pendulum length in the clock to provide a good ratio and the correct time when the clock runs. Do not change the escape wheel if the teeth are straight and not bent or chipped. The same number of teeth must be maintained.

In summary to improve the arcs of the pendulum, again make certain that you've got a recoil escapement (See James Tigner's articles in the Horological Times). Also, examine for worn pivot holes. Also, examine to see whether the anchor pallet faces haven't worn down. If they have, repair by soldering steel pads to bring the pads to correct relationship with the geometry of the escape wheel and escapement. See if your mainspring is too weak.

REPAIRING LED WATCHES

Because of their unfamiliarity, many jewelers have avoided LED timepieces and wished they'd go away, observes Eddie Endman, head of Marshall-Swartchild. "They will go away," he promises. "In the meantime there are a good many of them 'out there,' a good many needing repairs. The jeweler who provides this service has added opportunities for traffic-building and profit."

A special purchase makes it possible for the jeweler to gain experience at minimal cost. For under \$10—and less in quantities—the jeweler may have a complete LED to disassemble and reassemble and discover its simplicity. Then he may use the module and components for repairs. He may wear the timepiece, give it away, or sell it at a profit.

These LED digital quartz watches, which display time and date on a ruby red screen when a button is pushed, have US-made modules, elegantly styled Swiss cases of white or yellow metal, and stainless steel or yellow high styled bands to match. Two fresh, new battery cells are included.

The LEDs were made to sell at \$59.50 to \$89.50. They are "mill run," but all like new, and all have been checked by Marshall-Swartchild. More information will be supplied by M-S, P.O. Box 726, Chicago, IL 60690.

SWISS SHOULD DOUBLE ELECTRONIC OUTPUT

Production of electronic watches in Switzerland should double this year from the 1977 figure of five million units, according to Gerard Bauer, president of the Federation of Swiss watch manufacturers, in an article in the recent issue of the Swiss Credit Bank's publication Bulletin.

According to Mr. Bauer, the Swiss industry currently holds some 20 percent of the world market in electronic watches and delivers "at least half" of the top quality items. "On the immediate view, Switzerland will gradually come to occupy the same position in electronic timekeeping as it holds in the lever movement sector—where it commands a good third of the world market."

Despite coming to terms with the new technology, Swiss watchmakers have had a difficult time in the past three years, chiefly because of the world recession and the continuing strength of the Swiss franc. More than 21,000 jobs—or 27 percent of the labor force—have been lost since 1974, but the industry is now confident of regaining its former position, according to Mr. Bauer. It is generally expected that this can be achieved without increasing the labor force above its present level.

Mr. Bauer said, "The Swiss watchmaking sector has now launched a global action program aimed at improving the coordination of research, development, production and marketing. There is no panacea which will eliminate all the ills emanating from the global recession, the up-valuation of the Swiss franc and the revival of protectionism, but the industry remains convinced that these measures should yield positive results."

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Inside the Clock Shop

with **James L. Tigner**

CMC

REPAIRING WOODEN MOVEMENT CLOCKS

Part 3

Broken teeth in wooden movement clocks are common. Sometimes it's just a single tooth, but frequently the teeth are found stripped off in blocks of three or more, not just on one wheel, but on several, and not just the wheel teeth, but the mating pinion leaves as well.

No one questions the fragility of these small, 150 year-old wooden gears, and yet during the normal running of the clock they almost never break. It's while the clocks are being wound that the teeth split off.

Here is a place where the repairman can suggest ways for the customer to help in preserving his fine old heirloom. Many owners are uncertain how to wind their clock, and they force the key first one way and then the other until they find the right direction. Others crank up the weights as if they were on their way to a fire, stopping only after they have heard a loud thump at the top of the case. Still others let go of the key the instant they have finished winding, instead of easing it back gently until the click holds against a ratchet tooth. Winding habits of this sort always invite, and often result in, the havoc to gear trains we're talking about.

Is it economically practical to replace broken wooden teeth? I would say that it is, indeed. In this month's session we'll review two methods of tooth replacement, a fast, new method, and an old traditional one. Personal philosophy and individual circumstances will determine the preference of each clockmaker.

John Guerin, a fine craftsman from Poughquag, New York, who specializes in the restoration of old clocks, showed me an intriguing method about a year ago, and generously offers it now to anyone who is interested. Briefly, it consists of taking an impression of a group of sound teeth in a wheel, using nonhardening modeling clay available in any toy store, and then shifting the clay impression to the area of broken teeth, where it's used as a mold into which quick setting epoxy is poured. The result is a multiple tooth replacement in hard epoxy, done in a matter of minutes.

John has been doing this for three years, he says, and has been keeping a close check on the first clock he repaired which was his own. In that length of time he's been able to detect no wear to the wooden pinions as a result of mating with the epoxy wheel teeth. He attributes this to the fact that even though the epoxy teeth are harder, they are also smoother.

In most cases he pours the epoxy over the broken stumps of the old teeth without bothering to saw a supporting

recess in the wheel. In fact, where a tooth has been split in half on the diagonal, he uses this method for replacing just the missing half. John reminds us, however, that epoxy will not make a strong bond with an oily surface. Hence, when there's oil or grease on the wheel, he feels that it's necessary to saw down to clean wood. John says that as a sort of double insurance, a shallow cut can be sawed in the wheel routinely, if anybody wishes, but his experience is that it's not needed.

Now let us examine the details of the actual epoxy job. Figure 1 shows a shallow cut for a five-tooth replacement. Remember, John tells us that this cut isn't necessary except in cases where oil has spoiled the bonding surface of the old



Figure 1.

teeth stumps. But as long as we've made the cut, note that it isn't dovetail shaped. In a cut as long as this one, dovetailing would undercut and weaken the two teeth flanking the sawed-out area.

Figure 2 illustrates how the clay is pressed and kneaded on all sides into a section of sound teeth, making

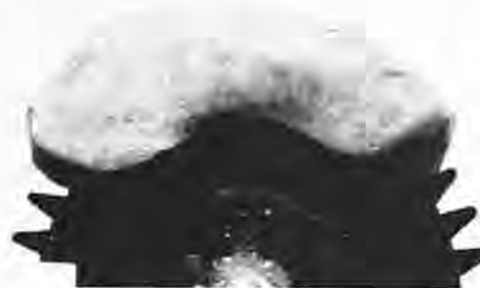


Figure 2.

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certain that the spaces between the teeth are completely filled, in order to insure an accurate impression. As we move along from step to step, you may notice that the wheels are not always the same in the different photographs. This is because we are working on several wheels at the same time. The impressions, of course, must always be taken from the same wheel in which the tooth replacement is to be made.

In Figure 3 a knife has been used to cut off the clay flush with the front side of the wheel, thus revealing the impression we need. The clay is then gently pushed clear of the



Figure 3.

wheel, and without distorting its shape, repositioned over the tooth replacement area, as in Figure 4. Before pouring the epoxy into the mold thus created, be sure the clay is firmly pressed against the back side of the wheel, or else the epoxy may leak to the back of the wheel, where it could be difficult

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Figure 4.

to remove after setting. In single or half-tooth replacements, use a piece of pegwood as you would an oiler to drop the epoxy into place, tamping it down, if necessary, to fill the mold completely.

Figure 5 shows the fully set block of five replaced teeth. The whole job, not including setting time, took about eight or ten minutes. If the mold is carefully made and positioned, little or no filing is necessary, but it must be made certain that no rough ridges or burrs remain that could wear out a meshing wooden pinion. This is an absolute *must*. The finishing touches should be done with a fine file. No. 6



Figure 5.

preferably, and the strokes should be lengthwise with the teeth, not crosswise. There's no such thing as a pair of mating gears totally without sliding friction, no matter how finely made.

The epoxy I use is Duro Quick Set, but any good brand of quick setting epoxy will do. Mix the two tubes in a small dish, according to directions. If you want to save the dish, be prepared to clean it out with hot, soapy water within five minutes after mixing. I find that in multಿನumbered tooth replacements, such as we have described, the clay mold is ready to be removed and the teeth filed, if necessary, after about an hour's setting time. Full hardness may not be reached until the next day, depending on how carefully the hardener and the resin have been proportioned.

The traditional way of replacing wheel teeth, of course, is with cherry wood, the wood from which all American wooden movement wheels were originally made. There's no question that it takes longer, but it does a beautiful job, maintains the original character of the clock, and in my opinion merits a higher repair charge.

Figure 6 shows a three-tooth replacement using cherry wood. The details for making this replacement are much the same as for replacing multiple teeth in brass wheels,



Figure 6.

using brass sheet for the plug, which was fully described in the January 1978 session of *The Shop*.

Years back, Jesse Coleman suggested clamping a piece of cherry alongside the area of broken teeth, and, with a fine blade, sawing out the dovetail cut and plug at the same time. The first time I tried it I got a perfect fit, and was delighted. But I was never able to repeat my success, and finally concluded that it was beginner's luck in holding the saw at just the right angle.

Constantine, whose address was given in Part 1 of the present series on wooden movements, can supply finished cherry wood in small pieces ¼-inch thick, which I find a great timesaver. If you saw and file the dovetail cut first, and then trace its outline on a piece of cherry of the right thickness, it really doesn't take much time to make a close-fitting plug. I used to pin, as well as glue, the plugs in place, but that's nonsense. Either a good white glue or epoxy is all that's needed.

I believe that both the methods we've talked about for replacing wooden teeth are structurally sound. I personally prefer cherry wood, since it better preserves the original character of the clock. For the time being at least, it is the method that I use.

We still haven't covered pinion leaf replacement, which we'll use for an opener in next month's meeting of *The Shop*, along with a few other sundries on wooden movements. For those who would like to get back to brass clocks, next month will end the series on wooden movements. □

PICCO TO MOVE TO NEW AND EXPANDED HEADQUARTERS

Picco, prominent producer of character watches and travel alarm clocks, will move to new and expanded headquarters in New York City on July 7th.

Raymond Canova, General Manager, stated that the company will move to the 14th Floor of 540 West 58th Street, from its present quarters at 16 East 52nd Street. The toll-free phone number, for customers outside of New York, will be 800-223-7554. The New York number will be 212-977-4620.

Mr. Canova stated that the expansion reflects the rapidly growing popularity of PICCO's watch and clock lines, and management's anticipation of future growth requirements. PICCO is Hallmark Card's exclusive licensee for "Betsey Clark" and "Lollipops" high-quality 7 jewel character watches, and also produces a new line of high quality quartz travel alarm clocks under the PICCO brand name.

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TESTING AND CATEGORIZING QUARTZ CRYSTALS ^{© 1978}

By Louis A. Zanoni

The quartz crystal is one of the most delicate components of a quartz watch. It is easily damaged by shock and vibration and it must operate in a partial vacuum. The slightest disturbance to its vacuum or the delicate wires which connect to the quartz slab within the metal container will cause it to malfunction. An improperly functioning quartz crystal is one of the major causes of LED and LCD module failure.

The subject of this article is the method of choosing a replacement for a malfunctioning quartz crystal.

To illustrate the accuracy and precision at which the quartz crystal must operate, consider the following. In or-

der for a quartz watch to keep precise time, the quartz crystal must vibrate at exactly 32,768.00 cycles per second (Hz). If the frequency of the oscillator increases by a fraction of a cycle per second, one tenth of one cycle per second (0.1 Hz) or 0.003% to 32,768.10 Hz, the watch will gain 8 seconds per month or 96 seconds per year. This accuracy is well within the capabilities of a good quartz watch, since ± 15 seconds per month is acceptable. Conversely, if the oscillator frequency increases by 1 Hz to 32,769 Hz, the watch gains 80 seconds per month, which is not acceptable.

Any LED, LCD, or analog quartz watch module,

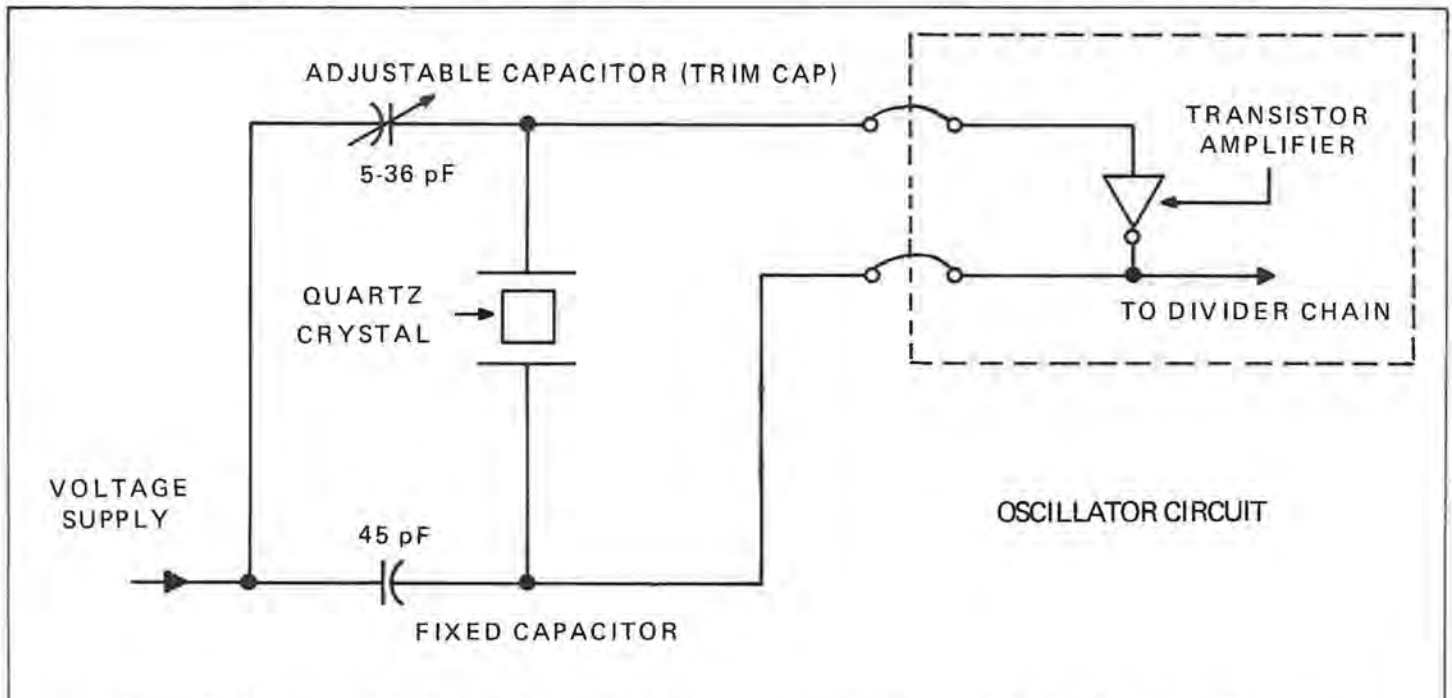


Figure 1. Quartz crystals do not all operate at exactly the same frequency. Therefore, capacitors are necessary to compensate for variations in the quartz resonant frequency. The fixed capacitor is a gross error compensator and the trim cap is used for fine adjustment. The larger the capacitance, the lower the resonant oscillator frequency. The low-

er the capacitance, the higher the resonant frequency. If the oscillator is either too fast or too slow and the trim cap cannot be adjusted to the desired frequency, the fixed cap can be changed with a little silver epoxy and a lot of care, or simply choose another quartz crystal and solder it in the module.

which uses a quartz crystal as a time base, is capable of extreme accuracy, regardless of its original cost. The quartz crystal and its associated capacitors are the only components responsible for the accuracy of the watch.

Because all quartz crystals are not exactly alike, it is necessary to use extra capacitors in the circuit to compensate for slight differences in the natural resonant frequency of the quartz. Figure 1 is a circuit diagram of a typical quartz crystal oscillator. The adjustable capacitor (usually referred to as trim cap, see Figure 2) is an electrical device in which the capacitance changes when one conductive plate is me-

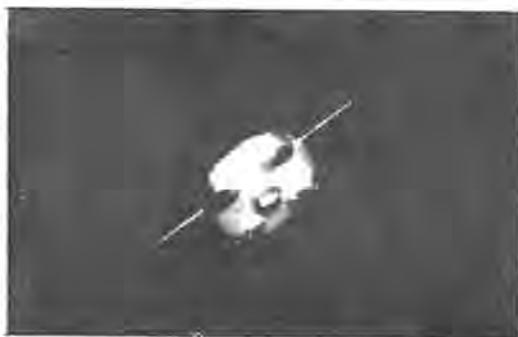


Figure 2. The trim cap is an adjustable capacitor. Its customary capacitance range is between 5 and 36 pico farads (pf). The capacitance changes as the center half moon metal plate is rotated in reference to the printed conductive pattern on the top of the ceramic. When the half moon rotating plate is directly under the printed conductor, the capacitance is its maximum. Each 180° rotation represents a complete capacitance change from 5 to 36 pf. There is no direct relationship between the amount of rotation of the half moon disc and the timing. The frequency shift of the oscillator circuit must be measured by a quartz timing machine. Some modules vary ± 150 seconds per month when the trimmer is rotated 10° rotation, and others vary ± 5 seconds per month of a 10° rotation.

chanically rotated upon a fixed conductive plate, like the condenser plates of a radio, only much smaller. When the capacitance of the oscillator circuit changes, the frequency of the oscillator changes. When the oscillator changes, the timing of the watch changes. It is exactly the same principle which is used to change stations of a radio. The only difference between the watch and the radio is the size of the capacitor and its tuning range. A radio is capable of being tuned over a wide range of frequencies because its tuning capacitor is large. A watch's timing range is limited by the physical size of the adjustable capacitor.

Since the trim cap is limited in its tuning range (5-36 pico farads) and fixed capacitors are available in a wide variety of capacitances (5-125 pf) without and appreciable increase in physical size (see Figure 3), fixed capacitors are added to the circuit to extend the tuning range of the trim cap. The trim cap is merely a fine adjustment of the oscillator

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Figure 3. Fixed Capacitor: The type of fixed capacitors used in the watch are known as chip capacitors. This type of fixed capacitor has no identifying marks. Therefore its value is usually unknown. If it is necessary to know the value, it can be measured by removing it from the circuit and measuring it on a capacitance bridge. Since it is easier to exchange quartz crystals than it is to replace fixed capacitors, replacing quartz crystals is the method commonly used to correct the frequency of a faulty oscillator.

capacitance. Because fixed capacitors have no identifying marks, and there is no simple way to determine which fixed capacitor the manufacturer has placed in the circuit, it is simpler to select and match quartz crystals to the existing watch circuit.

Selecting Quartz Crystals

There are several methods of selecting a quartz which will operate at the proper frequency in a particular watch. One method is trial and error. From your supply of quartz crystals, new or used, randomly select and solder it in the module. When you find one that is tunable through 0 seconds per month, leave it in. Although this method works, it is time consuming and damaging to the watch. Too many solder joints can damage a substrate (circuit board) and too much heat will damage a quartz crystal. A guessing game is not an effective method of efficient service.

The best method is to categorize your supply of quartz crystals according to how fast or slow they run. No two crystals vibrate at exactly the same frequency. With a supply

of crystals that have been categorized, it is only necessary to guess which crystal to use the first time. If the new one does not oscillate at the correct frequency (too fast or too slow), merely remove it from the module and select the proper one from your supply, depending on how fast or slow the original one oscillated. I have found that the chances of selecting the proper crystal for the first time from a categorized group is greater than 50% and nearly 95%, the second time. Consequently, it is essential to categorize quartz crystals for profitable and efficient service.

To categorize quartz crystals two items are necessary: a timing machine capable of timing quartz watches and a small inexpensive quartz crystal tester.

A quartz crystal tester is a very simple device which can easily be constructed. The only items required are a watch module (preferably LCD) and a connector capable of connecting to the two leads of a quartz crystal. To assemble



Figure 4. Q32 Quartz Crystal Tester: Manufactured by Zantech, Inc. The unique feature of this quartz crystal tester is its connector. By moving the lever of the connector, its jaws open and close, allowing the quartz crystal leads to be dropped into the socket and clamped in place. The connector has five openings on either side of the center line. The five openings on the left of center are connected to one quartz terminal of the LCD module inside of the box and the five openings on the right of center are connected to the other quartz terminal of the module. This arrangement allows the testing of quartz crystals with a variety of lead spacings. To test a quartz crystal, clamp its leads on either side of center and place the box on the quartz timer similar to timing a watch. (see Figure 5). The quartz timer will indicate whether the crystal is fast, slow, good, or bad.

a tester proceed as follows:

1. Select a watch module (preferably a low current LCD module) which has a good oscillator circuit.
2. Remove the quartz crystal from the watch module.
3. Solder a connector to the terminals of the module in the same place the original quartz was soldered. Connectors such as transistor sockets, mini alligator clips or zero insertion connectors, as used in the Zantech Q32 tester, are acceptable (see Figure 4).
4. Adjust the trim cap to the test module to the center of its tuning range.

5. Mount the necessary batteries in the module. (If an LED module is used, remove the leads to the display to avoid excess battery current drain.)

6. Test a quartz crystal by plugging the two leads of the quartz into the two receptacles of the transistor socket. If the quartz crystal is good, the module will begin to oscillate.

7. Place the module next to the sensing element of any quartz timing machine and read the time deviation of the quartz crystal which is plugged into the socket. *Do not adjust the trim cap. Leave it at its center position.*

Categorizing

By connecting a quartz crystal into the test module, it is possible to determine if it is good, bad, fast, or slow. To evaluate the quartz crystal, place the test module on the sensing element of the quartz timer (see Figure 5). When the timing machine senses the oscillation from the module, the

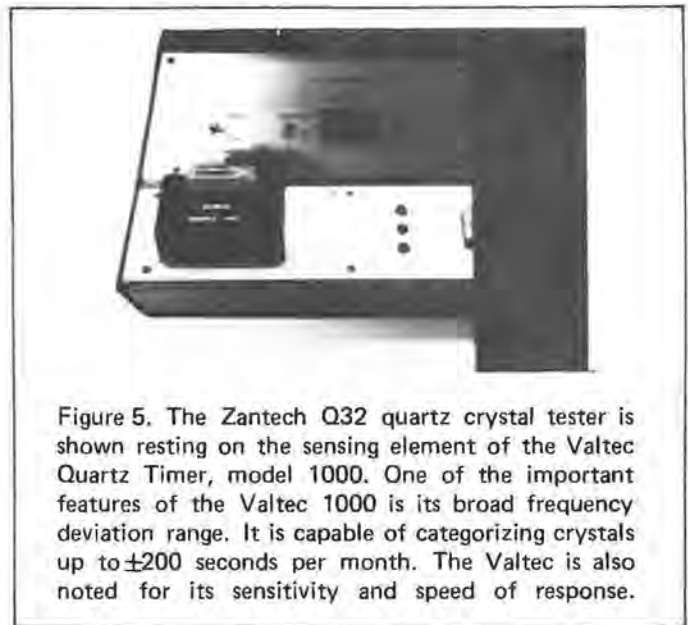


Figure 5. The Zantech Q32 quartz crystal tester is shown resting on the sensing element of the Valtec Quartz Timer, model 1000. One of the important features of the Valtec 1000 is its broad frequency deviation range. It is capable of categorizing crystals up to ± 200 seconds per month. The Valtec is also noted for its sensitivity and speed of response.

quartz is presumed to be good. If the crystal oscillates, the timer will indicate how fast or slow it is running in the test module. By categorizing each crystal according to how fast or slow it runs in the test module, it is possible to select a fast or slow crystal for use in the repaired module. The comparison between the oscillating frequency of the test module and the oscillating frequency of the repaired module will never be exactly the same. The variations are caused by different positions of the trim cap and possibly a different positions of the trim cap and possibly a different fixed capacitor. Therefore, it is important to remember that sometimes the test module is completely different from the module being repaired. See Figure 6 for an example of categorized quartz crystals.

Although it is impossible to predict the exact frequency at which a quartz crystal will oscillate when soldered into a repaired module, it is certain that a direct relationship

(Continued on page 42)

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*LED and LCD cells not included.



THE SHIP'S CHRONOMETER © 1978

by Marvin E. Whitney
CMW CMC

The chronometer time train is similar to that in the conventional mechanical watch except that the first wheel is not on the mainspring barrel, but on the fusee. Thus, the train consists of the teeth on the fusee, the center wheel, third, fourth and escape pinion wheel. The center wheel has a long arbor which projects through the pillar plate and dial and carries the cannon pinion. The fourth wheel is provided with a long pivot passing through the dial to carry the second hand. There is a pinion on the lower pivot of the fusee arbor which operates the up and down indicating mechanism.

The minute hand is attached to the end of the cannon pinion. The cannon pinion drives the minute wheel and pinion which in turn drives the hour wheel that freely rides around the shaft of the cannon pinion. It is to the shaft of the hour wheel that the hour hand is attached.

The time train in the ship's chronometer varies somewhat in combination of wheel teeth and train wheels. However, the 56-hour or standard chronometer and 8-day chronometers are both constructed to beat 14,400 vibrations per hour, or four beats per second. As the balance wheel makes four vibrations per second, two of the vibrations do not receive an impulse while the other two do, advancing the train in half second beats, thereby showing half seconds and seconds on the second's dial.

The 14,400 beat train was employed in ship's chronometers because it provided for more effective reading of the time when the navigator was observing astronomical bodies with a sextant. It was a definite advantage to have the second hand moving in half-second beats for smaller time units, e.g., fifths of seconds of an 18,000 beat train could not be caught as accurately by the observer's eye when he took his mark. Also, since the chronometer ran in a relatively fixed (dial up) position, there was little to gain by adopting a "quicker" train.

A quick train has been employed but a certain mystery surrounds its usage. Thomas Earnshaw made a chronometer number 813/3477 that made 130 beats per minute or 15,000 beats per hour.

The following combination of wheel teeth and pinions are practically standard today for most all 50 to 60 hour chronometers:

Great or fusee wheel	90 teeth
Center wheel	90 teeth, 14 leaves
Third wheel	80 teeth, 12 leaves
Fourth wheel	80 teeth, 10 leaves
Escape wheel	15 teeth, 10 leaves

The calculations of the above train with the balance wheel making a complete vibration and the escape wheel advancing one tooth every half-second, and the fourth wheel, which carries the second hand, will make one revolution per minute.

The train that Earnshaw employed to achieve 130 beats per minute had the following:

Great or fusee wheel	63 teeth
Center wheel	75 teeth, 14 leaves
Third wheel	64 teeth, 10 leaves
Fourth wheel	70 teeth, 8 leaves
Escape wheel	13 teeth, 7 leaves

The Hamilton train has the following combination:

Great or fusee wheel	90 teeth
Center wheel	90 teeth, 14 leaves
Third wheel	80 teeth, 12 leaves
Fourth wheel	75 teeth, 10 leaves
Escape wheel	16 teeth, 10 leaves

Additional train and gear information on the Hamilton is summarized in Figures 1 and 2.

Given below are the comparative data on the amount of endshake and sideshake found in several various makes of chronometers.

ENDSHAKES (in thousandths of an inch)				
	Mercer	Nardin	LeRoy	Hamilton
Arbor in barrel	0.0135	0.005	0.0025	0.000
Barrel arbor in plates	0.005	0.003	0.000	0.002
Fusee	0.005	0.004	0.002	0.001
Center wheel	0.0055	0.004	0.002	0.0015
Third wheel	0.0065	0.005	0.002	0.0015
Fourth wheel	0.0002	0.006	0.0015	0.0005
Escape wheel	0.002	0.002	0.0015	0.0008
Balance	0.001	0.001	0.001	0.0005

SIDESHAKES (in thousandths of an inch)				
	Mercer	Nardin	LeRoy	Hamilton
Arbor in barrel	0.004	0.0015	0.001	0.0005
Barrel arbor in plates	0.003	0.0015	0.001	0.001
Fusee	0.0015	0.0015	0.0015	0.001
Center wheel	0.001	0.001	0.0015	0.0005
Third wheel	0.001	0.001	0.0015	0.0006
Fourth wheel	0.001	0.001	0.0015	0.0006
Escape wheel	0.0004	0.0004	0.0004	0.0004
Balance	0.0004	0.0004	0.0004	0.0004

The balance and hairspring assembly is mounted between the balance cock and lower balance bridge. This assembly consists of the balance wheel, staff and hub, hairspring with stud and collet, impulse roller and unlocking roller.

The rotation of the balance is controlled by a helical hairspring. The lower terminal of the hairspring is pinned to a collet fixed to the balance staff while the upper terminal is pinned to a stud which is fitted with two steady pins and held firmly in place on the balance cock by the stud screw.

In the past, the most common method of fastening the hairspring to the collet and stud was to attach the extremity of the spring in a round hole with a tapered pin. This caused deformation of the spring adjacent to the point of attachment. In the Hamilton the hairspring is held between flat surfaces of the collet and stud by a clamp, all made of steel, and secured together by the pressure of a wedged pin. See Figure 3. This eliminated all deformation and kept the spring free from any cold working stresses. In addition, all dimensions were accurately controlled in order to bring the edges of the clamping surfaces of both the collet and stud and the clamps "in line." By this arrangement the active length of the hairspring was the same for both the winding and unwinding directions of deflections. This greatly aided in reducing the isochronal error.

The staff is approximately 1¼ inches in length, to which is fitted a brass hub. See Figure 4. The balance wheel arm has two drilled countersunk holes, one on each side of the center hole. The balance wheel is fitted down over the staff

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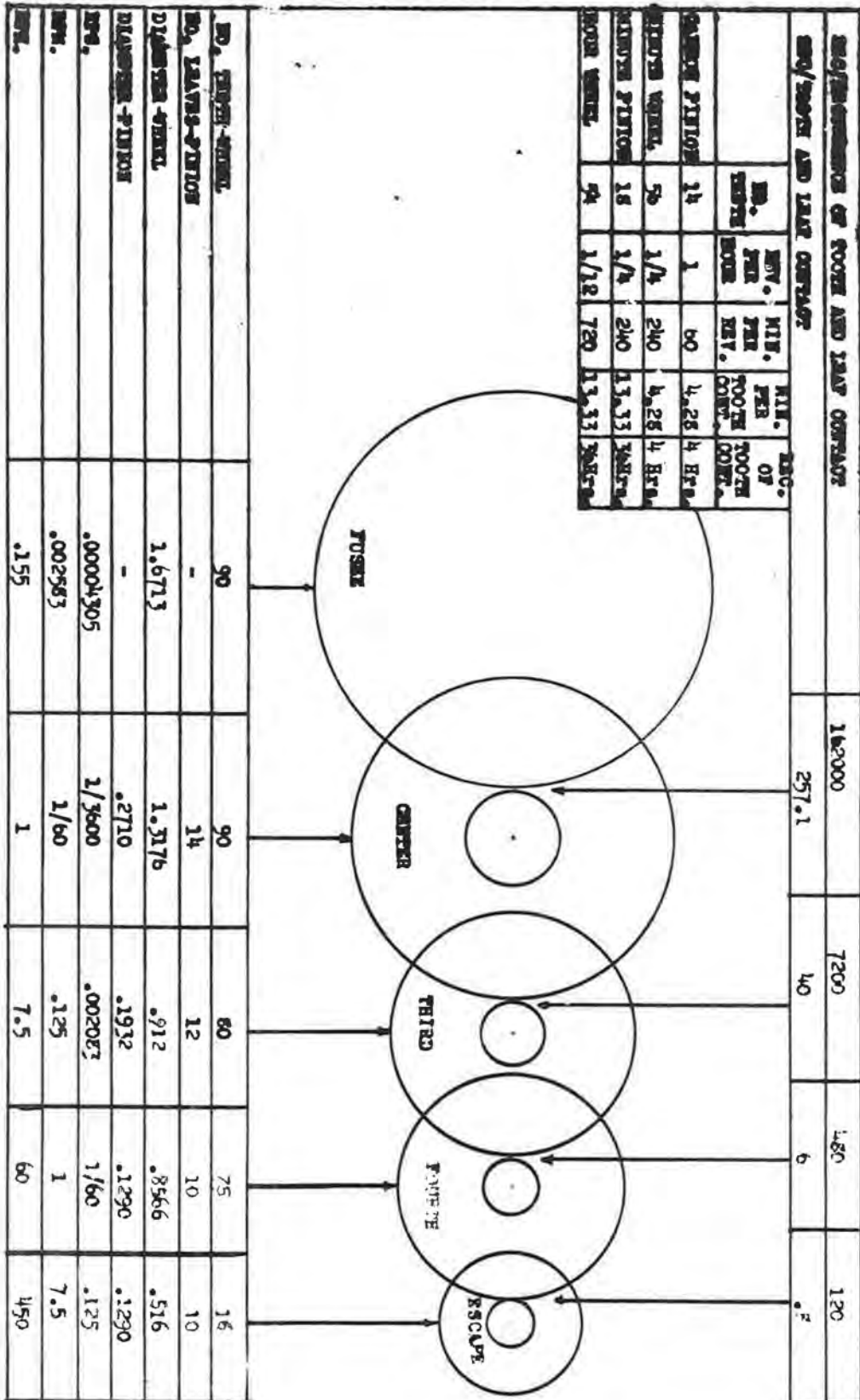


Figure 1.

TIME TRAIN

	NO. TEETH	REV. PER HOUR	REV. PER MIN.	REV. PER SEC.	HOURS PER REV.	MIN. PER REV.	SEC. PER REV.	SEC. PER TOOTH CONTACT	SEC. REC. TOOTH & LEAF	ESCAPE TOOTH CONTACT WITH JEWELS	
FUSEE WHEEL	90	.155	.0026	$\frac{1}{3600}$	6.424	35.714	$\frac{23142}{52}$	257.1	162,000	DEP	LOCK
CENTER PINION	14	1	1/60	$\frac{1}{3600}$	1	60	3600	257.1	162,000		
CENTER WHEEL	90	1	1/60	$\frac{1}{3600}$	1	60	3600	40	7200		
THIRD PINION	12	7.5	.125	.002	.133	8	480	40	7200		
THIRD WHEEL	80	7.5	.125	.002	.133	8	480	6	480		
FOURTH PINION	10	60	1	1/60	1/60	1	60	6	480		
FOURTH WHEEL	75	60	1	1/60	1/60	1	60	.8	120		
ESCAPE PINION	10	450	7.5	.125	.002	.133	8	.8	120		
ESCAPE WHEEL		450	7.5	.125	.002	.133	8			.5	.5

DIAL TRAIN

	NO. TEETH	REV. PER HOUR	MIN. PER REV.	MIN. PER TOOTH CONTACT	RECURRENCE OF TOOTH CONTACT
CANTON PINION	14	1	60	4.2587	4-HOURS
MINUTE WHEEL	56	1/4	240	4.2587	
MINUTE PINION	18	1/4	240	13.333	
HOUE WHEEL	54	1/12	720	13.333	12-HOURS

Figure 2.

(Continued on page 40)

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FRENCH SKELETON CLOCK

by Orville R. Hagans, CMW, CMC, FBHI

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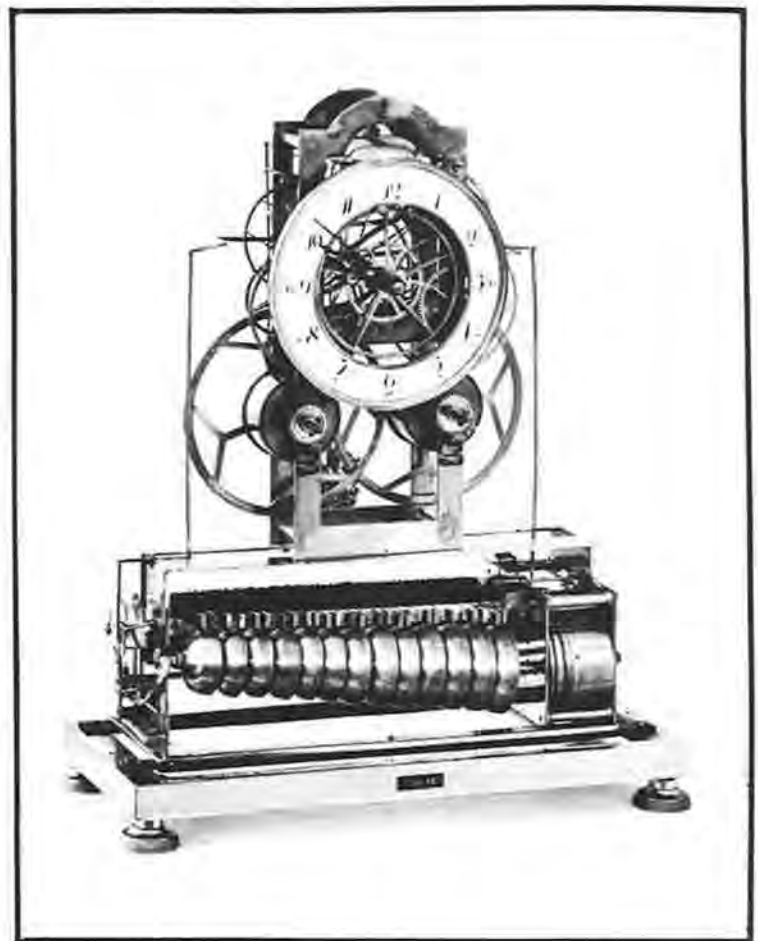
*An unusual French Skeleton Clock
appearing in the only book on
"Skeleton Clocks"
by F.B. Royer-Collard, FBHI*

The musical clock shown has its bells and barrel in the base and an extremely large count wheel or locking plate on the back. This wheel almost spans the entire width of the rear frame, being $4\frac{1}{2}$ inches in diameter, and around the edge are slots controlling the blows for both hours and quarters. The count wheel is fitted concentrically on top of a toothed wheel which in turn meshes with a pinion carrying the pin wheel which causes the hammer to strike the bell at the top.

We find that the pin wheel has lost its regular position in the striking train; moreover, it is not planted between the frames but is carried on the arbor square normally occupied by the count wheel. The usual practice in French striking trains is for the striking great wheel with its extended arbor to be squared for the purpose of carrying the count wheel. The steel striking hammer arbors, in their vertical position, are of the earliest verge form, with flat faces or pallets actuated by the pins on the pin wheel, as opposed to the normal hammer tail.

The two brass striking hammers, which are horizontal, are friction tight on the tops of the squares of the hammer arbors. They strike on two bells at each quarter. The first quarter is sounded as a ting-tang, the second as two ting-tangs, and so on. Immediately after the fourth quarter has struck the hours are sounded on the two bells together. When this ceases, it is followed by a melody which is played on the thirteen hemispherical bells seen below the movement. Double hammers are allocated to each bell.

The cylinder or roller plays ten tunes and automatically changes to a different tune at each hour, which is performed



on the usual cam system. The changeover bar runs parallel to and underneath the cylinder. An early form of motive power is employed to drive the musical section—the fusee wind. The two wire-like or strip arms projecting at right angles left and right of the movement lead to the musical mechanism. One is for the let-off and stopping of the musical melodies, while the other is for the melody change.

Both trains are driven by going barrels, an interesting fact being the size of the train wheels. The great wheels have

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a diameter of 6 inches; the second wheel in the time train has a diameter of 4 inches, and the escapewheel is 3¼ inches in diameter.

There are 116 teeth on the escapewheel, the clock employing an anchor escapement. The pallet cock has been positioned at the top of the frame, the cock dropping over the projecting post or pillar and being pinned and screwed to the frame.

A rod linkage at right angles connects the pallets to the pendulum rod, there being no crutch. In place of the original silk suspension a Brocot suspension has been incorporated, giving the normal rise and fall to adjust the pendulum, whose sunburst bob is in ormolu.

The Y formation of the crossings of the great wheels (a very French characteristic) is carried throughout both trains, but omitted from the motion work. Of particular interest is the stop work on the barrel caps. The rectangular frame carrying the trains is of rafter construction and is 12½ inches high, 5½ inches wide, and only 2 inches deep. On overall measurements, however, the musical clock stands 18½ inches high, 12 inches wide, and 6½ inches deep. The enamelled chapter ring is 7 inches in diameter and has Arabic figures with a pair of steel hands. This fits into an ormolu bezel of cord design. Four knurled ormolu feet support the whole assembly. The clock runs for eight days and is signed Sagnien, à Montreuil. The clock, formerly in the Hagans Clock Manor Museum collection, can now be seen at the Clock Tower Museum, Rockford, Illinois. □

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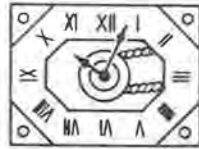
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PECULIARITIES AND PROBLEMS

Part XXXIV

Sometimes in discussing clock work, we need to drift from discussion of a particular timepiece to what might be termed the odd or the peculiar. In addition, there are peculiar problems that arise with clock work as we travel along the road of servicing and history. First, the three clockworks we shall briefly discuss, shown in the photos, are some which have recently passed through our workshop and are, therefore, the sort of things one is still likely to encounter on the repair bench, or in the field of home servicing.

Figures 1 and 2 show the front plate and side plate view of the old combo of Brewster and Ingraham, an American mantel clock, circa 1844-1852. This clock has both the going (time) and strike mechanisms maintained by the original brass springs. We know this because they were long-lasting (the label marked "springs warranted not to fail") and, except those produced by the relatively few manufacturers of such, they were never duplicated. As far as we know, the manufacture of these brass springs is a lost art. It has been presumed by experts that the original composition was devised in Holland. Subsequently, according to the reports of these experts, the art was brought to manufacturers in the US and for a short period, used in clock construction. After that, it seems, the process was discontinued. They were certainly fine springs, tensile, elastic, and effective as power maintainers. Moreover, they did not break easily.

Yet the technical composition of an effective brass spring, such as used in our Brewster and Ingrahams model, is unknown and/or not used today. However, should such springs be found in these old clocks they should not be changed for 8-day steel springs. Insofar as the clock's timekeeping is concerned, it will never keep time with steel springs. The essential properties of the mainspring are comprised of its width, thickness, and length. All these factors combine and, depending upon the material used, establish its strength. The tremendous width of the brass spring can be seen in Figure 2. All factors being considered, there is no duplication with a steel spring.

Therefore, in servicing old clocks with brass springs, if not broken, they should be removed and stretched out over their full length, except for the last two to three coils. This process should rejuvenate the springs. They should then be replaced in the clock, after being wiped with a soft lint-free cloth and lightly lubricated. Many will insist that brass does not need lubricating because it is virtually self-lubricating. However, bench experience has taught us that these old



Figure 1.

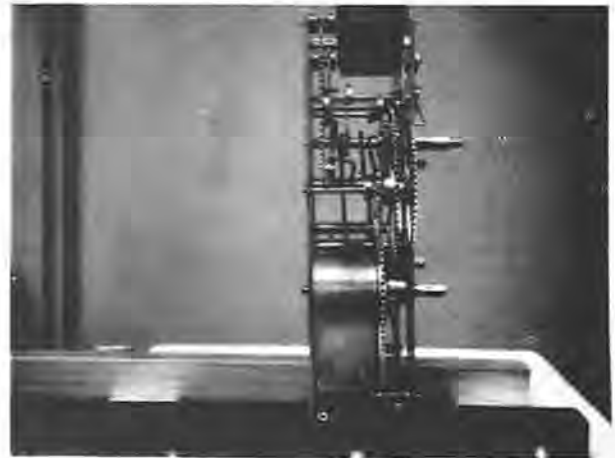


Figure 2.

springs do need a modicum of clock mainspring lubrication. We might recommend a Moebius clock mainspring lubricant, or *Lubriplate*, a commercial lube.

Henry Fried has informed us kindly that he has experimented (when the brass spring has been broken, or damaged beyond repair) with the use of a regular 30-hour steel clock spring of suitable dimensions. Mr. Fried has told us that a suitably chosen spring of this sort does very well for timekeeping. However, we omitted to ask our sage just how long

the clock will run. We have not experimented with such a changeover to be able to make further comment.

One final observation should be noted. Insofar as the intrinsic value (to a collector) of these old clocks is concerned, it becomes greatly reduced without the original brass springs being installed and functioning properly.

Our second peculiar and problem clock, shown in Figure 3, is a Gilbert mantel clock, circa 1910. According to Chris Bailey of the American Clock Museum, most Gilbert

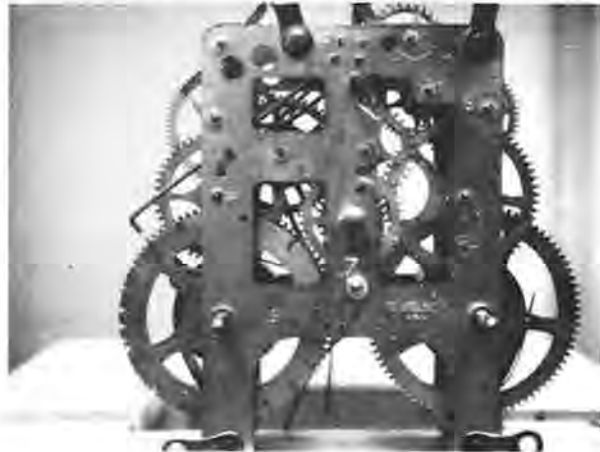


Figure 3.

clocks had the date of manufacture stamped between the winding arbors. However, the markings on our clock are unclear. The peculiar feature of the clock is that its plates are made of a low-grade steel, causing it to be often referred to as an iron plate or tin plate. However, such clocks were introduced by their manufacturers at the turn of the 20th century and were manufactured not only by Gilbert, but by New Haven and Ingraham. The ineffectiveness of the steel pivots working in a steel material gave rise to many early stoppages. New Haven and Gilbert soon abandoned such manufacture because of the short life and because the dies in stamping the plates wore out quickly.

In Figure 3 of our steel plate clock, it will be observed that it had been bushed in nearly every hole. We had to do this process again as the previous mechanic had not taken care in centering the holes. Gilbert, we understand, continued to make these clocks up to the 1920s and that they finally brass bushed the steel plates. Our sample, however, was not endowed with any effective brass bushing until we installed them. Originally, we could be sure from observation, no bushings were used anywhere.

Number three of our problems is shown in Figure 4. This is a modern chiming floor clock movement, shown mounted on its seatboard as it would be when installed in the clock cabinet. Please concentrate on the chain, shown in the foreground of Figure 4 and which happens to be the strike side. If the chain rotates evenly over the spokes of the pulley,



Figure 4.

over full rotation of the latter, with no slippage, we have no problems. If it does not, problems occur.

First, suppose that the person winding the clock assists the weight (or weights) in winding, especially the strike weight whose main wheel pulley is close to that of the center (going) main wheel pulley. The chain may jump over the pulley ferrule, jamming the strike mechanism. It may also jump over sufficiently to jam into the going train, which will also stop the clock. Therefore, one should advise the customer not to assist the weights in winding. Also, the weights should not be handled with the bare hands because they will eventually become tarnished. So many times we have heard of installation people and other mechanics telling the customer to assist the weights in winding. Even some manufacturers have been known to recommend this faulty procedure.

Secondly, we come to a case, recently experienced by us, of a clock running on time, but with the strike stopping at a certain point because the chain had overridden its pulley. A certain mechanic, prior to our intervention in the case, had informed the clock's owner that the malfunction was caused by someone assisting the weights in winding. When we visited the home the man and wife were adamant in assuring us that this was not the case. They assured us, however, that every once in a while the chain had overridden the pulley without the clock being touched in any way.

Too many times we are inclined to blame the customer and not ourselves, often for the lack of foresight. In this particular case we did indeed believe the customer. Therefore, we removed the mechanism from the clock for a closer examination of the chain and its operation. We found the trouble almost immediately. One link was malformed, causing the chain to ride over the pulley. Removal of this link and careful rehooking of the chain solved the problem.

Of course, a bad chain can occur on the going (time) or chime mechanisms also, resulting in the stoppage of one or both trains. □

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AWI NEWS

By Milton C. Stevens



Profits for watchmakers and watch repair department operators are in jeopardy unless immediate steps are taken to adjust shop charges to reflect the increased cost of watch material. *Generally, watch material prices have risen an average of 25% across the board.* For the most part, this sizable increase is justified if the part is manufactured in Switzerland, Germany, France, or Japan. Reports show that during the past year, the American dollar buys 27.3% less in Switzerland and 23.3% less in Japan. Thus, considering the US dollar's diminished purchasing power added to inflation in material house operating costs, the 25% increase seems to be justified.

Unfortunately, some manufacturers have applied an across-the-board 25% increase, regardless of where the part was manufactured. One such case came to my attention recently. A plain plastic crystal which could easily be manufactured in the United States for pennies is being billed to the watchmaker for more than \$8.00. This instance points out the need for the price adjustment to be made on an individual, rather than an across-the-board, basis.

Another factor affecting repair profits is the elimination of quantity discounts on certain materials for so-called "high-grade" mechanical watches. Naturally, without the price incentive for quantity orders, the repairman will not tie his cash up in spare parts. Individual orders for material rather than buying quantity is going to cause material house costs to soar. A quantity discount is in order because the material is handled just once rather than three, six, or twelve times. This results in considerable savings in material house personnel required to answer the phone, process individual material orders, package, and bill. We hope that manufacturers will reexamine this policy of offering quantity discounts. There is a limit to what the public will stand. Material excessively priced will force the consumer to abandon high grade mechanical watches for a less expensive solid state which in

reality offers more accurate time. In the electronic field, it behooves the manufacturer to investigate some form of exchange price program for the major components. If they do not do this, then these watches will be relegated to throw-away status.

As most AWI members know, we publish a price chart for the most used materials each year. Because prices are still changing, we will delay this list until October or November of this year. The complete list will be included in membership renewal packets toward the end of the year. It will be complete and up-to-date.

For now, we urge AWI members to check prices before they give estimates which involve the use of genuine crystals, specialty crowns, stems, etc. As distasteful as it may seem, a check with your supplier before you estimate may save you many dollars and much embarrassment. □

ELECTION RESULTS

The following men were elected to the Board of Directors of the American Watchmakers Institute: Henry B. Fried, Gerald G. Jaeger, Donald Leverenz, Sean C. (Pat) Monk, and Marvin E. Whitney. They will serve a three-year term, 1978-81.

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Henry B. Fried



Gerald G. Jaeger



Donald Leverenz



Sean C. (Pat) Monk



Marvin E. Whitney



ABOUT THE COVER

Cannon Beach on the North Coast of Oregon is featured on the July cover.

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SCHOLASTICALLY SPEAKING

by Gerald G. Jaeger CMW

Chairman, Research and Education Council

It is most interesting to me that for some reason or other there are many young people entering the horological field who are being deprived of the opportunity to learn from the experiences of the many great educators who contribute to the REC of AWI. I say interesting, but a more appropriate word would be distressing. Too many of our schools of horology are not involved in REC and its activities. This is a double loss because historically as one becomes involved with REC to learn, he more often than not becomes a contributor and teacher.

The AWI Roster of Watchmaking Schools lists 48 schools still actively teaching horology. This number may be greater and if you are aware of any unlisted schools in your area, please advise AWI Central and we will contact them. Of these 48 schools listed, 41 are member schools. This is an exceptionally large percentage and attests to the benefits of being an AWI affiliated school.

Attendance at the REC annual meeting and workshop could be improved. There are 20 schools being represented at

REC this year. This leaves a total of 21 member schools who, for some reason or other, will not be in attendance. This is a disappointment, as it represents a goodly number of the student enrollment in our schools. REC should concentrate on raising attendance in the future.

It is my hope that we develop a closer working relationship between our member schools and the AWI Affiliate Chapters. There are many outstanding horologists who can contribute to the schools. This is a two-way street and there are many schools who can contribute to the working watchmakers in their area.

Just as AWI represents the working bench watchmaker, it is good that REC and the schools fill the needs of that bench watchmaker and also provide the opportunity to update the skills so that we are all equipped to compete in today's market.

Tempus fugit!

□

HERSCHEDE HALL CLOCK COMPANY PAYS GEM CITY COLLEGE A VISIT

Recently, Gem City College was honored by a visit from two service directors of the Herschede Hall Clock Company. They are Mr. Earl Furnas and Mr. John Williams.

They were given a short tour of the School of Horology and seemed interested in seeing many students enrolled in this study. Later they set up their projector and gave a very informative presentation of how their quality Herschede movements and cases are made.

The gentlemen said that the Herschede family has been making clocks for over three generations. Today it is

the only firm in the country that actually manufactures movements for grandfather clocks. From the start of the company, the emphasis has been on quality, and the philosophy is "If you can't buy it, make it." This applies to everything from clock cases to minute gears and in making them quality is their number one objective.

Mr. Williams and Mr. Furnas extended an open invitation to tour their plant in Starkville, Mississippi, if you are in the area.

BENCH TIP

Tension ring crystals are supplied in 0.1 mm graduations. Sometimes when pressing them in a bezel one size will almost be the correct diameter but not quite tight enough for a safe seal.

Often when this happens the next size larger can not be pressed in without fracturing the crystal. Hence, a diameter only 0.05 mm larger is now needed to fit this watch.

An easy way to make this correct size is with a suction cup from a child's bow and arrow set. See Figure 1. These



Figure 1. Suction cup.

suction cups are surprisingly strong and have lots of vacuum because they are designed to stick to any thing they hit.

Most of them will fit nicely on a screw type shellac chuck fitted with a 1/4 inch brass arbor. If you don't have



Figure 2. Dressing down a crystal with fine emery board.

one, have the arrow shaft turned down to fit a number 50 collet.

Wet a corner of a towel, dampen the end of the suction cup and gently press it to the outside of the crystal. Wet your finger tips and spin true the crystal in the lathe. Then press it firmly on the suction cup and true again.

As shown in the diagram use a fine emery board with the crystal turning at a slow speed, Figure 2; dress it down approximately 0.04 mm. Then polish the edge with a flat felt buff charged with crystal polish. A good polish is pictured in Figure 3.

Oh yes, if you own an old model GS crystal press, they now have improved plastic rings to fit the adapters,



Figure 3.

which will cut down the chance of marring or fracturing a crystal.

When a tension ring crystal is broken off flat with the top of a bezel and you have trouble removing it, heat the bezel with the alcohol burner until the plastic starts to melt for easy removal without scratching the bezel.

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AFFILIATE CHAPTER COLUMN

by Willard Blakley CMW

This year has really rolled around in a hurry for me. Seems like I had just thanked you for electing me as your Director, and now I find myself thanking you for allowing me to serve. I would like to thank all of the delegates who serve faithfully and directors who have done such a fantastic job during the past year. These are the people who make it possible for AWI to continue to produce the kind of results we have seen in the growth of the technical aspects of the Institute. A special thanks goes to Milt Stevens for all the help he has given all of us. Personally, Milt has been a big support. I have also been privileged to be in close contact with AWI Central and have seen first hand, the growth process of the new Administrative Director, Mike Danner, with whom it has been a pleasure to work. I cannot remember a time he has ever said he would do something, and then fail to carry it out—a rare quality today.

By now we have seen the results of sending in the chapter reports early. I hope it is evident to all how successful and beneficial this can be. Whoever the new Affiliate Chapter Director is, I sincerely believe if we continue to be foresighted enough there will be no limit to what we will be able to accomplish in the coming years. So, let us not allow ourselves to be, restrained from growth by living with the things we have done for so long. But, let us all work together and give this new idea a chance to work for us.

Every delegate, representative, and member has the job to inform other watchmakers the importance of belonging to AWI, and telling them of the many ways it can help them everyday they work at the bench.

The *Horological Times* has been a great asset to AWI and to the growth of the organization. Hal Herman has done a masterful job of putting this technical digest together, and now with his son, Tom working with the magazine staff, I do not think the combination can be topped.

Thank you all again for all the assistance you have given me during the past year. Thank you for your con-

fidence in my ability to serve you. I only hope that as my current term comes to an end, you still have the faith in me that you had when you elected me. Please continue to give AWI your full support.

JUST A REMINDER!

When requesting a program from AWI Central, please use a number and street on the return address. This allows us to send it insured through United Parcel Service, which means faster delivery for you.

NEW JERSEY

The Watchmakers' Association of New Jersey celebrated its 39th anniversary May 9 at a meeting in the Polish Home, Irvington, where members and their spouses enjoyed the delicious specialties of the house. Following the festivities there was a lively buy-sell-trade session, a popular annual event.

President Walter Riegler announced details of the bench course to be given Sunday, September 24. This one will be on the Seiko 0903A and 4300 Analog. Enrollment is limited, so members of the Jersey Association and AWI will be given preference.

A second bench course will be offered November 19; this one will teach the intricacies of the Swiss quartz analog. President Riegler advises getting reservations in early for this one also.

The NJWA meeting on September 12 will feature Jack Schechter of Seiko as guest speaker. It will be held at

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Howard Johnson's in Clark. The October meeting will feature a panel of representatives from leading watch manufacturers who will give watchmakers an overview of the industry today and discuss trends which are developing that are sure to affect the business.

IOWA

On April 22, Iowa jewelers and watchmakers met in Des Moines for a spring seminar. A bench course conducted by the Citizen Watch Company in conjunction with S.H. Clausin & Co. of Minneapolis was attended by 85 watchmakers. Certificates were given to all who completed the course. A jewelry repair course and round table discussions were in session throughout the day. Deyo & Co. conducted a repair course and members of the Board of Directors of the Iowa Retail Jewelers Association conducted the discussions. Coffee and rolls were served throughout the day, compliments of Esslinger and Company and Iowa Jewelers Supply.

The 1978 Fall Convention is scheduled for September 9-10 in West Des Moines.

NEW YORK

On Monday, May 1 at the HSNY meeting, a panel consisting of representatives from the Service Departments of Omega, Bulova, Seiko, Helbros and Bucherer, answered questions on the topic "what can the watch repairer expect from the service department of the watch factories."

The factories were represented by Omega (Norman Morris Agency)—Alvin Rudnick, Martin Berzon; Bulova—Mitch Adler, Joseph Barbieri; Seiko—Jack Schechter, Ira Green; Helbros—Ralph Kalichman; Bucherer—Leon Schulman.

Irving Albert, President of the HSNY, acted as moderator and encouraged questions on both administrative and technical matters.

The topic proved to be extremely provocative and a continuous flood of questions bombarded the panel during the entire evening. Panelists were queried on prices, turn-around time, length of guarantee, price lists, handling of small jobs, off-set cannon pinions, scratch marks and tours of the Service Department.

MASSACHUSETTS

On May 16, the Massachusetts Watchmakers Association heard guest speaker W.A. "Bill" Hilliard. Mr. Hilliard, General Manager of Microsonic Corporation of Philadelphia, spoke on "Servicing Digital Watches" with the aid of colored slides. At the end of the program, the audience received service bulletins and other technical literature.

On May 7, AWI and MWA presented a bench course on the repair of the ESA 942711 LCD Swiss Chronograph and the ESA 904.101 and the ETA 940.111 quartz analog watches. Jerry Jaeger of AWI was instructor of the course, which was held in Newton.

On June 14, members of the Massachusetts Watchmakers Association and the Rhode Island Watchmakers toured the Speidel Time Modulator Watch Assembly Plant and the Speidel Watch Bracelet factory in Providence.

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CALIFORNIA

All the things you always wanted to ask about clocks and watches but didn't know who to ask . . . the persons with the answers were on hand Tuesday, May 23 for the Horological Association of California meeting. One hundred seventy HAC members and guests were given the opportunity to ask questions regarding many phases of the horology industry.

The panel was composed of the following individuals: Bob Sato from Bulova (specifically Accutron and Stepping Motor Quartz); M. Nishibuchi of Citizen; Oscar Carrasco in behalf of Longines-Wittnauer; Jack Schechter and Bob Watanabe of Seiko; Henry Eisenstaedt, owner of Associated Jewelers Service; Ferrell Majors of Ferrell & Company; Lee Jackson, master clockmaker with House of Clocks; and Jay Foreman, who, in addition to being panel moderator, answered any

questions relating to Omega (Mr. Foreman owns House of Clocks, Omega Service Center in Los Angeles).

Each panel participant delivered a five-minute introduction on new products or services available from their respective firms. Following these opening remarks the program was turned over to an exchange of questions and answers between audience and panel. Questions asked covered a wide range of subjects from the cleaning of clock plates to the increasing cost of replacement parts; from the updating of service manuals to the longevity of battery life; from shipping procedures to quartz timing machines.

This meeting again succeeded in achieving a primary goal of HAC, that of bringing the very best information to its membership in order to improve and upgrade the livelihood of the watchmaker.

There was a meeting of the Central California Watchmakers Guild on Tuesday, May 16. This was a technical seminar on the Speidel Digital Watch, including a film presentation. Bob Byrd from Calan Company and the technical director from Speidel Corporation presented the program.

The Bay Area Watchmakers Guild held a Trade Show on May 21. The theme was "Technology in Horology." Bulova, L&R, and John O'Connell Community College gave presentations.

FLORIDA

At a meeting of the Greater Miami Watchmakers Guild, Martin Rosenblum of Marty's Gold Factory lectured on "Things a Watchmaker Can Do to Improve His Service Image." Mr. Rosenblum pointed out that most people trust a person who runs a jewelry shop. Watchmakers can capitalize on this trust by offering such services as engraving, diamond setting, soldering and polishing, and even remodeling and designing jewelry. A watchmaker who used to farm out such jobs can no longer afford to do so—but he can learn to do the jobs himself. Mr. Rosenblum suggested each watchmaker devote one hour a day to learning to repair gold jewelry—an investment which will pay off. Many good jewelry manuals are available as teaching aids. A beginner could start with welding and progress to more demanding jobs such as Florentining. All of this would provide greater profit for the watchmaker.

On May 7, the Broward Watchmakers Guild attended the musical revue, "What's a nice country like you doing in a state like this?"

The FSWA recently honored some horological students: Sidney O. Smith, Lindsey Hopkins Education Center, Miami; Edward D. Stevens, Pinellas Vocational-Technical Institute, Clearwater; and Bruce McDannel, Daytona Beach Community College, Daytona Beach. Each received an award and a U.S. savings bond. Instructors Joseph Little, George Hoyt, Walter Renzetti, and James Watson were commended for their contributions.

ONTARIO

The Annual Member Meeting and Banquet of the Ontario Watchmakers Association was held at the Westbury Hotel, Toronto, on Sunday, April 23, 1978. A capacity audience enjoyed the showing of Les Door's slide lecture on "Jewelry Designing and Manufacturing for the Watchmaker." The slide lecture was supported by Les Durkin of Lacy & Co. with a



President David Barthau.



Mr. Jacques-M Reymond, the Watchmakers of Switzerland.

detailed description and display of the tools, material and equipment shown in the slide lecture. The question period was lively and informative. The seminar being organized by



Leslie Hills with Robert Phillip presenting plaque for 50 years of service to the watch repair trade.

Lacy & Co. to show the procedure in casting—model making and finishing of jewelry—is open. If interested, contact Les Durkin at Lacy & Co., 229 Yonge St., Toronto.

The second slide lecture by Wes Door was "Production Repairs." This was on organizing a watch repair department. This program had a hard hitting message on organizing time and work methods.

These two slide lectures were shown courtesy of the American Watchmakers Institute.

The election of Officers for 1978-79 followed, with the younger members of the organization getting involved. Results were as follows: President—David Barthau, First Vice President—Thomas Collingham (reelected), Second Vice President—John Blankenburg, Third Vice President—James Hill, Treasurer—David M. Murakami, Secretary—Robert Phillip, Immediate Past President—Joseph Rugole.

The President's Reception sponsored by the Watchmakers of Switzerland and Ebauches SA, was hosted by Mr. Jacques-M Reymond, Technical Advisor, New York City Office. The highlight of the banquet was the presentation of an engraved plaque to Leslie Hills for 50 years of service to the trade.

OHIO

The Watchmakers Association of Ohio held their quarterly board of directors meeting in Columbus recently. The directors discussed the seminar in Findlay (which was held on May 21); the upcoming election; and the 32nd Annual Convention to be held July 28-29 in Columbus. Al Brehl, convention chairman, worked on finalizing convention plans. Featured will be a Citizen LCD alarm seminar by Jim Broughton, a bus tour to the Ohio Historical Museum and Village, a jewelry repair seminar, material displays, a demonstration by L&R of new equipment, the President's Ball, the Credit Union meeting, and meetings for members and directors.

Applications are still being taken for the July 29 seminar to be conducted by Jim Broughton. Reservations can be made by sending a check for \$3.00 to Bob Allis, 106 Ernest Street, Fostoria, Ohio 44830.

NORTH CAROLINA

The Yadkin Valley Guild held a Ladies Night recently. At the meeting, the new officers (Carl Steele, President; George Sheets, Vice President; Bill Tolbert, Secy/Treas) were sworn in. Bill Burke was in charge of the program and a special plaque was presented to Paul Mathis, outgoing President of the Guild.

The Piedmontcrescent Guild held a meeting on May 9. President Roy Harris declared the meeting Bill Reid Night honoring the oldest watchmaker (83 years) of the guild and presented Mr. Reid with a special award. It was announced that AWI emblems had been ordered and all mem-

bers were urged to wear theirs on their coat while at work. After dinner two films were shown, courtesy of Bulova and local representative Hilbert Fuerstman.

The Unifour Guild met in April with Bobby Coffey presiding in the absence of President Henry Bruegge. Plans were discussed for a summer picnic with no final decision on the matter. A report on the Citizen LCD alarm seminar held in Hickory was made by G.W. "Red" Crawford and Cade Burns.

The Coastal Plain Guild has several plans for the first quarter of 1978: a program on gemology, election of new officers, a ladies night with dinner, and plans to host the NCWA seminar on LCD watches.

Land of the Sky Guild held a meeting in April. The main topic on the agenda was the upcoming Convention.

VIRGINIA

The Tri-City Triangle Guild held a meeting on May 16, featuring a slide/tape presentation by AWI on the ESA-9181 stepping motor quartz.



Potomac Guild Past President George McNeil turning the gavel over to Skee Jenssen, CMW, incoming President for 1978-79. Other Officers (L to R) are Marvin Whitney, CMW, Treasurer; Ron Beavas, Vice President; and Dan DeWolfe, Secretary.

ILLINOIS

The May 18 meeting of the Central Illinois Watchmakers Association featured a sell-swap-buy session. Also featured was a slide presentation from AWI on "Battle Time." Plans are now being finalized for the Third Annual Illinois Watchmakers Convention, scheduled for October 28-29 in Decatur.

ARIZONA

The Arizona Watchmakers Guild met on Tuesday, May 16. Featured at the meeting was a new slide presentation from AWI. □

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SHIP'S CHRONOMETER

(Continued from page 25)

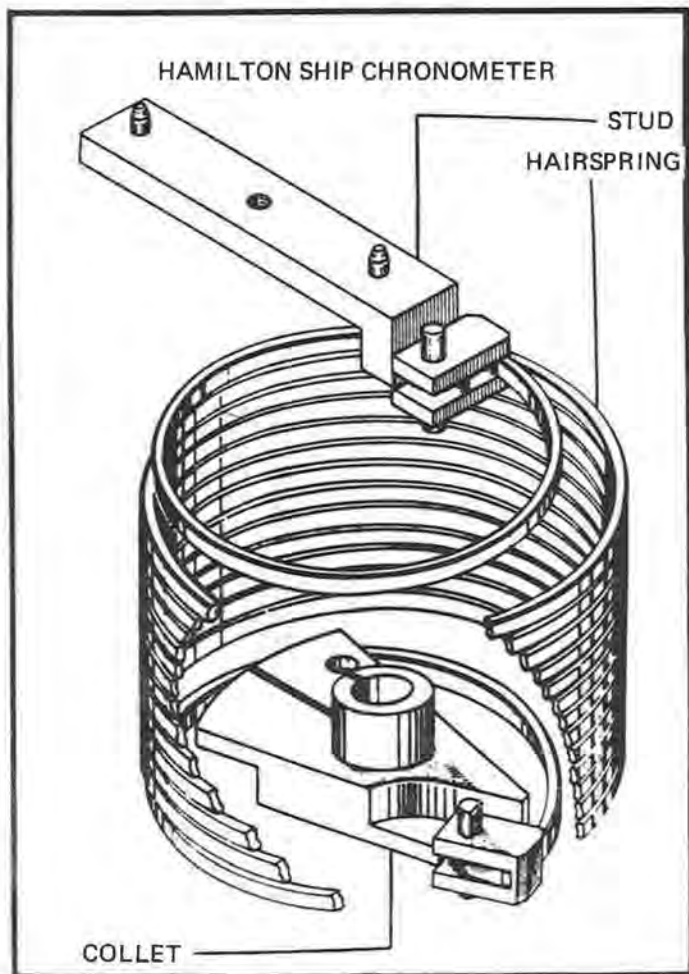


Figure 3. Hamilton ship chronometer.

onto the hub (which has two tapped holes) where it is securely held by two bevel-headed screws.

In the first Hamiltons, the balance wheel was assembled to the hub and staff in this manner. But Hamilton found this introduced lateral stress between the staff and balance arm. Although small, these stresses caused detectable irregularities in the balance assembly performance. This lateral stress was due to the fact that the shape of the screw heads and the countersinks in the balance arm could not be maintained in line with the tapped holes in the hub, thus affecting the concentricity of the wheel with the pivots.



Figure 4. Balance staff with brass hub (actual size).

Hamilton modified the design of this assembly, which eliminated this condition with the addition of a flange or "balance wheel cap" which fitted on the balance wheel arm and was provided with a clearance hole for the staff and two countersunk holes for the hold-down screws, and was made of invar—the same material as the balance wheel arm. With this change the wheel was centered on the staff by the same close fit as before, but now the bodies of the two hold-down screws passed through clearance holes in the arm with the lateral effect of the countersunk heads being exerted upon the flange or cap whose centered clearance hole around the staff permitted it to shift laterally without any harmful results.

The balance wheel in the most modern European chronometers is of a bimetallic design where the outer portion of the rim is brass, fused to the steel rim being cut at two points near the arm. See Figure 5. The balance rim is provided with either one or two sets of timing screws located at or near

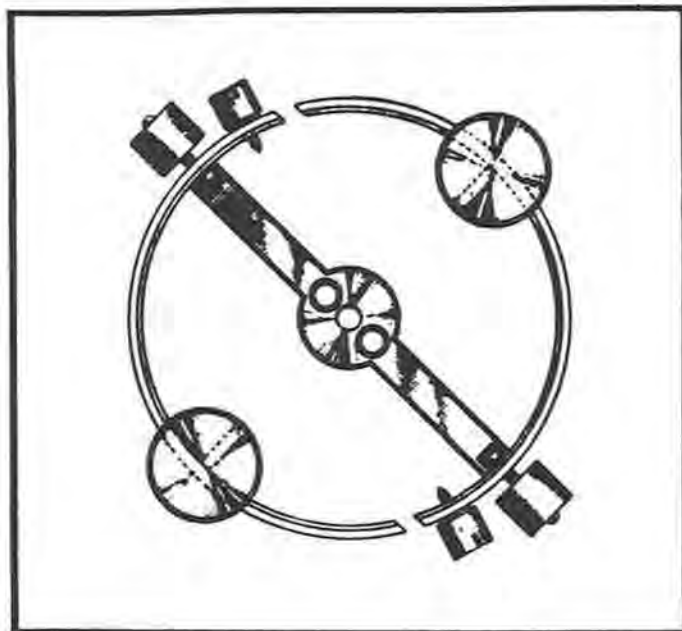


Figure 5. Modern plain brass and steel bimetallic chronometer balance.

the end of the arm. The larger screws are fitted with timing weights used to bring the chronometer to time. Since it is very difficult to turn the larger screws an infinitesimal amount for close timing, some makers added a smaller set of timing screws for the micro or vernier adjustment.

The circular or odd-shaped weights located further up the rim are used for temperature adjusting. The weights are made to move freely on the rim and are held in place by small screws found on the inside bearing against the rim. They are moved either nearer or farther from the end of the rim, as the compensating error dictates, to achieve proper temperature compensation.

The first balance wheels used in chronometers were either made of plain flat steel or brass. Pierre LeRoy is credited for inventing the bimetallic balance in about 1767, but it did not prove to be satisfactory, for he had riveted the two metals together. About 1774, Arnold started experimenting with a compensating balance and in 1775 applied for a patent.

Arnold's first compensating balance utilized brass and steel (not fused together), three arms, curved movable (Z)

curbs in the center of the wheel which were connected to the outer ring of the wheel and weights at the outer end which were used to alter the rate. See Figure 6.

His second type of balance consisted of a steel rim with a steel arm. Parallel with the arm were two straight



Figure 6. Arnold chronometer No. 312.

bimetallic bars, in which the brass was on the inside and the steel on the outside. Attached to the center of each of these bimetallic strips was a steel rod which passed across each side of the balance. It had timing weights at each end of the arm and was called the double T balance.

Thomas Earnshaw is given credit for devising the modern bimetallic compensating balance. See Figure 7. Having made balances for years with three arms, Earnshaw reasoned that the two-armed balance would do just as well. After repeated trials he found that the two-armed balance performed just as well as those with three and furthermore, the two-armed balances were much more easily made.

Earnshaw also contended that it was impossible to bend two different pieces of metal in exactly the same arcs

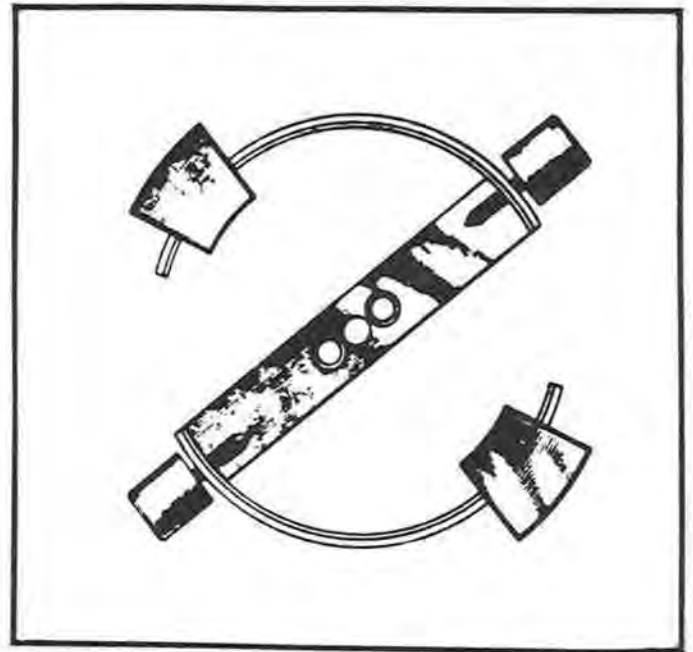


Figure 7. Earnshaw's original bimetallic balance.

without introducing some stress. To overcome the stress, he fused a tube of brass on a rod of steel, and then turned off the excess metal. To alter the amount of compensation, Earnshaw used weights which slid along the balance rim.

Next month the Ship's Chronometer will continue with the balance assembly. □

SPECIAL JEWELERS TOUR DURING RJA'S JULY SHOW

On Monday, July 25th, RJA will sponsor a special jewelers' tour of the Hall of Meteorites, Minerals, and Gems.... the most spectacular permanent exhibition hall at the American Museum of Natural History. Jewelers will have the opportunity to see more than 6,000 beautiful, rare, and costly specimens on display. Members of the staff of the Gemological Institute of America will be on hand to answer jewelers' questions.

Museum personnel will provide several film presentations during the special three-hour opening. Scheduled to start at 6:00 PM, the last presentation will end at 8:45 PM.

Admittance to the Section will be by Trade Show badge only. Jewelers are advised to go to the 77th Street entrance of the Museum.

For any further questions, inquire at RJA's Membership Desk during the July Show on the Second Floor Promenade of the New York Hilton Hotel.

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TESTING AND CATEGORIZING

(Continued from page 20)

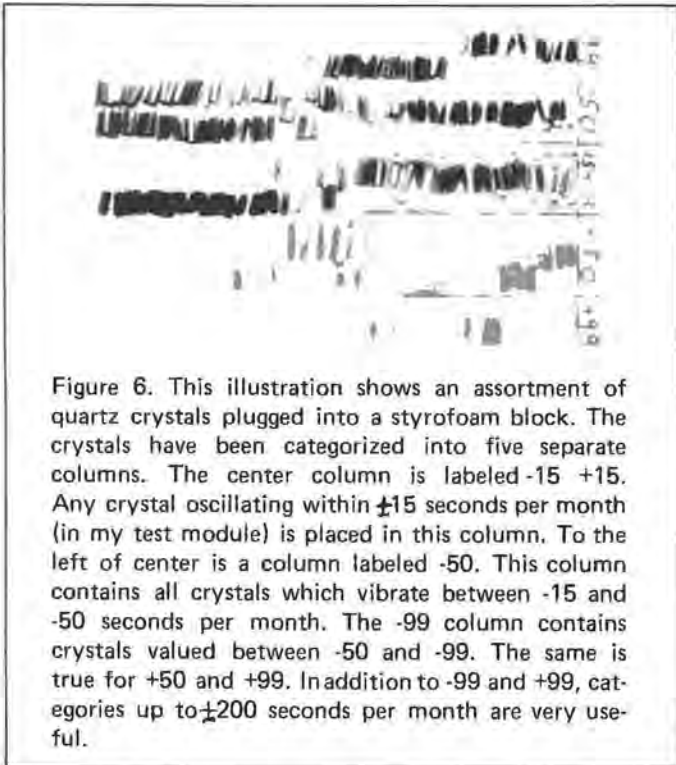


Figure 6. This illustration shows an assortment of quartz crystals plugged into a styrofoam block. The crystals have been categorized into five separate columns. The center column is labeled -15 +15. Any crystal oscillating within ± 15 seconds per month (in my test module) is placed in this column. To the left of center is a column labeled -50. This column contains all crystals which vibrate between -15 and -50 seconds per month. The -99 column contains crystals valued between -50 and -99. The same is true for +50 and +99. In addition to -99 and +99, categories up to ± 200 seconds per month are very useful.

exists between the test module and the repaired module. If crystal A runs 100 seconds per month faster than crystal B in the test box, it will run approximately 100 seconds per month faster than crystal B in the repaired module. Therefore, when crystal A cannot be adjusted to run slow enough in a repaired module, it should be removed and crystal B should be soldered in.

Service Note

When an oscillating circuit is faulty and the quartz crystal is suspect, be sure to visually examine (with a 20 or 30 X microscope) all of the components associated with the oscillator before replacing the quartz. It is possible that the trim cap may be cracked, broken, corroded, or poorly soldered. The fixed caps occasionally fall off and the leads from the quartz crystal can be shorted to each other and sometimes to the substrate. Make a thorough visual examination before performing any service. Visual examination saves time. Know exactly where the problem is before making the repair. □

The epithet you apply to another man probably fits you best.

BOOK REVIEW

Clockmakers of Lancaster County and Their Clocks, by Stacy B.C. Wood, Jr., Stephen Kramer III with a *Study of Lancaster County Clock Cases* by John J. Snyder, Jr. 8¼ x 11 inches, 224 pages, 246 illustrations, hard cover with dust jacket, Pub. 1977 by Van Nostrand Reinhold: New York. \$16.50.

Books on regional watch- and clockmakers have been published in the last few years with great appreciation by readers and researchers. Although these focus on a narrow segment of a nation's horology, they reflect an intense research. They provide, however, inspirational stimulus and leads which other authors follow with profit.

Clockmakers of Connecticut, Massachusetts, New Jersey, Vermont and other areas have been covered in books, monographs, and articles. Eckhardt's early book on Pennsylvania clockmakers was a commendable effort for its early period, but with continuous studies and searches, it is now considered as a comparatively skeletal reference. Thus, this book on one important Pennsylvania county was motivated in part at least in the thorough and inspired efforts of three highly respected authorities.

Stacy B.C. Wood, Jr. is the Administrator of the NAWCC who after receiving a BA in Psychology, also was graduated from the Bowman Technical School with a clockmaker's diploma and is an AWI Certified Clockmaker. Stephen E. Kramer III, with a BA and MA is also a diplomate in clockmaking from the Bowman Technical School where he met Wood. John J. Snyder, Jr., also of Lancaster, is a well known authority on Pennsylvania cabinetmakers. A Winterthur Fellow, Mr. Snyder has written about Lancaster furniture.

Eighteenth-century Lancaster was America's largest inland town, and at one time a campaign was initiated in the young republic to make it the nation's capital. Between 1729 and 1749, Lancaster County occupied almost half of the entire state of Pennsylvania, although after 1813, it assumed the area it includes today.

The period of the Wood-Kramer-Snyder research extending from 1750 to 1850 was chosen as the era when clocks were handcrafted. Their scholarly study is a valuable addition to the history of American horology and particularly about a geographical area singularly different from others, including close-by Philadelphia and its clocks.

This book has four main sections: first, a directory of clockmakers; second, cases; third, dials; and fourth, movements. Not the least is the chapter on clock cases by Snyder. Important details, influences, prices of the time, and famous Lancaster cabinetmakers who were known in their own right as makers of fine furniture are also listed here. Typical designs of certain makers supply much information and clues to the work of these craftsmen. It is noted here that often a

cabinetmaker would buy a movement from a county clockmaker or exchange or barter for each other's products.

Some cabinetmakers bought ornaments and medallions from specialists rather than carve or turn them themselves. Among the cases pictured are arched, flat-top, footed and flat-bottomed cases. Scroll pediment, Queen Anne, Chippendale, and Federal styles, open fretwork, flambeau, urns, rondels, rosettes, mahogany, walnut, maple, cherry were used as prime woods.

The chapter on dials extends 65 pages of text and photographs of approximately 65 dials. The authors note that for the most part, dials were English imports with some later domestic dial suppliers, and few others were made by the clockmaker with paintings, engravings or lettering supplied by specialists. Many of the painted dials show corner decorations with the same shellfish themes.

A study of these painted locally and reproduced in fine photographs reveals many interesting sidelights on history, customs, tastes. Floral and fruit designs, marine life, and birds indicate that individual dial painters might have worked for a few clockmakers. Although the close-up photographs of dials also show some with delicate fine hands, no mention is made about who supplied them. The large section of 86 pages on movements portrays the English and German traditions of Pennsylvania. This is explained interestingly with numerous fine, clear photographs which show each detail. Thirty-hour, eight-day, endless rope or chain, pulleys, compounded weights, lantern pinions, trundles, shrouds, snail and rack, and count-wheel striking are among the details described and illustrated.

Where music was included in these clocks, the melodies are for the most part German as evidenced by the names of the tunes on the song-selection arches.

The versatility of early Lancaster County clockmakers is recorded here as at times "doubling in brass," as jewelers, silversmiths, engravers, watchmakers, buckle and seal makers, makers of mathematical or surveying instruments, as well as tavern keepers or managers.

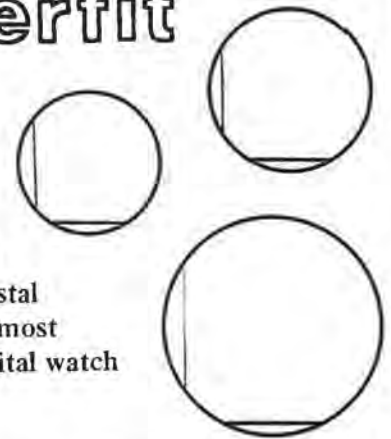
According to the authors, Lancaster County clockmakers did not use wooden or stamped brass movements. The almost 80 clock movements shown are page-sized photographs with clear details and captions. Among these are sweep seconds with moon dials, musical, striking, and repeating clocks, grooved drums, compounded pulley weights, three-train musical, and one by Christian Forrer with the Thintu escapement after a design by Lethune of Paris in 1727 (Tardy's *Montre*, Chas. Cros' *Echappements*, Keystone, *Watch and Clock Escapements*, Chamberlain's, *Its About Time*). It is interesting to note why Forrer should include an escapement which is seen virtually only in French clocks of the 1730-40 period. However, Forrer was trained by a French clockmaker in the Jura. As it is, it is an interesting application of the linked recoil escapement which, however abandoned, still can be seen in some clocks of all sizes, even an early French skeleton clock, which makes it an attractive if not efficient escapement.

Of the clocks pictured in this book, almost all are long-cased timepieces. The quality of the clocks, their cases, dials and movements range from excellent to moderate. But, none is shown or recorded that might be considered unschooled or crude. The book is a fine effort, scholarly with superior photographs, which makes it a welcome addition to those volumes full of authenticity and interest.

Reviewed by Henry B. Fried

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JOSEPH BULOVA SCHOOL OF WATCHMAKING RECEIVES ACCREDITATION BY NATIONAL BODY

Joseph Bulova School of Watchmaking, 40-24 62nd St., Woodside, New York, has been granted accreditation by the Accrediting Commission of the National Association of Trade and Technical Schools.

The Commission is listed by the US Office of Education as the official accrediting agency for the country's private trade and technical schools. Accreditation is an authoritative index of a school's standing within its own profession.

To satisfactorily fulfill the Commission's standards of education, ethical, and business practices, Joseph Bulova School of Watchmaking underwent detailed study and was visited by an examining team of qualified professionals and specialists. Among factors considered were the School's history and integrity of operation, its course offerings, faculty, admission rules, enrollment, and business policies.

This School opened its doors on July 23, 1945, initially to serve the returning World War II disabled veterans. Now in its thirty-third year, the School is a complete institution with a pleasant physical environment for the training and personal adjustment of disabled and non-disabled students.

Since its beginning, the School has graduated over 1300 men and women, most of whom have been able to return to the economic market as gainfully employed individuals.

AWI 1978 Horological Tour



Part of the AWI group with tour leader Henry Fried and Durowe Ebauches SA INT officials in the foreground.



Henry Fried, Dr. Geschwind, and Orville Hagans at the Flea Market in Basle.

The fourth annual AWI tour with fifty tour members was another success. All parts of the United States were represented in the group, including Alaska, Hawaii, California, Florida, New York, Colorado, Illinois, the Carolinas, New Jersey, Montana and others.

After arriving in Zurich and touring that city in bright sunshine with blossoms of all colors everywhere, the group was transferred to Mulhouse in France, close to Basle and its European Watch, Clock and Jewelry Fair.

The following morning they visited the ETA S.A. Ebauches factory at Grenchen where they were met by old friends among whom were Paul Tschudin of Ebauches, S.A., François Habersaat, ETA's commercial director and R. Waechli, Director of Information for Ebauches, S.A. Here they were shown the latest achievements of that factory. Afterwards, ETA hosted the group at Vinelz where a sumptuous luncheon was served with wines and welcome speeches by our hosts. Expressions of gracious appreciation were expressed by Henry B. Fried, tour organizer and director, and AWI Vice President, Orville R. Hagans. Following the luncheon, Mr.

Tschudin, along with Messrs. Huebener, Phompke, Mizere, Haberstaat, and Jaquet, led the group to the factory at Marin Neuchâtel where at Ebauches Electroniques S.A., they saw how analog and digital watches were made from the raw materials to the finished product. Completing the day's activities was a question and answer period with factory officials, René Goulaz of the Federation of Swiss Watch



Luncheon at the Basle Fair.

Manufacturers, Mr. Tschudin, Sully Jaquet and others participating over additional refreshments served at the factory lunch rooms.

The next morning, arriving early at Basle, the tour members were treated to a local flea market when Dr. Geschwind, world famous horological historian-collector, recognized the tour leaders and invited them to visit the horological section of the Basle Museum of which he is the benefactor. At the Basle Fair, we were received by Dr. Michel Mamie, Director of the European Watch, Clock and Jewelry Fair and Dr. Roland Schild, director of information. At a fine reception luncheon which they hosted, Dr. Mamie invited us to return in 1979 with the same receptions and welcomes.

The fair revealed a very large display of fine clocks and watches of all types; solid state, analog, ultra thin watches of all kinds, new minute repeating perpetual calendar pocket watches paved with diamonds, sapphires, lapiz and emeralds. Clocks featured all types of ornate wall, shelf, floor, skeleton, rolling ball Congreves and carriage clocks as well as small quartz alarms.

Jewelry from twelve European countries was abundantly in evidence. Machines, equipment, tools, books and many other items were displayed with many machines in productive operation. To those who have never been to the Basle Fair, it was a revealing experience with over 1220 exhibitors, all showing in their own, private self-contained enclosures similar to our own great enclosed shopping malls, unlike the open stalls of jewelry or trade shows in this country.

Strasbourg and its cathedral clock famous for six centuries was visited after touring Alsace-Lorraine. Our hotel in Wilbad was reached after leisurely touring through the enchanting cities of Baden-Baden, Colmar, and the Black Forest areas of Germany with the early Spring in resplendent showing.

Early the next morning, upon arriving in Schramberg in the Black Forest we were greeted at the Junghans factory by a full German brass band flanked by women costumed in traditional Bavarian folk pom-pom hatted costumes. After a brief orientation by their executives including Roland Gareis and Harold Steinhoff, their US representative who flew over to assist in our greeting, we were given a tour of the factory. There we saw quartz clocks made from the raw materials, including plastic wheel, pinions and plates and levers. The electronic fabrication was also observed with guided explanations. Following, the entire group was taken to a fine German restaurant to be wined and dined, hosts of Gebruder Junghans. At the close of the festivities and receptions each tour member was given a souvenir doll which contained a fine bottle of brandy.

The afternoon was engaged in visiting the excellent clock museum at Furtwangen with its fine display of early clocks, Black Forest clocks, complicated clocks, escapement models, and a complicated, automated musical clock. There was a section devoted to the restoration of a typical local clockmaker's shop of a hundred and fifty years ago.

In Wilbad, at our hotel, many tour members availed themselves of the thermal baths, known all over the world. Others enjoyed the quiet of this old resort community.



Lunch at Junghans.



How the AWI group was greeted at the Junghans factory.

At the Junghans factory watching the monitoring of precise clock parts. Left to right: Mr. LeDuc of Montana, Henry Fried, George Paine of San Diego, Junghans officials, Dorothy Bundens, Dr. Warner, M. Bundens of New Jersey, Mrs. Carter of Florida, Dr. Phil Gilman.



The next morning we were the guests of the (German) Ebauches S.A. INT Durowe factory. Here all enjoyed this visit as they saw an old, familiar friend, the 6 x 8 INT calibre being made, evolving step by step from a bar of metal to a throbbing, pulsating going movement. Director Edgar Piller guided our group, aiding in helping the group understand each operation. Assisted by Dieter Nischwitz his chief assistant and Hans Leitz, Director Piller informed us that this factory produced over 3.3 million mechanical movements a year. He also reported that the production of spring wound movements for the domestic market was already sold out for 1978 and that prospects for the future continued to be excellent.

Following this three hour morning comprehensive tour, Ebauches Durowe (INT) was our host for a fine luncheon with officials of both AWI and Durowe exchanging official sentiments. In the afternoon at Pforzheim, the group was escorted to the Permanent Jewelry and Silver exhibition where the finest contemporary pieces of jewelry in gold and silver were on display. Later that afternoon the group walked to the nearby Gold and Jewelry Museum where jewelry from Egyptian to modern times was on display. Here the director of the museum took us on a personal tour of the exhibits, explaining each display to a most enraptured audience.

Our tour then left the horological manufacturing area and visited horological collections in museums and famous public animated and historical clocks. Among these were the glockenspiels at Munich, the orgel-uhr of Vienna with its moving historical tableau, the many fine old complicated clocks in the various Danish castles and palaces as well as the fine Viennese Horological Museum. In Copenhagen, the group saw the world's most complicated clock, the work of Jan Olsen, skeletonized for easy viewing. Rothenberg's animated clock was also a fine attraction.

Touring delights included Munich, Oberammergau and its fine wood carvers, Salzburg, Vienna and its delights, Hungary and its twin cities of Buda and Pest.



Questions and Answer session at the (German) Ebauches SA INT Durowe factory.



Inside part of Mad Ludwig's Castle at Linderhof



Biedermeier Automation Clock C-1840 at the Vienna Clock Museum

THE AMERICAN WATCHMAKERS INSTITUTE INTRODUCES

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In addition to the written lessons, students will be involved in servicing two electronic watches as well as working with concept teaching kits. AWI will provide the watches and kits. This course will prepare individuals for the new AWI Certification Examination of **CERTIFIED ELECTRONIC WATCH SPECIALIST**.

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SWEST WORKSHOP HAILED A SUCCESS

Swest, Inc.'s 15th Annual Jewelry Casting Workshop was a very successful one, according to Earl R. Weaver, president of Swest, Inc.

The event drew 500 manufacturing jewelers, retailers, teachers and craftspeople to Dallas from all over the U.S., and from Canada and Mexico.

"This was our second year to have as co-sponsor El Centro College of the Dallas County Community College District," said Mr. Weaver, "and we expected a normal amount of problems to crop up. However, we were amazed to find that this has been one of the smoothest-running workshops we have ever experienced. I feel this is a tribute to the staff of El Centro, which was extremely helpful and cooperative, and our own employees, who grow more proficient at the logistics of such an operation each year."

Highlight of the workshop was the presentation of a gift of \$1500 worth of equipment by Swest to the Art Department of El Centro for furtherance of their jewelry and silversmithing programs.

Attendees of the two-day workshop were able to spend as much or as little time as they wished on the many phases of jewelry casting: Wax Model Design; Sprueing, Investing and Burnout; Casting; Mold Making; and Polishing and Finishing. Many "side shows" were also available to the attendees: Jewelry Repair, Precious Metal Testing, Metal Working and others.

The workshop instructors are all experts in their fields, as witnessed by a random sampling: Jim Morris, jewelry designer for "James Avery, Craftsman," demonstrating wax carving; Martha Ann Gilchrist, jewelry designer & instructor, winner of the 1975 DeBeers Diamond International and other awards, contributing editor for "Independent Jeweler" magazine, demonstrating sheet wax fabrication techniques; Sharon Leeber, jewelry designer and sculpture instructor at El Centro College, demonstrating wax modeling techniques; Stan Kruger, manager of Felco, Inc. of Albuquerque, demonstrating vulcanized mold making; David Walden, San Antonio jeweler and caster, demonstrating casting; Armando Rodriguez, San Antonio jeweler, demonstrating jewelry repair techniques; Luis Dominguez of Lumex Lumido Jewelry Manufacturing of Guadalajara, Mexico, demonstrating stone setting; and Chuck Wolfmueller, chief designer for "James Avery, Craftsman," demonstrating production casting techniques. Also, other well known jewelers, designers and teachers, as well as many of the Swest staff lectured and demonstrated on various phases of jewelry casting.

The Swest annual workshops are two-day affairs held on a weekend in the spring of each year. A social hour and banquet is held on Saturday night. Attendance is limited to 500 people, and recent workshops have reached that number of registrants, forcing Swest to regretfully reject and return some registrations.

NEW PRODUCTS

SEIKO DIGITAL WATCH DISPLAY WINS COVETED AWARD

Seiko's unique LC Digital Quartz window display was cited as a winner in the Point-of-Purchase Advertising Institute's recently held 18th Annual Merchandising Awards Contest. The point-of-sale fixture received its award over competitive displays in the jewelry store and department store categories.

The display—themed "Expanding the Boundaries of Timekeeping"—features four different Seiko LC Digitals,



and their complete descriptions illuminate sequentially. In addition, a photo of an LC Digital highlights the top part of the display.

The pad containing the four watches is removable, enabling the jeweler to place the timepieces in his safe when the store is closed. The copy—"Come In and See Our Com-

the house that has it all

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plete Collection of Seiko LC Digital Watches"—is set under the pad, and is on display when the pad is removed.

The compact and attention-getting display (WD007) measures 16 in. x 13 in. x 8 in. It was designed for Seiko Time Corporation by Thomson-Leeds Company, Inc., New York City.

Seiko has updated this display for 1978 to feature a photo of its new LC Digital Alarm Chronograph with time, day, date, alarm and stopwatch features. This new unit is now available through Seiko's distributors nationwide.

NEW UNIVERSAL MODULE SOLVES SERVICE AND INVENTORY PROBLEMS

A new "Universal" 6-function, alpha-numeric module for LED watches of 29 mm diameter has been introduced by Microsonic Corporation, and is being hailed as an important solution to the problems of providing replacements for modules in millions of watches now owned by consumers.

The new module enables instant replacement of dozens of brands of modules with a single high-quality unit at low cost. It enables service stations and jewelers to provide complete service with minimum inventory. Microsonic believes the new module will replace up to 90% of all models of this size now in use. This includes many modules no longer being made, some of whose manufacturers are out of business—thus making it possible to service watches that might otherwise have to be thrown away.



In fact, watches that were originally 3-and 4-function may now be modernized to alpha-numeric 6-function watches.

Microsonic has been developing the new module, "M-100" for nearly a year, in response to problems faced by the trade in having to stock large numbers of costly modules of various types without knowing which would move, and in what quantities, according to W.A. Hilliard, technical director.

The "M-100" is a 6-function alpha-numeric module (month, date, alpha-day, hour, minute and second)—and adapts to either one or two button operation so it can be used in any case of that standard size. It replaces modules

of 22½ degree button angles; 40 degree up or down button angles, or 90 degrees. These include modules made by Hughes, Frontier, National Semiconductor, Optel, Litronix, Dynatron, Olympos, Microelectronics, Mintronics, Exonics, Microstar and others.

Microsonic's Universal Module "M-100" uses batteries number 357 or number 386, depending on the case.

The module carries a 12-month warranty. A simple illustrated manual containing a guide to which models can be replaced by the "M-100," and details of simple installation techniques, is available on request.

Price lists and descriptive literature, as well as modules in any quantity can be ordered for immediate delivery from Microsonic Corporation, 531 Spring Garden Street Mall, Philadelphia, Pa. 19123.

FIVE NEW LC DIGITAL QUARTZ MODELS FOR LADIES



YH009M

Seiko Time Corporation recently introduced five glamorous new ladies LC Digital Quartz models, featuring continuous readout of hours on a 12-hour basis and minutes. The new models are YH009M and YH010M; YH011M and YH012M; YH014M.

New stainless steel model YH009M, with blue dial frame, will retail at \$165. Its mate, model YH010M, in yellow top/stainless steel back case, with gilt dial frame, sells for \$195. Both models are also water tested to 100 feet (30 m) and feature adjustable bracelets.

Model YH014M, has a yellow top/stainless steel back case, with gilt dial frame and elegant brushed bracelet. Its retail price is \$215.

Model YH011M has a stunning stainless steel case, with silver-tone dial frame, at \$225. Its counterpart, model YH012M, in yellow top/stainless steel back case, with brown dial, retails at \$250. Both models also feature adjustable bracelets.

Each of the five new models displays hours and minutes, and shows month and date at the push of a button. With another push of the button, a seconds readout appears. Other key features include a calendar which automatically adjusts for odd and even months (except February of leap years), battery life indicator, and Seiko's exclusive "Hardlex" mar-resist crystal.

All Seiko watches are available for immediate delivery through Seiko's nationwide network of distributors.

THE GOULD COMPANY OFFERS FREE NEW CATALOG

The Gould Company, the Dallas, Texas wholesaler of jewelry, watch material, tools, equipment, and supplies proudly announces a new catalog—FREE for the asking. The catalog is called Marcy's Extraordinary Catalog No. 78. It contains 91

pages with illustrations of jewelry-making tools (big and little), supplies and all kinds of findings, including ring findings.

"This catalog puts it all together for those involved in making and repairing jewelry, and for today's complex world, it's a must—not just a help," declared Kenneth Weil, Gould Company President.

Call toll free for your complimentary copy— Nationwide: 1-800-527-4722, Texas Only: 1-800-492-4104, or write The Gould Company, 13750 Neutron Road, Dallas, Texas 75240.

NEW QUARTZ ELEGANCE

This distinctive see-through dome shows off the polished four-ball brass finish pendulum of this traditionally classic 600-day Bulova mantel clock, which features a nontraditional quartz-based movement—that operates for more than



600 days on just one C-type flashlight battery. Suggested retail price is \$99.95. Additional information is available from National Sales Manager, Bulova Watch Company, Inc, Bulova Park, Flushing, New York 11370, tel (212) 335-6000.

Q32-QUARTZ CRYSTAL TESTER

This unique device enables the user to test 32,768 Hz quartz crystals after they have been removed from a watch module. It also simplifies the categorizing of new quartz crystals. It is capable of testing quartz crystals with a variety of lead spacings. The jaws of the connector open and close without causing any strain on the quartz leads.

To test a quartz crystal, clamp its leads on the connector of the Q32 tester and place it on or near the sensing

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————— DATES TO REMEMBER —————

JULY

1-7—Christmas Gift, Jewelry and Housewares Show; Dallas Market center; Dallas Texas

2-5—Miami Merchandise Mart Gift Show; Miami International Merchandise Mart; Miami Florida

2-5—St. Louis Gift and Jewelry Show; St. Louis Gateway Convention Center; St. Louis, MO

7-8—JC-K Financial Management Workshop; Sheraton/Atlanta Hotel; Atlanta, Georgia

9-12—SJTA Southern Jewelry and Gift Fall Show; Hyatt Regency O'Hare; Chicago, Illinois

14-16—Pacific Northwest Jewelers Association Convention; Jantzen Beach Thunderbird; Portland

15-16—Oklahoma Retail Jewelers Association; Annual Show; Camelot Inn; Tulsa, Oklahoma

15-17—Great Lakes Jewelry Exposition; Hyatt Regency O'Hare; Chicago, Illinois

15-17—Mississippi Retail Jewelers Association Convention; Biloxi Hilton Hotel; Biloxi, Mississippi

15-18—New Orleans Gift and Jewelry Show; Rivergate Convention Center; New Orleans, LA

16-19—Washington Gift Show; Shoreham Americana and Sheraton Park Hotels; Washington, DC

18-21—JC-K Inventory Management Workshop; New York Sheraton; New York, NY

18-21—Early Bird Gift and Decorative Accessories Preview; Merchandise Mart; Atlanta, Georgia

22-23—General Membership Meeting; Diamond Council of America; New York Hilton Hotel; New York, NY

22-26—Retail Jewelers of America Fall International Jewelry Trade Fair and Convention; Americana and New York Hilton Hotels; New York, NY

23-26—Charlotte Gift and Jewelry Show; Merchandise Mart; Charlotte, North Carolina

23-27—Atlanta National Gift Show; Georgia World Congress Center and Merchandise Mart; Atlanta, Georgia

24-29—Early Bird Gift Market; Merchandise Mart; Chicago, Illinois

28-30—Watchmakers Association of Ohio Convention and Annual Meetings; AWI Citizen LCD Quartz Alarm Seminar; Jim Broughton, Instructor; Marriott Inn; Columbus, Ohio

30-Aug 4—Chicago Gift Market; Merchandise Mart; Chicago, Illinois

AUGUST

5-6—NMRJA Convention; Hilton Inn; Santa Fe

5-6—MINK Jewelry and Silverware Show; Hilton Plaza Inn; Kansas City, MO

6-9—Memphis Gift and Jewelry Show; Cook Convention Center; Memphis, TN

9-11—Pacific States Fair; Ft. Mason Facilities; Pier 2; San Francisco, California

12-21—20th Annual Pacific Jewelry Show; Century Plaza Hotel; Los Angeles, California

13-15—Third Orlando Gift and Decorative Accessories Show; Convention Center/Sheraton Towers Hotel; Orlando, Florida

13-16—Minneapolis Gift and Jewelry Show; Radisson Hotel and Radisson Center; Minneapolis, Minn.

15-16—JC-K Inventory Management Workshop; Airport Sheraton; Los Angeles, California

17-18—JC-K Financial Management Workshop; Airport Sheraton; Los Angeles, California

20-23—Seattle Gift Show; Seattle Center and 6100 Building

21-22—JC-K Financial Management Workshop; Fisherman's Wharf Sheraton; San Francisco, California

23-24—JC-K Sales Management and Motivation Workshop; Fisherman's Wharf Sheraton; San Francisco, California

SEPTEMBER

3-6—Miami Merchandise Mart Show; Miami, FL

3-7—International Watch and Jewellery Trade Fair; Wembley Conference Centre; London, England

3-8—Dallas Fall Gift, Jewelry and Housewares Show; Dallas Market Center; Dallas, TX

9-10—Iowa Retail Jewelers Association; 1978 Fall Convention; Eddie Webster's; Dallas, TX

10-13—Miami Beach Gift and Jewelry Show; Convention Hall; Miami Beach, FL

10-13—Miami Gift Show; Miami Merchandise Mart and Expo Center; Miami, FL

12—Massachusetts Watchmakers Association; regular meeting

12—Watchmakers' Association of New Jersey; regular meeting; Howard Johnson's; Clark, New Jersey

24—Watchmakers' Association of New Jersey; Quartz Watch Seminar and Bench Course

OCTOBER

28-29—Third Annual Illinois Watchmakers Convention; Decatur, Illinois

NOVEMBER

19—Watchmakers' Association of New Jersey; Swiss Quartz Analog Bench Course

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