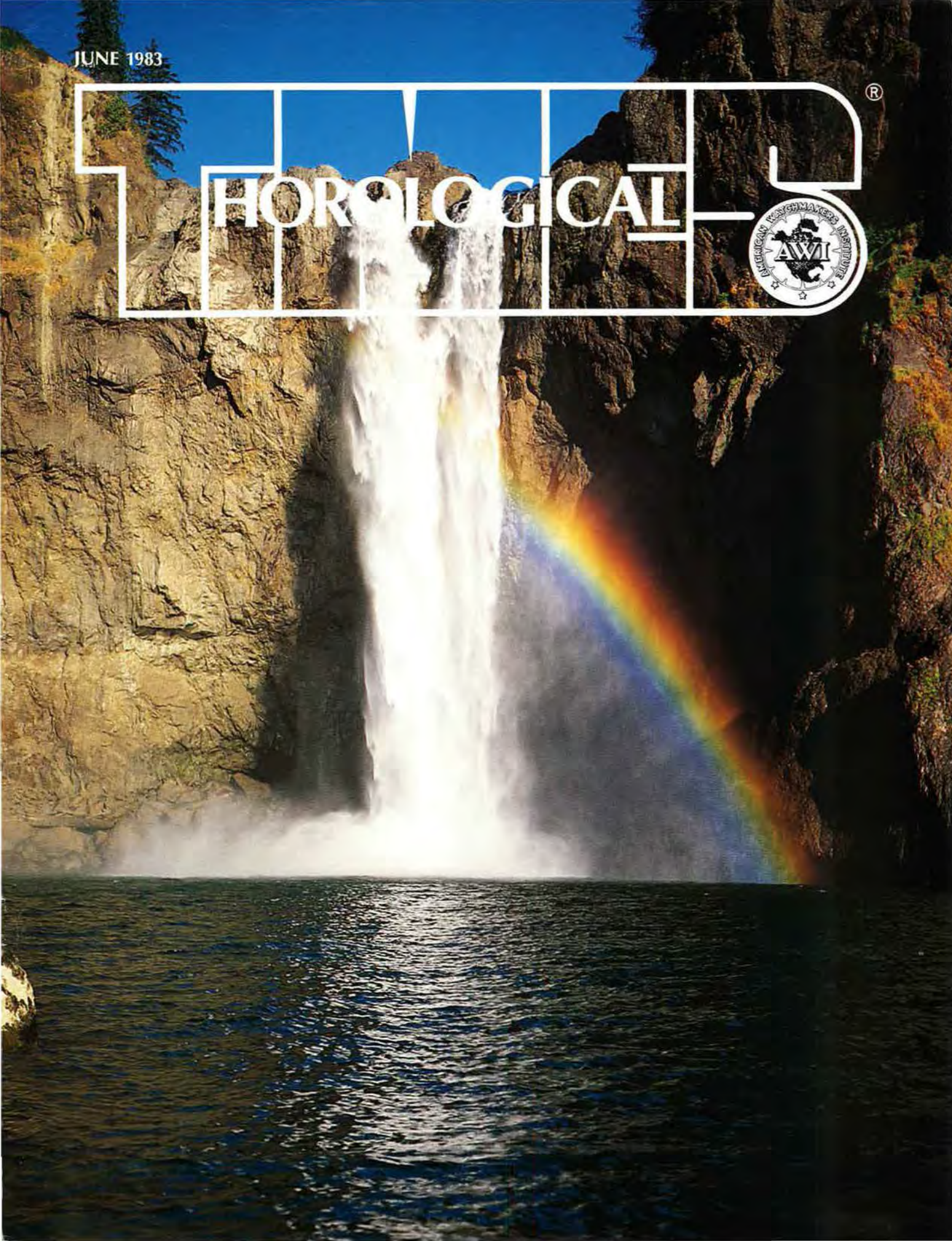


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*Encouragement May Well Be
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EDITOR'S NOTE:

Some of our regular writers will be missing from this month's issue. They'll be back on schedule next month!

Our desire to cover the quartz watch industry in depth, made it necessary to delete some non-related articles from this month's special issue.

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Special Quartz Issue!!

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Editorial

This month in *Horological Times*, we have specially gathered some of the most knowledgeable writers in the industry. The subject matter in the entire magazine is devoted to quartz, but not the quartz known as amethyst, citrine or onyx. Rather, it concentrates on all phases of quartz used in timepieces.

We begin with New Yorker Fried, AWI Fellow, who examines the history of modern watches and gazes into the crystal ball to ponder the future. Another prognostication comes from Minnesotian Nelson. Technical information on batteries is related by Virginian Hartman, originator and caretaker of the AWI battery numbering system. Two successful watchmakers/jewelers, Texan Burckhardt and Washingtonian Door give hints on selling techniques with quartz watches. Pennsylvanian Bishop delves into crystals and cases, and the ever affluent Wisconsinite Jaeger provides a trip from the battery to the advancement of the hands in the quartz watch. A very important "gate time" chart is provided by Portescap necessary for proper checking of these quartz timepieces.

Horological Times believes that this particular issue will rank among the finest in value to the watchmaker/jeweler.

On the Front

The majestic beauty of a waterfall, painting rainbow colors as it splashes into the waiting lake below, seems to epitomize the poet's query "What is so rare as a day in June. . . ?" The pictorial answer to the rhetorical question may lie in Snoqualmie Falls, Cascade Mountains in the State of Washington which we feature on our front cover this month.

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Trial and Error

Whether we know it or not, or whether we like it or not, our whole lives are based on "Trial and Error." When the first automobile was built and road-tested, many errors were found that had to be corrected. Today's fine dependable cars are a product of many years of trial and error. Every year when the new models come out, corrections are made from the previous years' models to try and correct their weaknesses. Oftentimes the corrections have errors that later need correcting.

Our life as watchmakers is a continual process of trial and error, and in our efforts to continually do more perfect work we find that perfection is just a goal that we will spend our lifetime in pursuit of—never to be attained. But we must never lose sight of that ultimate goal or we will find ourselves in a position of standstill and about ready to start slipping backwards.

Since the inception of the American Watchmakers Institute, the organization has also operated on a trial and error basis, and still is. There was one great advantage that AWI has had from the start, and that was the fact that it originated from a merger of two great horological organiza-

tions with input from the years of trial and error of both organizations. Even with this in sight it has been necessary to change the constitution and by-laws at least once to correct the errors that the trial showed. Programs have been launched, most of them highly successful, but when not they are replaced with others which are hoped to be more successful. Plans for future development are drawn up and reviewed periodically, and then sometimes altered to meet current or foreseeable needs. The dedicated people that drew up our constitution and by-laws drew upon the experience of the two previous organizations to gain the foresight necessary to put this together. After observing the development and growth of this organization from its inception, they believe that error was held to a minimum and today the services which are offered to horologists almost completely cover their needs.

Today we have in the American Watchmakers Institute as dedicated a group of officers, directors, committee chairmen and committee members as the institute has ever had, and with positive thinking still show growth in membership, in spite of the diminishing numbers we have in the trade.

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Past, Present & Future: Quartz Technology



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

The past of electronic horology would mean its very beginning. Where to begin: would it be with Franklin and his kite, Alexander Bain with the first electrically powered clock in the 1840's, or with the Curies' discovery of the piezo electric effect of quartz crystals? How about the vacuum tube and the early electronic timepieces? Of course this showed that the mechanical, free pendulum was not the ultimate in precision timekeeping although miniaturization was still a major problem.

Accutron with its miniature transistorized circuit and finely wound coils was another major step forward. However, it took the invention by Jack Kilby, at that time with Texas Instruments, to really herald the advent of the possibilities of quartz watches. Mr. Kilby's training as a metallurgist led him to the discoveries and invention of the integrated circuit. Kilby was able to do with microscopic layers of metallic oxides what was previously only possible with vacuum tubes and larger transistors.

Light emitting diodes were already on the scene before 1970. Liquid crystal chemistry was known almost 100 years ago but it wasn't until 1967 that George Heilmeyer introduced the first LCD.

In an interview with me in late spring of 1970 George Theiss, an electronic engineer and president of a small company, spoke about a small LED he saw in 1966. He was struck with the possibilities for a wrist watch. He told me upon his seeing that small light emitting diode display panel, he immediately realized that he could put all the necessary "hardware" he had "on the shelf," together into a timepiece that could be small enough to be worn on the wrist.

In conjunction with his associate Willy Crabtree, they labored until the wrist watch was successfully working but laid out on a large "breadboard."

Mr. Theiss told me also that they were able to compact this into a module although somewhat large but still within the limits of wrist watch size. At this point he realized that he was not able to market or successfully make a wrist watch case. His knowledge of horology or horological nomenclature was almost non-existent. Between Mr. Crabtree and himself they decided from that point on it would be better to enlist or join an experienced producer of watches in this venture. In answering my question as to patents, Mr. Theiss' opinion was that it was not patentable because everything in his watch was already on the market; he merely put it together. George Theiss told me that he thought the Hamilton Watch Company had the potential and facilities to further this to market.

At the same time, according to John Bergey of the Hamilton Watch Company, at Lancaster, PA they were in the midst of research with an electronic digital, no moving parts watch. Mr. Bergey's opinion as to patents did not parallel Mr.



The Hamilton Pulsar, the very first digital, solid state watch.

Theiss'. Bergey's survey of applying the technology available "hardware" into a watch led him to apply for patents as early as 1967 and 1968. Now with the Theiss-Crabtree (Electro-data) combined with Hamilton, the first cased, no-moving parts watch, and the Pulsar was first marketed. Its TV debut (1970) was on the same program "To Tell the Truth" in which I appeared and also the following week when we all flew down to Corpus Christi for the Texas State Watchmakers Convention.

In the meanwhile the Swiss and the Japanese were experimenting with quartz watches but powering a small motor to drive the traditional hour and minute hands. Longines of St. Imier in Switzerland came up with a vibrating reed indexing a set of wheels while Seiko used a type of magnet-

impulsed pallet to index the escape wheel. Ricoh of Japan also had an analog watch as these were soon to be called by that name, borrowed from the electronics industry. The Ricoh had a step motor with shock device on the rotor-motor.

Meanwhile, RCA also had developed the liquid crystal display in watches, and was soon marketed by the Optel Corp. of Princeton, NJ, very close to the RCA research center from whom they bought the rights to manufacture. This type of display was much heralded since it drew current in the μ A range as compared to the exhausting demands of the LED watches with their limitations in the mA range.

When James Ferguson of Kent University developed the field effect liquid crystal in 1971, this type of display soon eclipsed the LED as well as the dynamic light scattering effect LCD. Dr. Ferguson's new LCD was even more efficient with lower current demands and better visible-contrast.



Analog watch with clear-crystal which also serves as the LC display, providing full LCD potential and numerous services: alarm in local and world time zones, perpetual calendar, chronograph.

The integrated and the sub-miniature circuitry, with its modestly economic demands on energy cells, allowed more services to be supplied within this new little box of wonders. Alarms, calculators, perpetual calendars, world time, musical alarms and even speech announcing the time, could be incorporated. Even electrochromics, a new type of digital display, is now available. With this type of display, colored digits are possible, using metallic oxides instead of liquid crystal.

In electrochromic displays the colored digits become visible as a result of a type of miniaturized plating process, with the particles deposited on an otherwise transparent digit segment base. To disappear, a reverse current is applied and a de-plating process causes the oxides to quickly migrate to another, receptive off-stage surface. By using specific metallic

oxides, certain colors can result.

The limitations of electrochromism as compared to those of the field-effect liquid crystal is that they are too slow to respond and cannot be used for fifth or tenth of a second chronograph mode as in regular LCD's. However, their viewing angle is much greater than that of the liquid crystal display digits currently used.

At the same rate of development, the traditional hour and minute hand quartz watches have kept pace. Since an overwhelming number of people are so used to telling time at a quick glance at the analog dial and hands, these are gaining in popularity. With quartz accuracy, combined with a traditional appearance, high visibility and better cosmetic potential and variety of design, these will become stronger for a while yet.

From the early step motor watches by Seiko, Longines and Ricoh, with their unusual methods of advancing a train of wheels, came Accutron's transfer of its tuning fork from its original use as a chronometric base into a form of vibrating, step motor. Timex's use of the traditional balance and hair-spring into quartz-controlled balance to index the train and in some, worm pinions to reduce the action into readable units of time. These required units of energy multiples greater than the energy-stingy analog set-ups at present.

The first multipolar to bipolar step motors were large diameter magnets. Their energizing coils of wound wire on their stators also drew much of the battery's energy. Today, these step motors are so tiny and their tinier pinions so small, that their permanent magnets are not as large as the head of a small pin. In some, these are molded with a rotor pinion whose pivots and tiny pinion and leaves are molded plastic. In fact so is the rest of the train, the exception being a thin steel sweep-second post when it is included. These revolve, and are housed within plastic plates and pivot holes. The wheels of the train, also plastic, are quite small, yet under magnification appear to have very well-formed teeth and pinion leaves. The potential of using plastic wheels and pinions and pivots is that they can be made smaller, also lighter than metal wheels, and thus potentially with less tax on the energy fed to the step motor coil, prolonging battery life.

Alarms in analog quartz watches are now possible on a completely electronic basis without trip wheels, springs or lever, or the use of an LCD combination. Citizen currently markets such a watch which is thin and attractive. Pulling out the crown to the first of two outer positions and turning it slowly to click into the clockwise position causes the hands to move rapidly until the desired time of alarm has been reached. Pushing the crown back again stops the movement momentarily at the desired alarm time. Then the hands quickly race back to the time of day by themselves, remembering from where they started. Another button arms the alarm or disarms it. This is all part of the built-in memory function of the circuit.



The first Pulsar module with LED

An unusual new development by Seiko now uses a regular analog watch with dial and hands. However, its transparent watch glass is really a liquid crystal display. This thin display, when not commanded, is completely transparent, which allows an unobstructed view of the hour and minute and sweep seconds hands below. The dial is actually the LCD's reflector.

When commanded, the LCD then can cause the various alphanumeric informations to appear. Chronographic, alarm set and time modes, world time in many international cities, perpetual calendar including the day, date and year programmed into the twenty-first century and other informational bits, are also included. All the while, the hour and minute hands below can be seen. If only the time is desired, a command can clear the LCD panel-glass square.

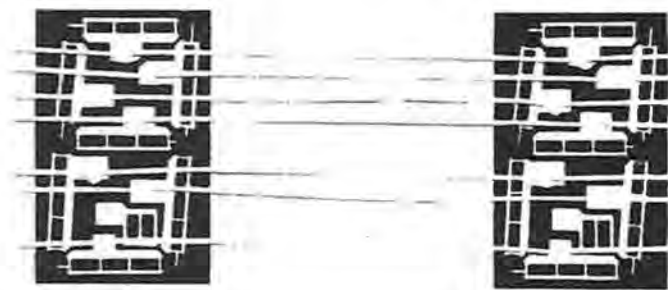
For the young, gadget-minded wearer, the LCD currently offers a myriad of services; games, TV, music with a choice of up to 12 melodies or using the calculator buttons, each emitting a distinctive note to allow the wearer to play his own composition or his version of another, all to the utter joy of battery-manufacturers. Another unit now available comes with a 1500-word memory chip to provide word translations into a selected language.

This brings us to the topic of energy cells as the sophisticated used to call them. Now they're batteries regardless of how they are hooked up on their voltage output.

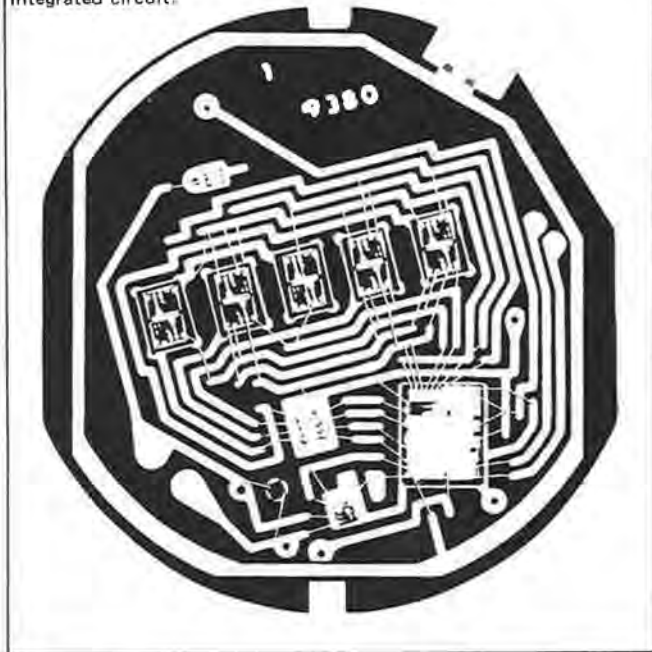
When the first electric watch was introduced, it had to use the only available battery to fit into its confines. This was a hearing-aid battery. The early problems with this high drain cell, a time-leaking energy source, also took a toll from its host with leaks of its corrosive, destroying electrolytes, and very short life.

As electric watches grew more popular, it became good business to engineer their chemistry and reliability to horological needs. Accutron and the transistorized balance motor watches soon brought competitive battery makers to vie for the growing market. The result was a greater variety, improvement in shelf-life, leak proofing and more consistent voltage output. When the LED first began to make its wearers aware that their watches were energy thirsty, makers of these and later makers of LCD watches incorporated photo voltaic cells to replenish the draining energy. Exposing the cells to light caused a production of electrical energy which was designed to either recharge the batteries or run them directly. These worked better in principle than in practice due to the great number of such cells required to raise the voltage to sufficient levels to recharge the batteries. Also, with shirt or coat sleeves and indoor lighting, these never were exposed to the necessary photo energy required to excite these light cells. Their unattractive appearance also required that they be positioned on the watch most wanted by the designer for cosmetic, eye-appealing patterns.

Early Swiss digital display module using light emitting diodes



Enlarged view of the light emitting diodes of early Swiss digital display, showing their connections from the integrated circuit.



The other advances in batteries were the use of silver and divalent silver oxide batteries with its beginning 1.57 voltage in preference to the mercury cell with its 1.35 voltage and poisonous cloak. Later came lithium cells which currently are used in certain watches and still hold great promise for the future.

The future of quartz or electronic timekeeping may not be quartz but some substance, gas or invention, with extremely stable frequencies despite temperature ranges, shocks or age of the material or magnetic influence. Circuitry will be smaller and more sophisticated with more efficiency and reliability.

Plastics will be used more in moderately priced watches and a special new type of plastics, hard, friction resistant will find their way into horological goods. These may not originate in horological laboratories but their very desirable characteristics may lend themselves to use in timepieces.

Displaying the myriads of information will puzzle horological designers as it did when the hairspring made the telling of time to the minute instead of parts of an hour in the late 1600's. Gadgetry may be dismissed by horologists but the tangential spin-off's technology developing the "how-to" will surely benefit future serious timekeeping.

The radio and TV wristwatch are here but require much energy. Upon this probably hinges the future. Should a dynamic, radical discovery in stored electrical energy come to surface, there is no end to the imagination in timekeeping or multiple services within a wrist-worn instrument. Orville Wright is said to have remarked that given enough power, he could fly the kitchen sink—or was it the stove?

With power to amplify services, the watch or multi-service device could pick up signals from the satellites and (no more quartz) pulse the ultra precise time, light up a color TV screen, switch stations, broadcast and translate messages, store memory for command recall.* It may even tell me where I just laid down my glasses.

* Small navigational devices now can pick up visualized signals without resident energy.

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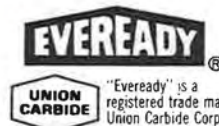
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Quartz Crystal Step-Motor Watch Repair



By Gerald G. Jaeger

Many professional horologists have neglected electronic watch repair. It should be quite evident to those who choose not to, for whatever reason, that their future income will be severely restricted.

What are the requisites necessary to meet the challenge of step-motor watch repair? One must become proficient in diversified areas. An understanding of mechanical concept, as well as an understanding of basic electricity and meter reading, and the tools and equipment to accomplish the task, would seem to be a reasonable beginning.

I have long maintained that it is a far less chore for the mechanical horologist to acquire the skills and knowledge for electronic watch repair than it is for those possessing electronic skills to acquire the necessary mechanical skills. The most difficult task for the mechanical horologist is to realize that his love affair with levers, pinions, and wheels need not be diminished simply because he chooses to get involved in electronic watch repair.

It would be impossible to include a complete step-by-step procedure in meter reading. A quick re-examination of the meter readout and selection area is in order. The prime concern when using the meter is that when you choose a specific range selection in the meter selection area (Figure 1), this dictates the set of numbers in the readout area (Figure 2) which must be used. You must be able to properly read and understand what the volt-ohm meter is telling you. *Horological Times* carried a series of articles on basic electricity, meter reading, and their relationship to electronic watch repair. The articles were printed in the February through July 1982 issues. For those who require further study, this series has been printed in pamphlet form for easy reference. It is available from AWI Central. The learning electronic horologist should also secure "General Service Manuals For Analog Quartz Watches." The Seiko Time Corporation and the Bulova Watch Company have published general repair manuals for analog quartz watches. Each prescribe somewhat different procedures because of the use of different measuring instruments. It is good to understand both methods and including them in your reference library would be a show of good judgment.

Step-motor watch repair begins in the same manner any repair begins. Here is an analytical approach to problem solving, the problem being: why doesn't the watch function properly? The problem must be isolated. Assuming physical damage is not evident after careful examination, this process begins in the electronic portion of the watch.

To accomplish this electronic diagnosis, we must understand the function of the electronic portion of the electro-mechanical watch. The ultimate task of the electronic module is to provide a flow of electrons to the coil at

Figure 1

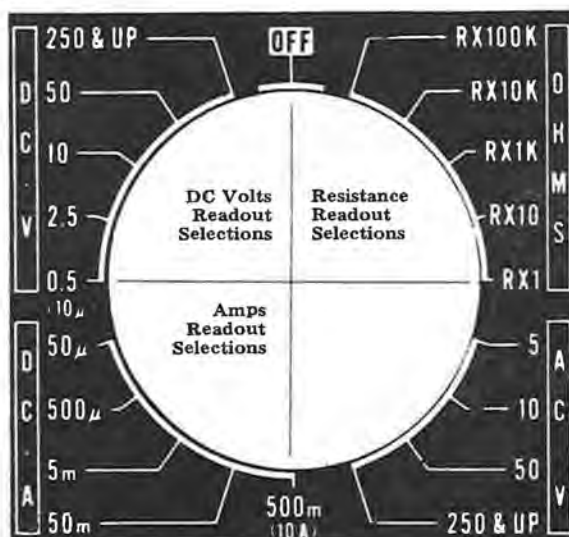
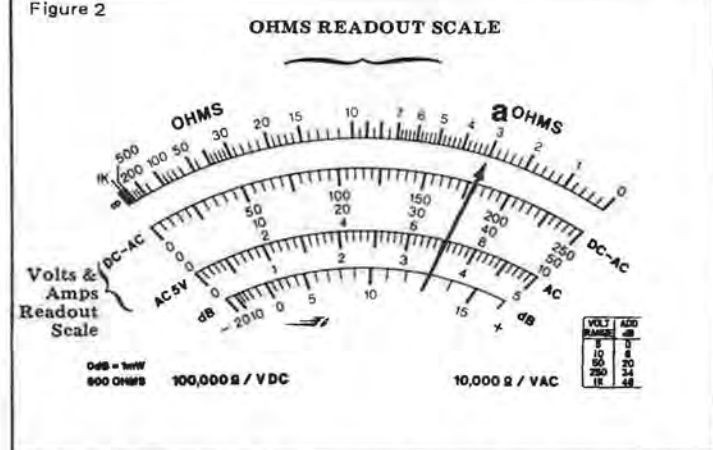


Figure 2

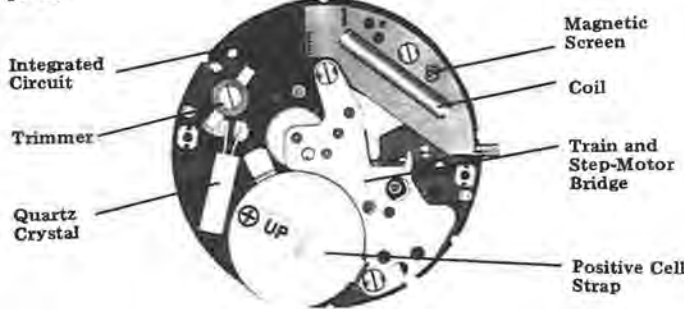


precise intervals and to alternately reverse the polarity of this electron flow. This may seem an oversimplification of the electronic module function, but at the diagnostic stage of repair it is sufficient. Since the step-motor receives its driving from an electro-magnetic field whose power source is a cell or battery, it is obvious we test the power source. This should be accomplished with one of the many cell testers which test cells under load. Your regular VOM or multimeter is not a good instrument to test cells with. Any cell tester which has different selections to test 1.5V and 1.3V cells most likely

has the capability to test under load built into it. Assured we have a good cell it is to be replaced in the module only after cleaning both the positive and negative cell strap or cell connection. Prior to replacing the cell it is well to observe where both cell straps surface themselves on the module. Either the "+" or "-" strap will be hidden once the cell is replaced. We want to be able to test the cell with a voltmeter after the cell is replaced in the module. This is an important test as it assures that we have proper connection of the module to the cell. This accomplished, and since the ultimate function of the electronic module is to provide electron flow to the coil, it is advisable to next test for this.

We must familiarize ourselves with the general placement of all components in step-motor watches. Regardless of the manufacturer, all step-motor watch construction is quite similar. Figure 3 shows a watch manufactured by ESA Industries, Inc., and in Figure 4 a watch manufactured by the Seiko Time Corporation is shown. You will note the similarities, but it is good to also note the variations in component placement.

Figure 3



Carefully seek out the two connecting leads from the IC (integrated circuit) to the step-motor coil. Some are easy to find, whereas others at first search may be difficult. When a person is familiar with step-motor watches, this will not be a problem. In Figure 3 is a movement where the magnetic screen may have to be removed to reach the two leads with our meter probes. Figure 4 illustrates a movement where the leads are readily accessible. These magnetic screens serve an electronic function, but they also act as a protection for the coil. Many of the newer production models have access holes in the magnetic screen for easy testing. I cannot emphasize enough the caution necessary when working with screwdrivers or meter probes in the area of the coil.

Having found the two leads from the IC to the coil, proceed to check the output from the IC. We can do this with either an ammeter or a voltmeter. Set the meter selector on the lowest DC Volts selection (Figure 1) or on the lowest micro-amp (μ A) selection available. It is important to realize the coil is energized at different intervals depending on the watch. All watches with a sweep second hand will receive a signal once each second. Those without a sweep hand could energize the coil once each 5 seconds, and subsequently each 10, 15, 20, and 30 seconds, or once each minute. It is also important to realize that when you apply your meter probes to the aforementioned leads of the coil, you may have a wait for the signal. With your meter leads properly applied, the meter pointer should show alternate negative and positive movement. The frequency of the meter pointer movement will depend on the module design. The intensity of the pointer motion is of little importance so long as it is an alternate negative and positive movement. What has this alternating signal proved? It tells us the electronic module is in good order; it is accomplishing what is intended of it.

The step-motor watch industry has introduced many new innovations over the past two or so years. One of them is the introduction of electronic rate adjustment. Watches with this capability will not have a trimmer. A few years back it was only the most inexpensive watches that did not provide a trimmer. This is not true today and we cannot write off a watch without a trimmer as just another poor timekeeping, cheap watch. This introduction may cause some concern among repair people when making the aforementioned IC output test. Your meter pointer may sometimes register a weak signal immediately followed by a normal signal. The correction factor is stored in the memory portion of the IC, and when a correction is made it will manifest itself by an output signal somewhat different than we have become familiar with. This signal inconsistency will vary from manufacturer to manufacturer, depending on the program they employ to accomplish this automatic correction.

We cannot assume our complete electronic module is functioning because we have yet to test the coil. It is the passing of electrons through the coil which creates the magnetic field which repulses the rotor of the step-motor a step at a time. Most of today's rotors rotate 180 degrees each step. Testing the coil can be accomplished with either an ohm meter or an ammeter. When using an ohm meter we measure the resistance to the flow of electrons through the coil. This resistance is measured in units called "ohms." When measuring coil resistance we cannot have current present in the circuit. In many watches simply pulling the stem to the hand-set position will accomplish this. This is not always foolproof, so for the beginner it is best to remove the cell. You will in time find which method works on what calibres when you become more experienced. Just as certain calibres of mechanical watches require different procedures to accomplish the same thing, so too do electronic watches. You will soon learn that variation in your method of test and the order in which you make the different measurements will be dictated by the construction of the watch.

Courtesy ESA

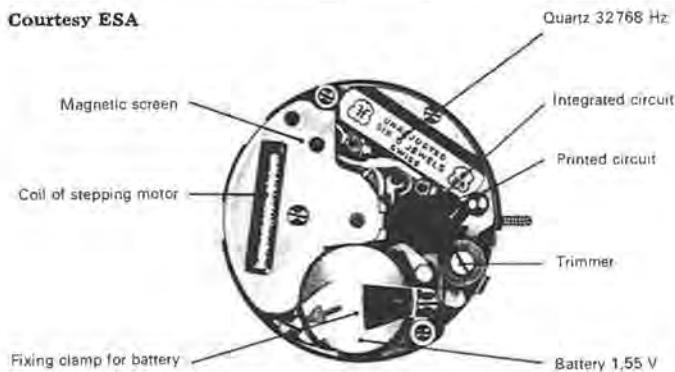
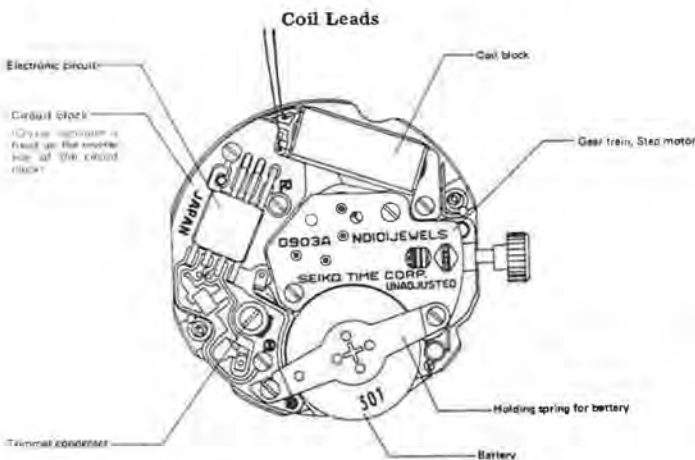


Figure 4



Courtesy SEIKO

When measuring a coil for resistance we should set

our ohm meter selector at a range which will measure 2,000 to 4,000 ohms. The best selection for this measurement would be the RX1K selection (Figure 1). The ohm values on the readout scale (Figure 2) dictate this to be the best selection. At this setting, a coil with a value of 3,000 ohms would register at point A in Figure 2. With experience you will begin to recognize the general resistance ranges that step-motor watch coils fall into. It is good practice to obtain technical bulletins for individual watches whenever possible. Most will give you exact resistance values, current consumption values and lower-operating voltage values.

With repetition of repair and mental alertness you will begin to recognize acceptable measurements without technical bulletins. You will either measure a coil resistance somewhere in the 2K Ω to 4K Ω range or infinity (∞). Infinity is found at the far left of the ohms readout scale in Figure 1. If the resistance value is within the allowable values, the coil is good. If you do not get any pointer movement (∞), your coil is open. An attempt at coil repair is now in order. I will explain this procedure later in this article.

There is another reading other than infinity you could possibly get on an open coil when checking a coil using the ohms measurement method. You could get a very high resistance reading, possibly in the 150,000 Ω (150K Ω) range, or even higher. This also tells us our coil is open. What is taking place, due to the open coil, is that the meter is measuring back into the IC. Some modules will exhibit this tendency. In any event, any ohms reading substantially above the proper reading could very well be an open coil. Some manufacturers construct the electronic module so that the coil can be completely separated. This makes coil-only measurement possible. Most electronic modules will have the coil permanently attached. I would be remiss if I did not point out that 99% of coil failure is due to repairman error, carelessness, or call it whatever you like. Always be wary of any electronic watch brought to you for cell replacement with the old cell missing. This indicates either the consumer or a fast cell outlet has done some unprofessional tampering—and unfortunately, this sometimes happens in the jewelry store.

Another method often used to check a coil is by means of the ammeter in conjunction with a power supply unit attached (see Figures 5, 6, and 7). The ammeter selector should be set in a low microamp range and the meter probes made to contact the two coil leads. If the coil is not open (good) the ammeter pointer will peg to the far right of the readout scale immediately on contact of the probes. This is not the most scientific method to test coils but in practice

it works well. It is actually a continuity test. This test assumes that if a coil has continuity, the resistance of the coil is correct. I generally shy away from tests that rely on assumptions. If you know your equipment and are familiar with the watch, the method is reasonably conclusive.

In the event of an open coil (break in the coil windings), most technical bulletins will advise to either replace the electronic module or the coil only where possible. This would be great but in the real world of watch repair, it is costly impractical to both the repairperson and the consumer. Coil repair presents one of those "no lose" situations. If the repair is facilitated, both the repairman and the consumer will win. If repair is impossible very little time has been lost by the repairperson and we can still resort to replacement of the electronic module or coil if warranted. The ability to repair a coil can result in completing many jobs at a profit where replacement costs would have made the job cost-prohibitive to the consumer. As a matter of fact, it often saves the out-of-pocket cost for an electronic module or coil because of error or careless handling of these components by the repairperson.

Effective coil repair requires an instrument capable of at least 20 power magnification. A mounted binocular type instrument of at least 50 power is even better. We must all be aware this is a new arena in watch repair. To attempt entry into solid state or electro-mechanical watch repair lacking the proper tools is foolhardy. The degree to which you become involved will certainly dictate the extent to which you equip yourself. Using the highest magnification available, we must search the entire surface of the coil for any mar or blemish. The tears and screwdriver gouges will be evident. Many of the coil breakages will not be evident under our much-used 10 power loupe. As in mechanical watch repair, once the problem is found, the solution is relatively easy.

Repair of the coil is achieved by providing a conductive path from one separated portion of the coil to the other. These breaks are most often physical separations with the raw end of the separation exposed. The necessary conductive path is provided by painting the complete area of damage with a conductive paint. I have had better results with conductive paint than with conductive epoxy. The conductive epoxy is also available but its consistency is much heavier than the paint, thus making application more difficult. Conductive paint seems to flow into areas where the epoxy will not. All outer surfaces of the coil have an insulating coating. We must be extremely careful so as not to apply too much conductive paint to the coil. If we overdo it, the coil surface may contact the magnetic

(Continued on page 50)



Figure 5



Figure 6



Figure 7

QUARTZ
 QUARTZ
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 QUARTZ
 QUARTZ
 QUARTZ

The Business of Watch Batteries

By Ewell Hartman, CMW



In 1957, we insisted on calling them cells. There was only one type—a carbon-zinc chemistry that had a poor shelf life, a low amount of energy, and a declining voltage during its service life. Now we permit ourselves to call them batteries. There are about 80 combinations of types (chemistries) and sizes, and some that can deliver a stable voltage for more than five years. We have now been replacing batteries for over 25 years, yet there is a great deal of misunderstanding about their various characteristics and applications. There is confusion about interchangeability and substitutions. There are problems in determining the correct battery dimensions for a particular watch. There are questions about making this part of our business productive and profitable.

CHARACTERISTICS & APPLICATIONS

Mercury batteries were developed to provide greater energy relative to their size (energy density). They also produce a uniform voltage throughout their useful life (flat discharge). While their energy density is excellent, their shelf life is only fair and they have a tendency to "salt" and self-discharge due to the nature of mercury.

Mercury batteries for watches will not likely be perpetuated because of their sub-standard voltage and because of ecological problems with mercury. All of them produced to date are 1.35 volts and low-drain; therefore, they cannot be interchanged with *any* other type watch battery.

Silver batteries quickly became known as an outstanding type for use in watches. They have the excellent energy density qualities of mercury but generally have a longer shelf life and less problems with salting and self-discharging. By changing the chemical that permits conduction (electrolyte) between the positive (cathode) and negative (anode) electrodes, the manufacturer can produce either a low-drain or high-drain battery. (The electrolyte is a part of the separator in Figure 1.) The low-drain battery has a slightly longer shelf life and is a bit less likely to leak over a long period of time. The high-drain battery can produce a high amount of current as needed (pulse).

Since all silver batteries are 1.50 volts, the low and high-drain can be interchanged under certain circumstances. A high-drain battery may be substituted for a low-drain if the dimensions are the same, although it may not last quite as long because its shelf life is a bit less. A low-drain battery may be substituted for a high-drain in an LCD or analog providing the watch does not have a light or musical alarm. (According to Mr. Louis Zanoni of Zantech, a regular alarm will operate properly on a low-drain battery.) An LED watch, on the other hand, requires a high-drain battery to supply sufficient current to light up the display. Substitution of a low-drain battery in a watch with a light or musical alarm would permit the time-keeping function to operate but these special features would not.

Rechargeable batteries for watches are a silver chemistry but are not the same as the non-rechargeable (primary) type. The original objective was to make battery replacement an infrequent repair instead of a routine. Unfortunately, their reliability and longevity proved to be less than expected, and the converting (charging) systems add considerably to the cost and size of the movement.

Perpetuation of the rechargeable battery appears to be questionable considering the continued improvement of the primary battery. In many instances, a high-drain primary silver battery of the same dimensions can be substituted, providing the original is not soldered to the terminals of the movement. This substitution would not, however, recharge.

Lithium batteries are the newest type to be developed for watches. Three different lithium chemistries are currently being marketed, and at least eight other types are under experimentation. The electrolyte in a lithium battery has no water in it (non-aqueous); therefore, the battery has an unusually long shelf life with no leakage problem. Lithium batteries can be produced in either 1.5 or 3.0 volts by changing the chemistry. Unfortunately, these advantages are offset by a very high internal resistance which necessitates that the diameter be quite large for other than low-drain applications. One of the chemistries under experimentation for use as a watch battery uses a *solid* electrolyte. While this battery could only be used in a watch with very low current require-

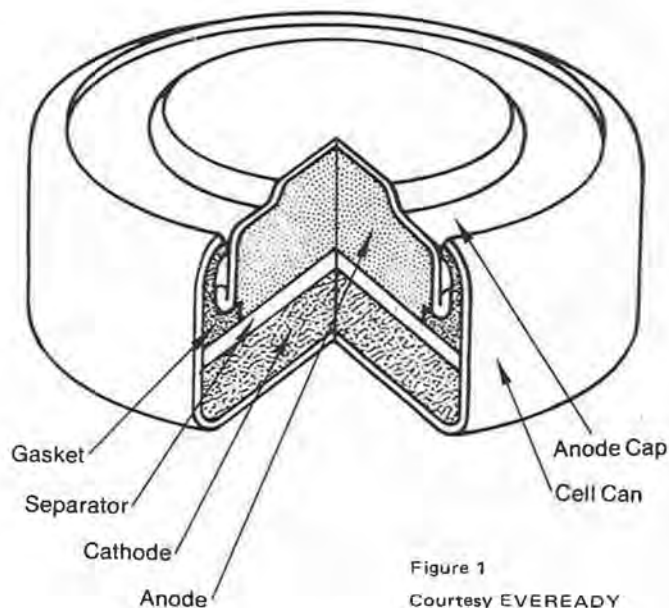


Figure 1
 Courtesy EVEREADY

ments, its shelf life would likely be 15 to 20 years! The demand for lithium batteries has been somewhat disappointing to most battery manufacturers. Reduction of the size and cost of this new battery will likely increase the demand for it.

Only a small number of "standard" diameter, 1.5 volt, low-drain lithium batteries are being marketed at this time. They can be interchanged with the same dimension silver batteries. Generally, 3.0 volt lithium ("BR" and "CR") batteries can be interchanged. The "BR" chemistry has a slightly lower internal resistance and a more constant voltage during its service life; for this reason, some watch and battery manufacturers do not recommend interchangeability. Other manufacturers say that the differences between the two chemistries are not sufficient to create any performance problems.

Alkaline batteries are now flooding the market. While their cost is quite low, their energy density is also very low. They are similar to the original carbon-zinc batteries, in that their voltage declines (sloping discharge) during their service life. These batteries will not supply the proper voltage for a satisfactory period of time when used in a watch.

Alkaline batteries should *always* be replaced with a silver battery of the same dimensions. While all alkaline batteries are high-drain, the replacement can be low-drain if the watch does not have a light, musical alarm, or LED display.

REPLACEMENT PROCEDURES

Testing the battery should be the first step in determining the cause of an electronic watch malfunction. Most battery manufacturers recommend the use of a special meter that places a drain on the battery under test, according to its electrolyte (low or high-drain). This test, according to the engineers, shows whether or not the internal resistance of the battery has increased sufficiently to prevent the necessary current flow under a load. They point out this resistance tends to increase with age and degree of discharge. The engineers readily admit that the drain placed on the battery under test should be different for the various sizes as well as the different chemistries and applications. For this reason, the loads used in the testers are a compromise and are different on almost every tester available, ranging from 250 to 50,000 microamps!

Mr. Tom Broderick, of Varta, believes that testing a battery under load is more beneficial for research purposes than for practical use in a store. A number of watch manufacturers also recommend testing watch batteries with a conventional 20,000 or 50,000 ohms-per-volt multi-tester, and rejecting any battery that tests even a few hundredths under its nominal voltage. A 20,000 ohms-per-volt tester, for example, will place a load of 75 microamps of current on a 1.5 volt battery under test—this is at least ten times the load the average quartz watch will place on it during normal operation! If the battery being tested is subject to pulses, such as light, musical alarm, or LED readout, the watch itself will readily demonstrate if enough current is being produced to properly supply these special needs.

All testing of batteries should be of short duration. This is especially true when using a tester that places a substantial drain on the battery. It may be advisable to test *all* new batteries on a "low-drain" setting or with a conventional multi-tester, to conserve the battery's energy. Exceptionally small batteries that are used in high-grade ultra-thin watches have a very limited capacity and should be tested *only* on a high-resistance multi-tester.

Selection of the correct replacement battery protects the image and profits of the watch manufacturer, the store owner, and the watchmaker. A battery that is too thick may damage the movement or module, one that is too small may not make good electrical contact. The wrong voltage or drain may cause performance problems. Unfortunately, we determine the type and size of the replacement battery by reference to the one that is in the watch. If, for any reason, that battery is not the correct one, the replacement may be incorrect perpetually. If the watch, or new movement, is re-

Figure 2

AWI BATTERY NUMBER SYSTEM

Compiled and Edited
by
Ewell D. Hardman, CMW

Even Numbers—Low Drain
Odd Numbers—High Drain
S—Silver Oxide
M—Mercury
L—Lithium
A—Alkaline
R—Rechargeable

BATTERIES OF THE SAME TYPE (CHEMISTRY) AND DRAIN ARE GROUPED TOGETHER

BLOCKS WITH MORE THAN ONE MANUFACTURER'S NUMBER SHOW THEIR CURRENT NUMBER FOR THAT BATTERY AT THE TOP OF THE GROUPING.

SELF-STICKING LABELS ARE SUPPLIED FOR ALL EXISTING AWI BATTERY NUMBERS AS WELL AS SOME FUTURE ONES.

MARK THE AWI BATTERY NUMBER IN THE CELL COMPARTMENT OR ON THE BATTERY STRAP TO ELIMINATE THE NEED TO REFER TO ANY CHART WHEN REPLACING THE BATTERY IN THAT WATCH IN THE FUTURE. Example: AWI 522

QUESTIONS ABOUT BATTERIES WILL BE ANSWERED BY AWI, BY CALLING (513) 561-3838 (24 hour recording "Hot Line" for use by members).

THIS CHART WILL BE REVISED PERIODICALLY. CURRENT BATTERY INFORMATION WILL BE PRINTED IN THE "HOROLOGICAL TIMES" AS AVAILABLE. THIS NUMBER SYSTEM MAY BE REPRODUCED BY PERMISSION FROM THE AMERICAN WATCHMAKERS INSTITUTE.

The American Watchmakers Institute has assigned these watch numbers to watch batteries according to their chemistry, drain, voltage, and dimensions.

Some manufacturers recommend specific brands for their watches for various reasons. These recommendations may be followed by consulting the watch company on a direct basis. This in no way increases the value of the AWI Battery Number System.



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ceived without any battery, selection of the correct battery is even more difficult. While a small percentage of new movements and watches have battery dimensions or numbers marked on them, the majority of them need a universal marking. The American Watchmakers Institute (AWI) Battery Number System (BNS) (Figure 2) is the logical answer to this need. This number, marked on the movement or case, would identify the correct chemistry, drain, voltage, and dimensions. In addition, this system provides the most complete and accurate interchangeability information available. Current information is printed monthly in the *Horological Times*. Mr. Gilbert Merritt, of Eveready, commented recently, "We think you are doing a great thing for the industry." We believe we can do more—with the help of our friends in manufacturing and distribution.

There are instances in which the battery that is in the watch has a brand name that is not listed in the AWI BNS. In that event, look for the number under any brand that has the same number and/or letter series, as some number systems are derivatives of other systems. For example, "Gold Peak" uses the last two digits of "Eveready" numbers while "Saft" prefixes an "S" or "M" to "Renata" numbers. It is easy to confirm the selection made in this manner by measuring the original battery with a vernier caliper and by noting the drain requirements of the watch.

In the event a watch or movement has no battery, the replacement must be selected by measurement and drain determination only. The diameter can be obtained by measuring the battery compartment in the movement, and the height by using a small ball of Rodico® as discussed in an earlier "Battery News" column.

Replacement of a battery requires checking the contact points for dirt or corrosion. It is advisable to always clean them with a leather buff stick, either dry or dipped in alcohol. While an eraser may be necessary if corrosion is present, it should not be used at other times because the particles often drop into the mechanical part of the movement and its abrasiveness can remove the special conductive plating that is on some contacts. If a watch has two batteries, both should be replaced at the same time as there is no means of determining the remaining life in the one that has full voltage. After the case is closed and the watch has been set to correct time, always verify that it is running by observing the hands. If the watch has no second hand, observe the minute hand with a loupe, remembering that some dress-type watches advance as infrequently as once each minute!

Storage of watch batteries should be in a cool, dry area as heat and moisture will shorten the shelf life of any battery. Some watchmakers store their batteries in a refrigerator. While this definitely retards chemical action within the battery, it is not recommended by the majority of manufacturers.

Shelf life varies with the chemistry and dimensions of a battery (Figure 3). It is important to date the battery packets and to keep the stock rotated. According to Longines, silver batteries that are very thin and/or large in diameter lose more of their capacity each year than thick or small diameter batteries.

Small repair shops may feel they can stock only a minimum number of batteries. The substitution chart (Figure 4) in conjunction with the BNS booklet will be helpful in determining which batteries to purchase.

Charges for battery replacement must take into consideration the cost of the batteries, inventory investment and turn-over, labor, risk, and warranty expense. Most shops use a flat-rate charge for the installation of a single silver or mercury battery. Charges for the second battery, in the same watch, are generally substantially less since the labor remains the same.

Special prices must be scheduled for limited-production batteries such as those used in the original Hamilton electric watches, the special batteries used in very thin high-grade watches, the very large cells used in the original Pulsar LED watches, and the new 3.0 volt lithium batteries. While some watchmakers and jewelers reduce the price for batteries that are installed by the customer, others feel this practice is not good as we are primarily selling service.

Warranty of watch batteries is considered necessary by some stores because about 5% (according to Longines) of all silver batteries fail in use due to internal problems (self-discharge). Most shops do not, however, guarantee batteries that are replaced in watches that have high-drain functions such as a light, musical alarm, or LED readout. While some feel that a warranty builds good customer relations, others feel that it is unnecessary. It is a good practice to mark the date of installation on all batteries for future reference, whether or not a warranty is involved.

THE FUTURE

The development of batteries for watches has been commendable. Twenty-six years ago, Eveready designed and produced the first watch battery. Mr. Merritt, of that company, sees the watch battery market as continuing to progress and grow but with more price stabilization. Mr. Tom Irwin, of Ray-O-Vac, points out that watch manufacturers continue to "encourage" development as they impose ever-increasing

Figure 3

SHELF LIFE GUIDELINE FOR WATCH BATTERIES	
Mercury	1 Year
Silver, High Drain	2 Years
Silver, Low Drain	
Very Thin	2 Years
Standard	3 Years
Lithium	5 Years

Figure 4

SUBSTITUTIONS FOR WATCH BATTERIES	
Mercury	No substitution may be used
Silver, High Drain	May use silver, low drain if no light, musical alarm or LED
Silver, Low Drain	May use Lithium, low drain, (1.5 volt). May use silver, high drain.
Rechargeable	May use silver, high drain if original is not soldered in (substitute will not recharge).
Lithium, 1.5 Volt	May use silver, low drain. May use silver, high drain.
Lithium, 3.0 Volt	May interchange "BR" and "CR" (Not recommended by all manufacturers).
Alkaline	Advise silver, high drain May use silver, low drain if no light, musical alarm or LED.

1. Dimensions of substitution battery must be correct.
2. Hearing aid and photographic batteries are never acceptable substitutions.

standards on the battery manufacturers. He sees their specifications, in the future, as requiring more batteries that are very thin.

Many battery companies that have expressed disappointment in the lithium battery market believe this chemistry holds a great deal of promise for the future. Lithium batteries may, someday, make problems like leaking, salting, and shelf life cease to exist.

Millions of watches are being produced every year that will need battery replacements for an indefinite period of time. Many individuals and firms are trying to build a battery replacement business without adequate equipment, proper training, sufficient inventory, or essential information. As a result, they are encountering problems that are costly to their image and to their profits. Two very large national retail firms have recently decided to replace batteries only in products they have sold, presumably because of these problems. The watchmaker, through AWI, has the opportunity to keep up-to-date on all phases of battery technology. This knowledge, along with professional skill, places us in an advantageous position to continue to build our image and to profit from this new business. Batteries are big business, and AWI is committed to help the watch and clock industry make it a good business!

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Our Readers Write

I am returning the books that you so kindly sent to me. They answered my questions about the suspension spring clock very adequately.

The AWI has always been so kind and helpful with their services and your magazine is so interesting and informative that hopefully I will never cancel my membership in the AWI.

I want to thank you again for all your help and cooperation and wish you continued success.

Milton Shopnick
Oak Park, Michigan

I just would like to take this opportunity to congratulate you and your staff for the excellent job you are doing!

Michel Mallet
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Henry B. Fried, CMW, CMC, FAWI, FBHI

Quartz In A Clock

Q I'd like to make a comment on a note in your letter to me dated January 8, 1982. I had asked if you knew of a quartz movement which would swing a long pendulum of 39 inches or more. At that time you said that you had not heard of such a movement. I have now received a letter from Verband Der Deutschen Uhrenindustrie E. V. of Germany, advising me that such quartz movements are made by KB-Uhren GmbH & Co, postfach 200, 7210 Rottweil, Germany.

The following question is of great importance to me. I am very old and am using my remaining few years to build clock cases that I hope will give someone pleasure to own someday. Thus, it is important to me to know that the movements that I fit will continue working for many years after I cease to "tick."

Quartz movements, with their accuracy and battery-operated convenience, make them attractive; however, I am aware that the mechanical movement has proven that, with care, it will operate reliably for over 200 years.

Therefore, my question is: Can such a long service life be expected from the simple quartz movement? I realize that the quartz movement is cheap to replace, but it could well be that the clocks I make may fall into hands that

have no understanding of such replacement.

In your hoped-for reply, I would appreciate your comment as to which movement you feel would be the better choice, spring wound or weight driven.

The very great difference in prices of mechanical clocks also troubles me. Prices range from approximately \$175 to over \$2,000—a price that is now beyond me. Would you be so kind as to recommend a movement and maker?

I do most sincerely appreciate your very valuable advice.

R. Elton
Ballina, N.S.W., Australia

A In my opinion, if you desire to make a clock that will serve as an heirloom, you use a mechanical timepiece. To provide a quartz clock movement would indeed be one that would keep much better time, but the pendulum will be a fake and all will know that it served no useful purpose except to "catch the eye."

While it is possible for a quartz movement to last a very long time, it is also possible that in years, even a minor ailment will cause the whole clock to

become utterly useless as parts or repairs will be beyond the ken of any but the most knowledgeable and dedicated electronics craftsman. Also, in only a few years, the technology of quartz or other types of electronic timekeeping will make current quartz clocks appear uselessly old. Therefore, your clock, if it is to remain acceptable in a household, must have some history of mechanical timekeeping associated with the old days of the pendulum.

Movements, of course, run in various grades. Some German movements and some French and English are well made and should last very long—it depends on what you pay and what your budget is for such a project. My opinion leans very much towards a weight-driven clock. Spring-driven clocks have a varying amount of power and eventual wear. Weight-driven requires always the same weight and is designed for that purpose. It is also more elegant and a better timekeeper because the weight is always supplying the same power to the timing mechanism.

I wish you success in your projects and I think that they will be a beautiful monument to your skill and dedication.

(Continued on page 56)

QUARTZ CHIMING MOVEMENTS

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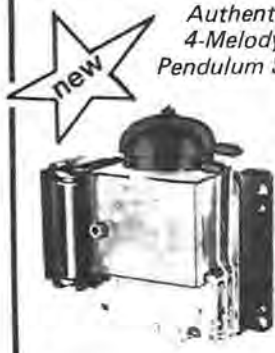
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ESA 961.001 Quartz Analog Movement



6¾ x 8 L size
3.5 mm thickness

\$11.95

Battery Included

(Dial has to be shortened, before installation.)

Replaces Font 60 and Font 69

Other available movements:

102.001	3¾ x 10L	\$ 29.35
301.001	5½ x 6¾ L	18.25
950.001	7¾ L	36.60

Y 480 A Quartz Analog Movement



6¾ x 8L size
2.8 mm thickness

\$14.00

Battery Included

This movement used by Pulsar.

Other available movements:

Y 481	6¾ x 8L, sweep second	\$ 17.50
Y 590	5½ x 6¾L	17.50
Y 561/571	11½ L, sweep second	17.50
Y 572	11½ L, date	20.00
Y 573	11½ L, day/date	20.00



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The Future of LCD Watches



By Robert A. Nelson, CMW, CEWS

What is the future of this watch?" was the question asked at the Emerald Inn Hotel, Corpus Christi, Texas in June, 1970 where the "Mystery Watch With No Moving Parts" was first shown to a Watchmakers and Jewelers State Convention. Today, 13 years later, after millions of these watches have been produced, the same question is asked.

Watchmakers and jewelers who attended that historical meeting were very skeptical about the future of such a watch. "Who will pay \$1200.00, or half that much, for a watch where you must press a button to see the time?" The general opinion was: "This is only a passing fancy." The watch introduced was the Light Emitting Diode (LED) Pulsar, developed and shown by Mr. George Theiss and Mr. Willie Crabtree of Electro-Data Corporation and the Hamilton Watch Co.

The skeptics were correct in their appraisal of the future of this watch. What they did not realize was that this was just the beginning of the greatest revolution in timekeeping for the common man since pocket watches became available to the general public about two centuries earlier.

The LED was soon to be replaced by the Liquid Crystal Display (LCD) watch. The objections to pushing buttons to see the time and the short battery life had now been overcome. In spite of the fantastic developments which followed, there are still skeptics who believe that the solid state watch with no moving parts is a passing fancy. They believe the quartz analog "stepping motor" (QSM) watch will ultimately replace the LCD.

"Not so." says this writer. The LCD will be with us a long, long time. Ten years of history has shown that manufacturers will overcome the objections of the public to their product. The first major change was from the light-scatter-

ing type of display to the field-effect type generally in use today. This change made the digits easier to read. It also made them respond faster, making a split second chronograph possible. Battery life was extended because less current is needed to operate this display.

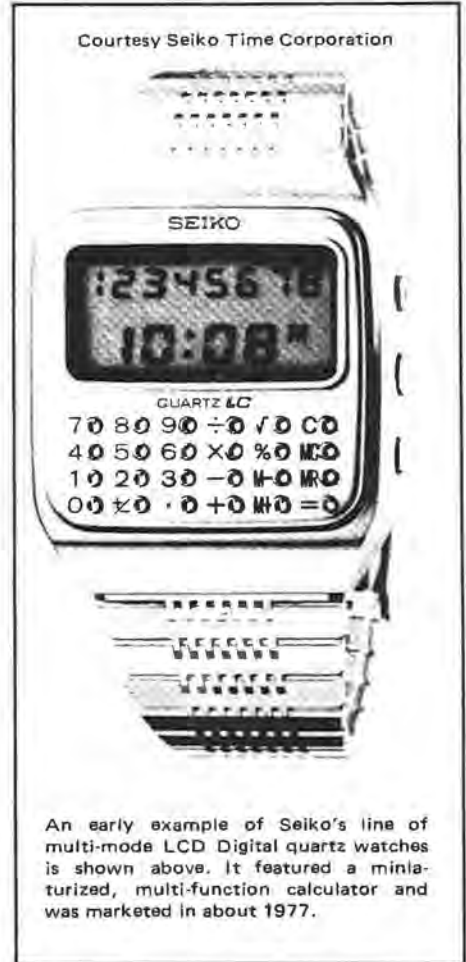
The problem of seeing the time in the dark was overcome by the addition of a tiny light bulb, or the constant illumination provided by a tube in which phosphorus material glows due to the radioactivity of tritium gas sealed inside.

Problems of leaking or sticking push buttons are reduced by making displays which constantly show more information, thereby decreasing the need for using them.

The liquid crystal display itself was a cause for concern in early models. The life expectancy was estimated to be about five years. New technology in manufacturing and sealing the edges has made an indefinite life expectancy possible. Unlike the light-emitting diode which was developed about 20 years ago, the principle of liquid crystal has been known for almost 100 years, and has actually been in use for almost 50 years.

Traditional watchmakers have had some difficulty in adapting to the repair procedures needed for LCD watches. Some have been frightened by the suggestion that they must be knowledgeable about electronics, and are not accustomed to using meters. However, they are gradually learning that the most common problem is due to poor electrical contact, which can be easily corrected. Careful examination, a few simple tests with a meter, and some good common sense will usually locate the problem. After the problem has been located, the repair is generally mechanical, which is the watchmaker's expertise.

Some of the more stable manufacturers make replacement displays avail-



able and are assembling their modules with screws so replacement is quite simple. Quartz crystals are readily available from many sources, and their replacement is generally quite easy. These quartz crystals, and the canisters in which they are mounted, are made more durable than in early models. Durability of the entire module is improving and will continue to do so.

LCD watches offer unlimited possibilities in the functions they can perform. Adding more digits, letters and symbols to the display is relatively easy to do. Integrated circuit technology, which provides the "brain" for electronic watches, is advancing faster than the applications can be utilized. Perpetual calendars were the first addition to telling the time, after which came the chronographs. Hourly beeping signals and alarms became standard. Eventually musical alarms replaced the beeps. Calculator and video game watches have come and gone. Present models make it possible to program appointments for the day, including telephone numbers and printed messages. Sports timers and racing watches may be programmed for an entire game or race. Next will be watches in which events for an entire year may be programmed, which will mean no more missed birthdays or anniversaries! Computers, which have been reduced from room size, to refrigerator size, to typewriter size, may eventually be reduced to watch size.

Several talking watches have been produced in the experimental stage. Talking alarm watches are on their way, followed by talking reminders of appointments. "Meet Mr. Smith in his office," "Pick up Johnny at school," "Take your medicine now," may be heard throughout a busy day. You may be awakened by: "Remember Ann's birthday today."

A question which has not been resolved is whether wearers will prefer digit displays over analog displays. The United States market shows preference for analog, while the worldwide market is growing faster in digit displays. Several LCD's which show hands instead of digits have been on the market. Until recently, however, they were usually more expensive than digital models. Timex has now broken that barrier. Analog dials can usually be made more attractive than digit displays, but that may also change with newer developments in color LCD's. Perhaps the time will come when, by pressing a button on your watch, you may select a color appropriate to your clothing that day, or perhaps to fit your mood. A sensing device may be incorporated in your watch which will detect your mood and change the color accordingly,—a "blushing" watch.

TV watches are presently available. However, they require a receiver to be carried in the pocket. How long will it be until the entire set is incorporated into the watch? Perhaps the Dick Tracy two-way wrist TV set.

With the developments in the science of bio-feedbacks, LCD watches may become monitors of many body con-



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has the look of an analog with the accuracy and
price of solid state. This silver-tone bezel and dial are
integrated with a matching band.

Courtesy Timex Corporation

ditions. Pulsemeter watches are presently available, although some manufacturers make disclaimers about their reliability. Will blood pressure watches be far behind? Suggestions have been made that certain conditions detectable on the surface of the skin may be indications of possible heart problems. Imagine the time when your watch might say, "See your doctor, you may be having heart problems." Someday a lady may wear a watch which will indicate when she "has a headache," or perhaps better, when she does not.

The phenomenal reduction in the cost of the LCD watch will be a contributing factor in its future. I recently bought a complete LCD watch, in a metal case, with a metal band, hanging on a

rack in a bubble pack in a hardware store for \$1.95! Such ridiculous prices are usually due to a manufacturer dumping excess inventory, or the result of bankruptcy. However, the fact is that anyone can own an accurate timepiece for the cost (according to today's economy) of about 1/10th of the "Watch Which Made The Dollar Famous" of 50 years ago.

What is the future of the LCD watch? It is here to stay.

Why? Because of the almost unlimited versatility it offers, and the low cost.

Does this mean that all watches will become the throw-away type and there will be no more costly watches to sell or service? No, unless human nature
(Continued on page 40)

AWI's New Microfiche Series

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The AWI Microfiche Series is now ready for distribution to AWI members only. Fiche in this system will be of the 48x magnification type; this has somewhat become the standard in our industry. The AWI Series will not only aid in parts and movement identification, it will also contain "how to" technical information for servicing Pulsar, Ronda, Ricoh, Girard Perregaux and Mido and Borel watches. Also included in the AWI Series will be general information on the repair of quartz digital and analog watches.

Through the cooperation of Rudolf Flume, one of Europe's important suppliers of horological parts, tools and supplies, the Series will include more than 200 trademarks compiled and published in the Flume catalogs. These trademarks will aid in the identification of a large majority of manufacturers from the international horological community.

The AWI Series consists of 10 sheets of film. It will be a welcome addition to the microfiche already available for the horological industry. It is available to AWI MEMBERS ONLY for \$8.50, postpaid, for the entire series. Contact AWI Central, P.O. Box 11011, Cincinnati, Ohio 45211.

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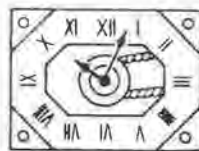
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The **ESSENCE OF CLOCK REPAIR** is profusely illustrated with drawings and photos by the author as well as others. It is printed on over 200 pages of easy-to-read 8½x11-inch stock and hard bound with a durable cloth cover. Published by the American Watchmakers Institute Press, the book sells for only \$19.95. Advance copies are limited to the first 200 orders received. They will be processed on a first-come basis with AWI members given preference.

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- Low current consumption and noiseless operation
- Kienzle transducer system—Bipolar 180° step-angle
- Self-starting and service-free



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- Movement size: 5" x 6 5/8" x 2 1/2"
- Choice of Westminster, Birn-Barn or Bam strike.
- Night-time volume reduction-volume control
- Front controls—can be mounted to wall.
- Operates on a single "C" cell. (4 "C" cells for chime mechanism.)
- High precision quartz crystal
- Kienzle transducer system. Bi-polar 180° step-angle
- Pendulum length: up to 42 1/2" from center shaft to tip of pendulum
- Self-starting and service-free

QUARTZ
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Gate Times...

FOR QUARTZ ANALOG WATCHES

The following information is provided by Portescap U.S., 6 Ohio Drive, Lake Success, New York, NY 11042. The testing method and display time pertains particularly to their M-90 Vibrograph. The "motor runs every seconds" or "gate time" is valuable information for whatever piece of equipment you may have.

ANALOG QUARTZ TESTING INFORMATION USING M-90 VIBROGRAF					ANALOG QUARTZ TESTING INFORMATION USING M-90 VIBROGRAF						
		Testing Method		Testing Method				Testing Method		Testing Method	
Calibre of Movement	Gate Time Motor runs every seconds	Acoustic - Quartz Level Set red LED to 32768HZ Display time will be 2 seconds automatically. Use left sensor. green synchro light - on steady.	Inductive - Motor Level Set red LED to 2-10-12 -20-60 (see below) Use left sensor. green synchro light - will flash with motor pulse	Display Time	Calibre of Movement	Gate Time Motor runs every seconds	Acoustic - Quartz Level Set red LED to 32768HZ Display time will be 2 seconds automatically. Use left sensor. green synchro light - on steady.	Inductive - Motor Level Set red LED to 2-10-12 -20-60 (see below) Use left sensor. green synchro light - will flash with motor pulse	Display Time		
<u>ESA/ETA/PHF</u>					<u>BULOVA</u>						
101.001	60	Yes	Yes	60	242	1	Yes	Yes	2		
102.001	30	Yes	Yes	60	243	1	Yes	Yes	2		
361.001	10	Yes	Yes	10	245-246	1	Yes	Yes	2		
536.111	1	Yes	Yes	2	262-263	1	Yes	Yes	2		
870.101/111	1	Yes	Yes	2	266	1	Yes	Yes	2		
923.031	20	Yes	Yes	20	280	1	Yes	Yes	2		
924.001	20	Yes	Yes	20	2440	5	Yes	Yes	10		
926.311	2	Yes	Yes	2	2470	12	Yes	Yes	12		
935	1	Yes	Yes	2	2480	5	Yes	Yes	10		
940.031	5	Yes	Yes	10	2500	10	Yes	Yes	10		
940.101/111	1	Yes	Yes	2	2562	1	Yes	Yes	2		
944	1	Yes	Yes	2	2577	5	Yes	Yes	10		
950.001	5	Yes	Yes	10	2640	20	Yes	Yes	20		
951.101/111	1	Yes	Yes	2	2650	4	Yes	Yes	10		
952.031	5	Yes	Yes	10	2681-82	1	Yes	Yes	2		
952.101/111/121	1	Yes	Yes	2	2690	5	Yes	Yes	10		
954.031	5	Yes	Yes	10	2691	1	Yes	Yes	2		
954.101/111	1	Yes	Yes	2	2692	1	Yes	Yes	2		
955.031.431	5	Yes	Yes	10	2703	1	Yes	Yes	2		
955.101/111/121	1	Yes	Yes	2	2710	30	Yes	Yes	60		
956.031	5	Yes	Yes	10	2783	1	Yes	Yes	2		
956.101/111/121	1	Yes	Yes	2	2792	1	Yes	Yes	2		
959.001	5	Yes	Yes	10	2680	5	Yes	Yes	10		
960.111	1	Yes	Yes	2	2732	1	Yes	Yes	2		
961.001	10	Yes	Yes	10	2742	1	Yes	Yes	2		
961.101	1	Yes	Yes	2	2750	20	Yes	Yes	20		
963.111/121	1	Yes	Yes	2	2810	20	Yes	Yes	20		
963.112/113/123	1	Yes	Yes	2	2900	1	Yes	Yes	2		
965.001/0010	10	Yes	Yes	10	<u>SEIKO</u>						
965.002	10	Yes	Yes	10	14A	10	Yes	Yes	10		
965.101/111/121	1	Yes	Yes	2	16A	2.5	Yes	Yes	10		
965.102/112/122	1	Yes	Yes	2	43A-4303A	1	Yes	Yes	2		
977.001	5	Yes	Yes	10	47A	2.5	Yes	Yes	10		
978.001	20	Yes	Yes	20	0845A	1	Yes	Yes	2		
979.001	20	Yes	Yes	20	0903A	1	Yes	Yes	2		
999.001/061/401 451	20	Yes	Yes	20	1320A	1	Yes	Yes	2		
999.301/351/361	20	Yes	Yes	20	2320A	20	No	Yes	10		
9180/9181	1	Yes	Yes	2	2633	1	Yes	Yes	2		
9182/9183	1	Yes	Yes	2	3400	1	No	Yes	2 or 10		
9220	5	Yes	Yes	10	4325A	1	Yes	Yes	2		
9222/9225	5	Yes	Yes	10	4633A	1	Yes	Yes	2		
9241	1	Yes	Yes	2	5931A	1	No	Yes	10		
9361/9362	1	Yes	Yes	2	6020-6030	10	No	Yes	2 or 10		
					7123	1	Yes	Yes	2		
					7564A	1	Yes	Yes	2		
					7813A	1	Yes	Yes	2		
					8223A	1	No	Yes	2 or 10		
					9700	10	No	Yes	10		

* Yes - means you can use this testing method.
 No - means you cannot use this testing method.

ANALOG QUARTZ TESTING INFORMATION

USING M-90 VIBROGRAF

ANALOG QUARTZ TESTING INFORMATION

USING M-90 VIBROGRAF

Testing Method		Testing Method		Testing Method		Testing Method	
Calibre of Movement	Gate Time Motor runs every seconds	Acoustic - Quartz Level Set red LED to 32768HZ Display time will be 2 seconds automatically. Use left sensor. green synchro light - on steady.	Inductive - Motor Level Set red LED to 2-10-12 -20-60 (see below) Use left sensor. green synchro light - will flash with motor pulse	Calibre of Movement	Gate Time Motor runs every seconds	Acoustic - Quartz Level Set red LED to 32768HZ Display time will be 2 seconds automatically. Use left sensor. green synchro light - on steady.	Inductive - Motor Level Set red LED to 2-10-12 -20-60 (see below) Use left sensor. green synchro light - will flash with motor pulse
SPD PRECISION			Display Time	CITIZEN			Display Time
Y331	10	Yes	Yes 10	* 1000	20	Not	Yes 2
Y334	2	Yes	Yes 2	1100	1	recommended by	Yes 2
Y371	1	Yes	Yes 2	1200	1	calibre	Yes 2
Y405	1	Yes	Yes 2	1250	1	manufacturer.	Yes 2
Y432	10	No	Yes 10	* 1300	20		Yes 2
Y480	10	No	Yes 10	1400	1		Yes 10
Y481	1	No	Yes 10	1410	1	M-90 Vibrograf Quartz	Yes 10
Y513	1	No	Yes 10	1430	1	Timer will test all	Yes 4
Y56/57	1	No	Yes 10	7100	1	of these calibres	Yes 2
Y590	10	No	Yes 10	7302	1	using the acoustic	Yes 2
Y642/643	1	No	Yes 10	7500	1	method.	Yes 2
				7530	4		Yes 2
				7920	1	But, once again,	Yes 2
				7930	1	Citizen does not	Yes 2
				7950	1	recommend this	Yes 2
				7980	1	method.	Yes 2
				* 8300	1		Yes 2
				8500	1		Yes 2
				8550	1		Yes 2
				* 8900	4	Combo.	Yes 2
				* 8910	4	LCD/	Yes 2
				8920	1	Analog	Yes 2

Calibre manufacturer recommends using only inductive testing method for all Citizen Analogs.
Also recommends capacitive pickup method for Citizen LCD watches.

* These calibres give a one second electronic signal to the inductive sensor for measurement.

** Yes - means you can use this testing method.
No - means you cannot use this testing method.

* Yes - means you can use this testing method.
No - means you cannot use this testing method.

Testing Method		Testing Method		Testing Method		Testing Method	
Calibre of Movement	Gate Time Motor runs every seconds	Acoustic - Quartz Level	Inductive - Motor Level	Calibre of Movement	Gate Time Motor runs every seconds	Acoustic - Quartz Level	Inductive - Motor Level
PULSAR				RHONDA			
Y432	10	No	Yes 10	HQ 372,73,75,77	1	Yes	Yes 2
Y433	1	Yes	Yes 2	671	60	Yes	Yes 60
Y468	1	Yes	Yes 2	672	5	Yes	Yes 10
Y469	1	Yes	Yes 2	871	60	Yes	Yes 60
Y480	10	No	Yes 10	872,873,875	1	Yes	Yes 2
Y481	1	No	Yes 10	1071,1073,1075	1	Yes	Yes 2
Y51 series	1	No	Yes 10	1175	1	Yes	Yes 2
Y541	1	Yes	Yes 2	1377	1	Yes	Yes 2
Y55 series	1	Yes	Yes 2	3572	10	No	Yes 10
Y56 series	1	No	Yes 10				
Y590	10	No	Yes 10	PIAGET			
Y642	1	No	Yes 10	7P-7P2 (4 MHz)	12	No	Yes 12
Y643	1	No	Yes 10	8P	20	Yes	Yes 20
				Le Coultre 602-601.1	10	Yes	Yes 10

* Yes - means you can use this testing method.
No - means you cannot use this testing method.

(Continued from previous page)

ANALOG QUARTZ TESTING INFORMATION USING M-90 VIBROGRAF					ANALOG QUARTZ TESTING INFORMATION USING M-90 VIBROGRAF				
Testing Method			Testing Method		Testing Method			Testing Method	
Calibre of Movement	Gate Time Motor runs every seconds	Acoustic - Quartz Level Set red LED to 32768HZ Display time will be 2 seconds automatically. Use left sensor. green synchro light - on steady.	Inductive - Motor Level Set red LED to 2-10-12 -20-60 (see below) Use left sensor. green synchro light - will flash with motor pulse	Display Time	Calibre of Movement	Gate Time Motor runs every seconds	Acoustic - Quartz Level Set red LED to 32768HZ Display time will be 2 seconds automatically. Use left sensor. green synchro light - on steady.	Inductive - Motor Level Set red LED to 2-10-12 -20-60 (see below) Use left sensor. green synchro light - will flash with motor pulse	Display Time
<u>OMEGA</u>									
1310-1315	1	Yes	Yes	2	Bifora	1	Yes	Yes	2
1320-1325	2.5	Yes	Yes	10	Ericar 320	1	Yes	Yes	2
1330	2.5	Yes	Yes	10	GP353	1	Yes	Yes	2
1332	1	Yes	Yes	2	GP641	1	Yes	Yes	2
1342-43-45-46	1	Yes	Yes	2	Heuer 104.403	1	Yes	Yes	2
1350-51-52	60	Yes	Yes	60	Heuer 8515	1	Yes	Yes	2
1360	1	Yes	Yes	2	Junghans 632.50	12	Yes	Yes	12
1365	60	Yes	Yes	60	Junghans 664	1	Yes	Yes	2
1370	1	Yes	Yes	2	Junghans 667	1	Yes	Yes	2
1510-1511-1516 (2.4 MHz)	1	No	Yes	2	PUW 632	12	Yes	Yes	12
1611 (comb.)	2.5	Yes	Yes	10	Ricoh 510	60	Yes	Yes	60
<u>TISSOT</u>									
2030	1	Yes	Yes	2	Ricoh 530	60	Yes	Yes	60
2031-2037	1	Yes	Yes	2	Ricoh 580	1	Yes	Yes	2
2032-33-34	60	Yes	Yes	60	Ricoh 590A	1	Yes	Yes	2
2035	1	Yes	Yes	2	<u>TIMEX</u>				
2036	5	Yes	Yes	10	M160	20	Yes	Yes	20
2039	2.5	Yes	Yes	10	M145	1	Yes	Yes	2
2041-42-43	1	Yes	Yes	2	M140	1	Yes	Yes	2
2045	60	Yes	Yes	60	M162	20	Yes	No	20
2100	1	Yes	Yes	2	M270) M155) Future Calibre --- No information available yet				

* Yes - means you can use this testing method.
No - means you cannot use this testing method.

* Yes - means you can use this testing method.
No - means you cannot use this testing method.

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TIMEX TO BE GRANTED PATENT

Timex Corporation announced that it will be granted U.S. Patent Number 4,385,842 on May 31, 1983, for a multiplexing liquid crystal display for a liquid crystal analog watch. The display shows radial markers representing hour, minute, and second hands of a conventional timepiece. By interconnecting the radial markers in a serpentine pattern (not visible to the eye), fewer connections are needed between the electronic circuit and the display because multiplexing techniques can be used.

The issuance of the patent culminates eight years in the U.S. Patent Office, where the application was involved in an interference and an appeal. The inventor is Leo Wiesner, now retired and a consultant to Timex.

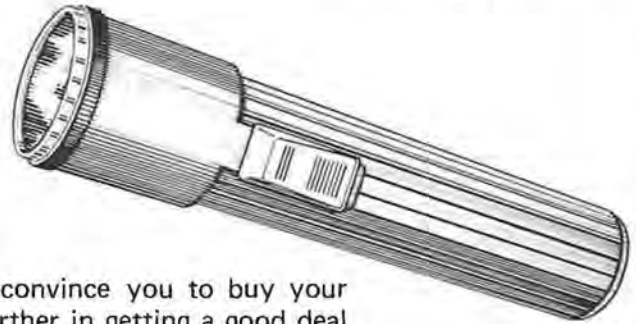
Timex introduced liquid crystal analog watches for the first time in 1982 using the patent. The watches are marketed under the ILLUSION trademark.

In 1971, Timex built what is believed to be the world's first quartz LCD analog timepiece with multiplexing. A liquid crystal display of the "dynamic scattering" type simulated conventional mechanical hands moving around the dial and displayed the time in hours, minutes, and seconds. The electronic circuit operating the display used CMOS integrated circuits and employed the same multiplexing techniques as are used in most LCD analog wristwatches today.

Timex holds several early patents on the LCD analog watch.

TIMEX

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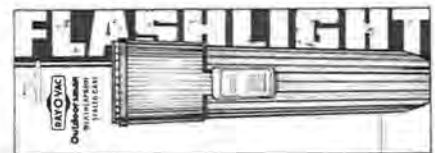
Our low wholesale price alone would be enough to convince you to buy your batteries from us. But we always like to go one step further in getting a good deal for our customers. So, when you purchase 100 or more Ray-O-Vac watch batteries from us between now and July 31, we'll send you Ray-O-Vac's Weatherproof Floating Flashlight. It's a rugged, dependable flashlight come rain, sleet or snow; gasket sealed to make it completely waterproof; also rust resistant. Plus, bulb mounting is spring-cushioned to resist bumps and breakage . . . The sooner you order your batteries, the sooner we'll get your flashlight to you. Just in time for summer camping! Call our toll-free number or mail in our convenient order coupon. One per customer, please. Offer good while supply lasts.

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RW - 30	381	.75 each	.65 each	_____
RW - 33	394	.83 "	.72 "	_____
RW - 36	344	1.01 "	.85 "	_____
RW - 37	384	.67 "	.55 "	_____
RW - 40	391	.83 "	.65 "	_____
RW - 42	357	1.17 "	.95 "	_____
RW - 44	386	.91 "	.75 "	_____
RW - 47	392	.59 "	.45 "	_____
RW - 48	393	.79 "	.65 "	_____
RW - 49	389	.79 "	.65 "	_____
RW - 51	387	1.13 "	.97 "	_____
RW - 52	313	.73 "	.67 "	_____
RW - 54	354	.73 "	.67 "	_____

RAY-O-VAC NUMBER	EVEREADY REFERENCE	1 to 29	30 of a No. or 150 Asst.	QTY.
RW - 56	343	.62 each	.50 each	_____
RW - 57	325	.83 "	.67 "	_____
RW - 58	323	.62 "	.50 "	_____
RW - 310	362	.75 "	.65 "	_____
RW - 311	397	.84 "	.67 "	_____
RW - 313	395	.79 "	.65 "	_____
RW - 315	371	.75 "	.65 "	_____
RW - 320	364	.75 "	.60 "	_____
RW - 410	361	.75 "	.65 "	_____
RW - 411	396	.80 "	.67 "	_____
RW - 413	399	.84 "	.67 "	_____
RW - 415	370	.75 "	.65 "	_____
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Casing and Crystals

By Robert Bishop



When the customer entrusts his quartz watch to the watchmaker, he has the right to expect competent and honest service. Those of us in our profession who believed early that the quartz watch would someday be a large part of our daily work, availed ourselves of whatever training that was available to us. We became skilled in the repair of quartz movements, but based on many of the watches coming across my bench, the handling of the exterior of the watch has been neglected by many.

The customer cannot see the results of our skills on his movement, but he can see scratches in his case that weren't there when it was new, and the crystal that leaks dust—or falls out. He can see the dent in the back and the marks on the dial, and he remembers . . .

If we are to deserve the prices that our talents and training entitle us to earn, we must pay more attention to the exterior of the watch.

In the good old days, all that was needed to open cases was a sharp knife. Then along came the screw-back waterproof case, and we were faced with a plethora of case wrenches and case vises.

Today, we are faced with snap-in backs, snap-on backs, bayonet backs, front opening cases, ultrathin cases, mineral crystals epoxied crystals, crystals frictioned into plastic sleeves, and many other examples of modern technology.

How can we cope with this new technology? First, when we are confronted with a new case construction we must make the effort to learn the proper technique, and not condemn the manufacturer for not continuing in the old familiar ways.

Second, we must invest in the proper tools. Time is money to the watchmaker, and money invested in tools that save time and insure more professional workmanship, returns high dividends.

The use of a universal case back wrench on a hand-held case is a sure invitation to a scratch. Invest in a good bench mount screw back case opener. It will save you time and also add a professional touch. Also, a bench mount crystal or case press is an absolute necessity today. The modern snap-on and snap-in backs will not close without this tool. A large selection of blocks is important because often a half millimeter means the difference between success and failure.

We are all familiar with the knife-type opener for those snap-back cases with a lip or a notch. Most of the commercial openers work well in most situations if used with care. One of the most useful tools for opening snap-type cases can



Figure 1

be made from an ordinary stubby screwdriver. Mr. Scott Chou, Technical Manager of the Seiko Service Center in New York, provided this idea, and it has many advantages over the conventional knife. The screwdriver shown in Figure 1 is a Sears Craftsman, but any brand that uses high quality steel will do.

The first step is to grind a concave surface on the top of the blade with a 3/8" to 1/2" diameter grinding wheel, extending to the end of the blade. Directly opposite the concave surface, grind the bottom to a convex contour to make a knife edge at the tip (Figure 2).



Figure 2



Figure 3

In use, this opener works exceptionally well because the thin edge will penetrate narrow notches, and the tapered curve provides both wedge action and leverage. The stubby handle allows heavy but controlled pressure. Use care in placing the opener in position before applying pressure, and be sure to support the case firmly (Figure 3). Most cases with a notch respond to push pressure only, while those with a lip should be pried or lifted. Use a piece of plastic or tape under the opener to prevent marring soft metal cases. The notch or lip is often well disguised, and careful study may be required to locate the opening point. If you cannot find a notch or lip, DO NOT PRY!!

Some snap-back cases, notably Seiko, have a lip that indicates that the back should be pried off. Logic tells us that a back that pries open should be snapped closed. Logic is wrong in this Seiko design. In Figure 4 note the retaining spring as shown by the arrow, one on either end of the case back. If you attempt to force this case closed against these springs they will be damaged, and you may have to replace the complete case. To close this case properly, insert the "6" end of the back into the matching recess in the bezel and using a screwdriver or similar tool depress the spring on the lip end, and gently closing the case with finger pressure. Variations of this design require that you depress the detent springs to open, and snap the case closed. On some models, the access to these springs is covered by the band.

The modern fancy shaped snap back is designed to close easily only one way. The end opposite the opening notch or lip should be inserted in the corresponding recess or ridge in the bezel. Finger pressure should be applied at the opposite end, both down and towards the inserted end. Do not use a case press if finger pressure is not sufficient; investigate the problem. Most case closing difficulties can be traced to damage caused by too much pressure applied to the wrong place. The back may be bent, or the locking tabs may be crushed and cannot align with the matching recess in the bezel. NOTE: Not all cases open and close at the traditional "6" or "12" position. Seiko has several models that open at the "9" and will not close if the back is inserted at the "6" or "12" position.

The majority of round snap-type backs require the use of a crystal or case press. There are two major types of snap backs: snap-on, and snap-in. The snap-on back fits over a raised lip or ledge on the main part of the case. It is vitally important that the point of pressure be at the center or evenly distributed across the back. Pressure applied at the outer edge will cause the back to contract slightly, thereby making it harder or impossible to close. (See Figure 5). If the back is asymmetrical, or has a raised battery hatch, look for a well-defined ledge that is intended to be the point of pressure.



Figure 4

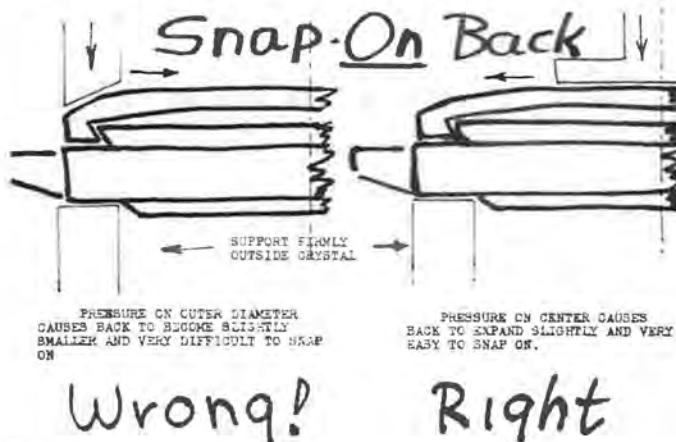


Figure 5

The round snap-in seems to cause the most problems. The protruding lip or ledge on the case back snaps into a corresponding recess in the bezel. The correct point of pressure is at the outer perimeter, preferably using an inside tapered block slightly smaller than the case back. Pressure applied at this point causes the back to become slightly smaller, and it snaps into place easily. (Figure 6). If the point of pressure is at the center, the back tends to spread and no matter how much pressure is applied, the case will not close. Too much pressure will severely damage the case, and possibly destroy the movement and dial.

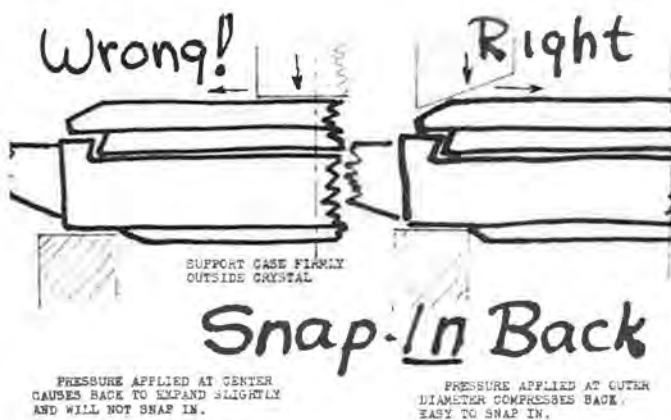


Figure 6

The selection of the proper support and closing blocks cannot be over-emphasized. The bezel should be supported outside the crystal, and the supporting and pressure surfaces

must be parallel. (Figure 7). Even the slight protuberance of a battery hatch can cause uneven pressure, and corresponding difficulty in closing. If you use metal blocks, place a piece of heavy plastic or cloth between the bezel and the support block to prevent damaging the bezel.

Another type of case construction makes use of a bayonet back, much the same as many battery hatches. The back locks and unlocks in a quarter turn or less, and the alignment marks are easy to follow. Extreme care must be used in the Seiko models to make sure that the gasket is well lubricated with silicone grease and properly seated in its groove on the case back. Insert carefully, and turn slowly to prevent the gasket from being forced out of position or damaged. In fact, it is good policy to open the back once to verify that your technique is correct, and close again.

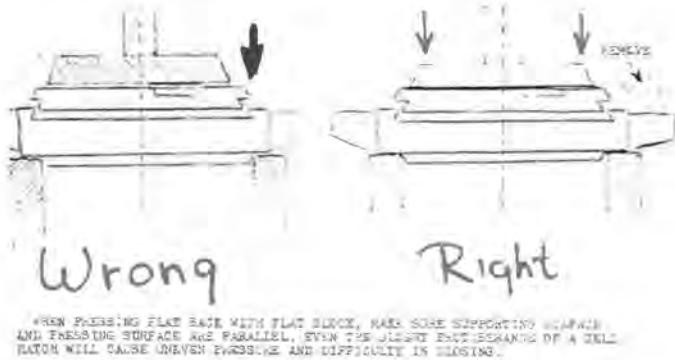


Figure 7

It would seem unnecessary to point out the importance of gaskets, but apparently it is. Too many times the watch is returned to the customer without a sound gasket. Quartz watches deliver very little power to the train, and the slightest particle of dirt can cause problems. Also, moisture entering the watch causes not only rust, but electronic problems in the circuit as well. *Never* allow a watch out of your shop without a good gasket in the battery hatch. The hatch is a loose fit without a gasket, and creates an open door for perspiration to enter the watch.

A good method of applying silicone grease evenly to the gasket is to place a piece of sponge or foam plastic in both the bottom and the cover of a round container. The sponges should be thick enough so that they will compress slightly when the container is closed. Saturate the sponges with silicone, place the gasket on the sponge, apply the cap, twist slightly, and the gasket is evenly lubricated. The original gaskets can be re-used if they are not stretched, cut or hardened. The few cents spent for a new gasket is a small price to pay for the satisfaction of knowing you have done a professional job.

Here is a word on tightening. The back of a watch does not need to be tightened with the same force as the head bolt on an auto engine. Make sure the gasket is lubricated and in good condition, then tighten with only enough force to make a complete bond between the back, the gasket, and the main case. Too much tightening distorts the case, stretches, cuts or distorts the gasket, and the case is no longer water resistant.

The advent of quartz technology has brought with it new methods in the fitting of crystals. Many manufacturers, in order to use a glass or mineral type crystal and still maintain water resistant features, have developed complicated sys-

tems to maintain case integrity with non-compressible glass. This involves multiple gaskets, outer bezels, inner rings, etc. While it is not possible in this article to cover in detail specific examples, some general comments are in order.

First, if it is apparent that the outer bezel must be removed, and there is no notch, do not make one! That particular case may be designed to remove the crystal assembly from inside.

Seiko quartz watches manufactured in the last few years have a case construction code on the case back. The *Seiko Case Servicing Guide*, published by the Seiko Technical Department, and which may still be available at this writing, details this code, and the techniques for opening and closing cases, as well as fitting crystals according to this code. Briefly, this code consists of a letter or a letter and a number, either following the words: "water resist" or after the case number (the number separated by a dash). For example: "Water Resist G" or "7813-8029 B." Some simple cases with plastic crystals may not have this code. (The words "Japan R" are a factory production code, not a case construction mark.) Some examples of the Seiko code:

- B or F**—Outer bezel assembly is pried off at the notch. Glass is pressed out along with reflector ring from the top. Reassemble in reverse order.
- E or A**—Glass is frictioned into plastic gasket or sleeve, and is pressed out from inside (press on glass only, not on mask). To insert, press glass into sleeve with a crystal press, using a flat block.
- C or G**—Outer bezel assembly must be pressed out from inside, using a block that fits ledge on reflector ring. Main case must be supported outside outer bezel. Crystal and reflector ring is pressed out of outer bezel from the top. Reassemble in reverse order. Be sure to place clear plastic gasket on bottom ledge of outer bezel, with larger bevel facing main case, before closing, or the gasket may be crushed.
- K or H**—Crystal assembly is pushed out from the inside with the palm of the hand, through the inside of the main case. It is reassembled from the inside in this order: gasket, crystal, and crystal retaining ring. Press in place with a crystal press.
- M or L**—Glass and gasket is held in place by a friction fit retaining ring, and is removed from inside by prying at the notch in the retaining ring. The assembly is pressed closed with a crystal press.
- P or R**—These are epoxied crystals, and are covered later.

While the above codes apply only to Seiko watches, the general principles apply to many other makes. Usually, careful study of the case will offer clues to its construction.

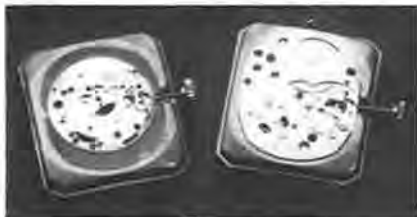
We "old timers" were taught that a replacement crystal should fit the bezel tight enough to stay in place by its own friction, and that crystal cement was used as insurance and a sealant. Today, many crystals are designed to be smaller than the bezel, and must totally rely on cement for adhesion and sealing. The traditional crystal cement is not durable enough, or strong enough, and should not be used. Nor should the Aron Alpha® type glues be used. They do a
(Continued on page 36)

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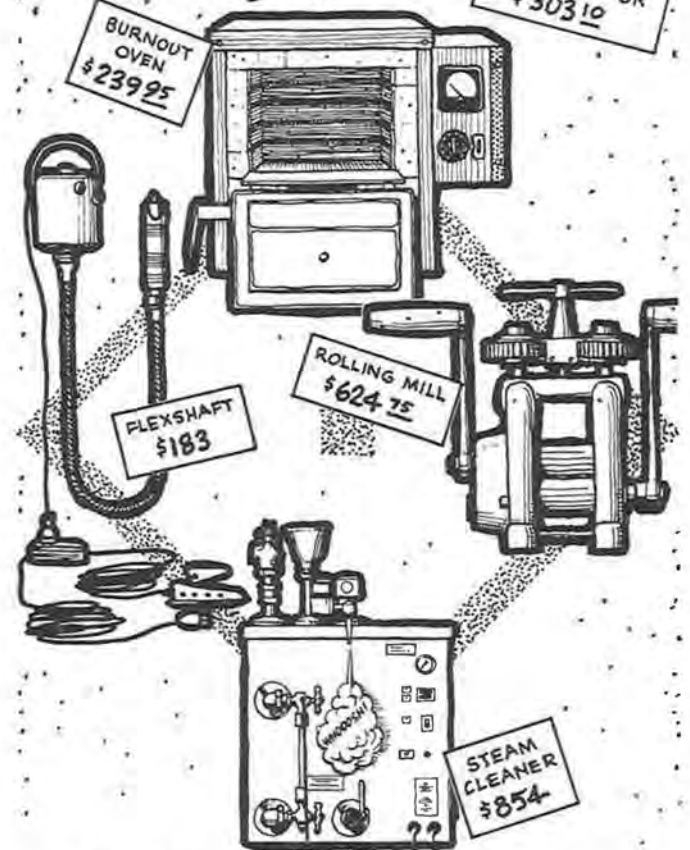
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900.231	Digi-Ana Alarm	23.50	34.00
934.611	29mm Quartz LCD 7½ digits	18.50	26.00
934.711	29mm Quartz LCD 7½ digits chrome	18.50	28.50
934.832	29mm Quartz LCD 3½ digits	18.50	26.00
935.112	8¾ S.S. Calendar	19.50	28.00
940.111	12½ S.S. Calendar	25.00	57.50
950.001	7¾ same size as Eta 2512	25.00	38.00
955.111	11½L S.S. Calendar	25.00	44.00
955.121	11½L S.S. Day-Date	25.00	45.00
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How Much Business Will Be Yours?

By Fred S. Burckhardt



We've lost 75% of the watch sales! According to a recent survey, jewelry stores only sell one out of every four watches. This is rather hard to believe. After all, we're a pretty nice group of people. Surely someone else is to blame. Perhaps we should blame the Far East manufacturers for flooding the marketplace with all those low-end timepieces or the importers and wholesalers selling to everyone except those that are in the retail jewelry business. We could blame the customers who buy their watches at the department stores, drug stores, discount houses, flea markets, shoe repair shops, etc.

As you can see, the above statements are rather ridiculous. It's easy to say others have caused our sales to plummet, when we all know the main reason is that person we see in the mirror each morning. The time has come when we should put our energies into retaining the business we have left and regaining some of that which was lost.

Things have changed. The times have passed when all we had to do was open the front door and the customers would come flocking in. No other facet of the jewelry industry has seen as many innovations as the watch department has in the past 30 years. In the 50's we had the electric watch; the 60's brought the tuning fork watch; the 70's saw the advent of the LED and LCD timepieces followed by the quartz analogs. There is no doubt these hectic times have had some effect on the merchandising of watches. Many stores were afraid to buy watches for fear that something new could come along and make their stocks obsolete. (Would anybody care to buy some LED's at a good price?) Sales and repairs both have become a burden for those not offering service or for those not learning how to repair quartz timepieces.

BUYERS' MARKET

At one time, for instance during World War II, jewelry retailers had the problem of getting enough watches to

sell—it was a *sellers' market*. Today, with maximum production and the market place flooded with watches, it has become a *buyers' market*. We must keep in mind that we are nothing more than purchasing agents for our communities. This means we can't stock watches that suit our own personal tastes and budgets, but rather those of our prospective customers. The consumers know what they want and it is up to us to provide it for them. We sometimes forget that it is possible that what they want may not coincide with what we would like to sell them. There are three types of customers:

1. Those who want and can afford the best quality, regardless of price.
2. Those who consider both price and quality, but not especially interested in style or fashion, yet want good quality.
3. Those to whom price alone is the only factor and will buy the cheapest merchandise available.

Some stores specialize in one of these areas. Others try to capture two or three. It depends on how you have positioned yourself in the marketplace. If you become too snobbish, your price points may not appeal to those in categories 2 and 3. If you carry only lower priced watches, you may lose those in the first two categories. As you can see, it's very important to learn what *your* customers want. When you can do this and stock this type of merchandise, you're on your way to becoming a successful merchandiser of watches.

MERCHANDISING

Merchandising is having the right goods in the right place at the right time at the right price! After you've learned what the most popular price lines are for your store, concentrate in this area. This isn't to say that you shouldn't stock other price lines, but don't buy as many. Control your buying on the basis of careful planning. This will enable you to get the most efficient proportions between stock and sales; but only what you feel you need for your customers—not what's

the hottest number in Minneapolis or Houston, unless you live in one of those cities. Fashions and styles take time to travel around the country. What's great in one area may be a bomb in another. A good salesman, who is really interested in your business, can be a great help in selecting the right stock. Remember, his or her company has to sell watches too. If one tries to push something you don't feel is right for your store, tell them to flake off!

TURNOVER

Once you become more proficient in your buying, you'll find that this will help to increase your turnover. *Turnover is the amount of work you're getting out of your capital investment.* For example, let's say you have \$10,000.00 tied up in your watch inventory and your stock turns once with a net profit of \$500.00 or 5% on the investment. If you turn the stock twice, you'll make \$1000.00 or 10% on your investment. However, with double the rate of turnover, overhead expenses will also increase, but far less than double because you can secure double turnover without doubling the cost of doing business. It doesn't take twice as many sales people to make twice as many sales. Your rent, light, heat, etc. do not double. A true discount house uses this principle of turnover, only they sell at a lower price in order to increase their stock turn. As an example, we'll say one unit costs \$10.00 and sells at \$15.00. At this price, one unit is sold for a profit of \$1.00 (after expenses). By lowering the price to \$14.50, three units are sold for a profit totaling \$1.50. Assuming expenses remain the same, it means the percentage of profit on investment was 10% in the first case and 15% in the second case.

There are many benefits to increased turnover:

1. Smaller capital investment in proportion to amount of business.
2. Smaller interest charges on your loans.

3. Fewer mark-downs (having to reduce price in order to sell).
4. Fresher stocks.
5. Proportionately smaller expenses.

There are ways to increase your turnovers:

1. Have the right watches at the right time.
2. Eliminate slow sellers.
3. Adjust prices to where watches move most quickly with a reasonable profit.
4. Don't jump at quantity discounts—these 'bargains' may end up costing you more than if you had paid the regular price.

Remember, the longer your watches remain in stock, the greater the loss will be. It may be better to take a small mark-down than hold them for so long that regardless of the size of the mark-down, they still won't sell.

SELLING

Now that you have learned to stock the right merchandise and have customers waiting to get into your store or shop, next comes the hard part—selling your merchandise. Instead of taking up space and going through the whole selling process from the time you approach the customer up through closing the sale, let's concentrate on the psychological aspects of selling.

A customer buys something, not because they want that something, but because they want what that something can do for them—the benefit they will derive! Everything we buy we do so because we are interested mainly in ourselves, we're selfish. We think in terms of our own desires, our own comforts, and our own happiness; in other words, all those things that will make our own lives more pleasant. Even buying a gift for someone else could be a selfish act. We do so because we hope the person receiving it will love us more and each time they look at it they will think of us. We in turn will receive pleasure knowing we made it possible.

In selling watches, we can spend all day telling the customer about the features of the watch they are considering to purchase; unless you can tell them how these features will in turn offer them a benefit, you'll end up doing nothing but *not* making a sale and putting an undue strain on your vocal chords. For example:

FEATURE	BENEFIT
Waterproof	Wear it swimming, boating, taking a shower, etc. Less worries, peace of mind.
Accurate Time	Won't be late for appointments, catch a plane, etc. Punctuality is a sign of efficiency.
All 14K Gold	Compliments from friends and acquaintances - a symbol of achievement - social status.
Dual Time Zone Calendar Alarm Chronograph	How will these features benefit your customer?

Never sell the feature without selling the benefit.

There are two types of buying motivations — emotional and rational. Emotional: love of beauty, pride of possession, social status, romantic interests, family affection, and symbol of achievement. Rational: convenience, efficiency, dependability, durability, and economy.

Which type of motivation will you appeal to? That depends on your customer. If you are trying to sell an expensive, stylish quartz watch to a woman who belongs to a bridge club, let's face it, she'll be more interested in how her companions will compliment her than in whether or not it will keep time to within a minute a year. On the other hand, if she is buying a quartz watch for her husband, the timekeeping element may prove to be the motivation she'll need to make the purchase. Unless you appeal to one or more of these motivations, you'll have a hard time closing the sale.

We, as watchmakers, have another plus to help make sales. This is our ability to repair the watches we sell. Customers still like to deal with the places where they know they can get service if needed. Play up this angle, it's an extra benefit you can offer. *Service after the sale!* Make use of this phrase.

ADVERTISING

We can't get into a long dissertation on this subject, but if you haven't done any advertising give it a try; unless you have all the business you want at the present time. Watch companies are planning to spend over 85 million dollars on advertising in the United States this year. Take advantage of it, tie your own in with it. Use your co-op dollars if possible. Watch companies spend lots of money on ad mats that are available to their accounts. All are excellent and they are readily available for you to use. If you would rather make up your own ads there is one rule to remember, *always offer at least one benefit*. For example, if you just show a picture of a watch and say "Quartz Watch - \$59.95," it will be unlikely that you'll get much response. On the other hand, how about with a benefit? *Quartz Watch - with a crystal that resists scratching or breakage! \$59.95, or Quartz Watch - will keep time to a minute a year - no more late appointments! \$59.95 or At last - a ladies dress watch that will resist water! Save money on repair - \$59.95.*

Think about the repairs that come in day after day. Rust is a big problem and crystals is another. How many catches have you repaired or replaced? One watch line that I looked at recently had a beautifully made catch that should solve this problem. Why not use it in an ad: *The catch on this watch will keep it* (Continued on Page 45)

Figure 1

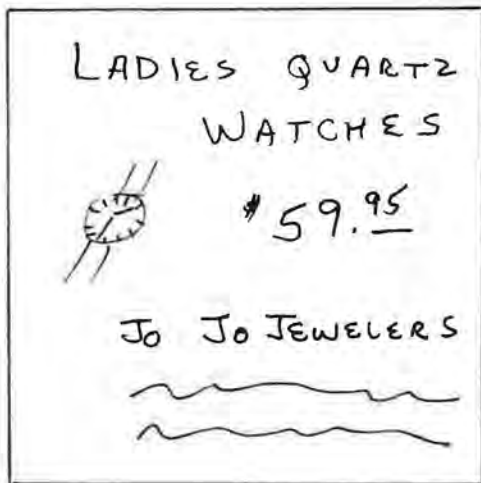
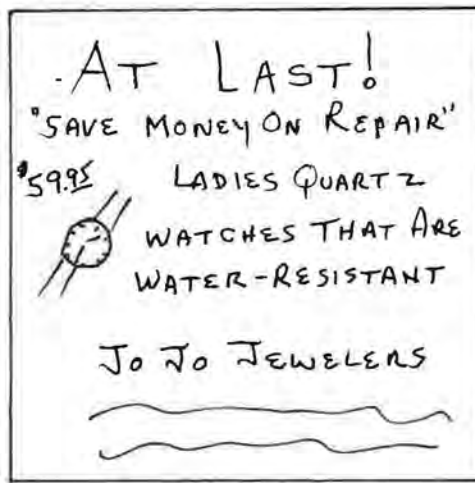


Figure 2



fine job of holding the crystal, but this class of adhesives emit fumes, long after drying, that can damage the electronic circuits, and may discolor the dial. **DON'T USE IT!**

Instead, use epoxy cement. It is best to use the cement recommended by the manufacturer whenever possible. Bulova supplies Narval® epoxy with their mineral crystals, which is mixed within the plastic bag before opening, thereby insuring accurate proportions. I prefer the 24-hour or slow-curing type because there is less of a problem with cleanup, and it does a neater job than the five minute types. Whichever epoxy you use, mix it thoroughly, according to directions. Apply a small quantity evenly to the crystal seat in the bezel, and insert the crystal carefully. You can speed up the curing process by placing the bezel on a source of heat, such as a light bulb, but don't exceed 200 degrees F.

Before you can install the new crystal, you must remove the old one. Epoxy is a stubborn glue to remove, but the task can be made easier by the application of heat. Bulova recommends placing the bezel on an electric hot plate, while Seiko suggests softening the cement by boiling water. While both methods work, I prefer the boiling water because there is no danger of over-heating, and the action of the water on the epoxy makes it easier to remove the residue from the bezel. In some cases, it may require 5 to 10 minutes of boiling to properly prepare the crystal for removal. Once the glass has been pushed out from inside, carefully remove any remaining cement from the bezel with sharp pegwood, and dry thoroughly. Commercial epoxy remover, such as Attack®, can be used, but it has been my experience that this method takes longer.

A special warning! If you use heat to remove the crystal, and the case has stem tubes and/or push-button tubes, make sure that they were not epoxied also. If they were, you must re-cement them. Once epoxy has been heated beyond a certain point, it will no longer hold securely.

Replacing epoxied crystals does take more time, but the superior results should enable you to command a higher price for your services.

Another area of servicing the quartz case is that of push-buttons. Many times, the only problem with a digital

watch whose functions do not work, is the pushbuttons. They become clogged with dirt, and can no longer reach their intended contact. A good way to clean the removeable type is to place them in a small container, such as a 35mm film capsule of a full strength ammoniated household cleaner, such as Top Job®. Place the container in your ultrasonic tank cleaner for 20-30 seconds, rinse, and dry. Lubricate with silicone grease, and they will work like new.

Obtaining case parts is sometimes a problem. To minimize the problems, avail yourself of the casing catalogs and microfiche information provided by the major companies. Give a complete description, including case numbers when ordering. Names of the same part may vary between manufacturers, so obtaining the correct part number is essential. In Figure 8, courtesy of the Watch Material & Distributors Association, there is a list of case parts ordering information for various major brands.


Naturally, all facets of casing and crystals cannot be covered in one article. Hopefully, this article will lead you in the right direction, and you will regard servicing the case as carefully as you do the movement.

Figure 8

CASE PARTS ORDERING INFORMATION

To obtain case parts correctly, it is imperative that case numbers be used when ordering these parts. Different watch manufacturers place these numbers at different points on the case. This listing is a guide in obtaining the correct number.

ACCUTRON	Number inside of case back, embossed or stamped in black ink.
BULOVA	
CARAVELLE	Example N510 or 3170
CITIZEN	Number on outside of case back. Begins with number "4". Example 4-063546
OMEGA	Number inside case back. Example 166.028
PULSAR	Number on outside of case back. Example Y432-5901
RADO	Number is on outside of case back.
ROLEX	Number inside case back or between case lugs at "12" position. Example 6334
SEIKO	Number on outside of case back. Usually 8 digits. Example 6139-6005
TIMEX	Number on dial below "6" position. May also be on inside of case back. Example 521012739
TISSOT	Number inside of case back. Example 17-422
WITTMAN	Number on inside of case back. You must use all numbers including movement number.
LONGINES	
JUBILEE	Example 1388-410
WYLER	Number on outside of case back. Example 4140
ZODIAC	Number on inside of case back. Example 722-946B
ZENITH	Number on outside of case back.
MOVADO	Example 20-0090-500



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Book Review

Minerals & Gemstones

An Identification Guide

By G. Brocardo

A complete new way to approach the mineral world is here offered to the experienced collector and the beginner. The 156 splendid color photographs are accompanied by a brief description and a pictographic table which provides, through easily recognizable symbols, the available information necessary for identification and classification. The key to the symbols is printed on a bookmark. The corners of the pages are colored to reflect those of the minerals themselves and to aid quick identification.

The color plates are preceded by extensive information on how to recognize and collect minerals, their origin and formation, their structure and properties, their classification, and how to prepare them for preservation. A glossary, bibliography and indexes complete the volume and add to its value as an indispensable guide for all collectors.

Giuseppe Brocardo is director of the Natural History Museum in Turin and has taught and written on mineralogy for many years.

CONTENTS

Minerals and their importance
In search of minerals
How minerals are formed
 Minerals with magmatic origin
 Minerals of sedimentary origin
 Minerals of metamorphic origin
How to recognize minerals
 Geometrical structure: basic crystallography
 Physical properties of minerals
 Chemical Tests
Mineral classification
Preparation and care of minerals
How to read the symbols

PLATES

Glossary
Further reading
Alphabetical index
Systematic index

With 219 pages, 156 color photographs, and pictograms accompanying each plate, it is to be published in August 1983, and retail at \$12.95. For more information, contact Elane Feldman, 171 Madison Ave., New York, NY 10016; Phone (212) 685-4371.

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" - 9200 - 6¾x8 L (6UDC Caravelle) . . .	33.50
" - 9222 - 6¾x8 L	24.00
" - 9225 - 6¾x8 L	27.00
" - 9362 - 11½ L (536-121)	22.00
" - 102.001 - 3¾x10 L (FF 59.21)	30.00
" - 301.001 - 5½x6¾ L (AS1012)	18.00
" - 924.001 - 5½x6¾ L	18.00
" - 935.112 - 8¾ L - S.S.Cal	28.00
" - 944.111 - 12½ L - S.S.Cal	18.00
" - 950.001 - 7¾ L (ETA 2512)	38.00
" - 870.111 - 11½ L - S.S.Cal	18.50
" - 960.111 - 11½ L - S.S.Cal	26.00
" - 961.001 - 6¾x8 L - (ST 69.21)	18.00
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Quartz and the Customer

By Wes Door, CMW



The ultimate goal of any transaction is to please the customer. In the case of watches, the customer makes the final decision as to what is placed on his or her wrist. In our new world of quartz it seems like our job is to educate the customers in such a way that they may make the best decision for their needs.

Although much advertising has been done in the last several years in newspapers, radio, television, catalogs, and by word-of-mouth, etc., it is interesting to note the real lack of knowledge that exists among the average John and Jane Doe as to what is a quartz watch.

To answer this question from a customer's view point, I took a survey from many "average"-type people. Let me explain that the word "average" is used here to indicate that these people were not especially gifted in quartz technology but just a good cross section of people. Remember, this is a survey, the results of which were surprisingly different than we would have anticipated. The question asked was "What is a quartz watch?"

The answers were as follows:

- Quartz is a stone, so I guess it's a watch made out of stone.
- Quartz watches have an oscillating crystal.
- Quartz watches are those that are more accurate than others.
- Quartz watches are those that have numbers on them like my watch.
- Quartz is some sort of jewel, I guess.
- I don't really know.
- It's a watch having a quartz crystal. (In this case they meant the lens crystal, not oscillating crystal.)
- A quartz watch has an oscillating crystal and some type of divider system to divide, I think about 38000 down to some measureable amount, like one second, and is powered by a battery.

This last answer is the best one of this survey. Only three people of the 30 in this survey had an answer as accu-

rate as this last answer (although, of course, the hertz was mis-stated as 38000 instead of 32768). These three people are Eric, age 16; Ken, 25; and Bob, 45. This would indicate that age was not the determining factor. However, if we made a larger survey and included many young persons, my hunch is that those in Eric's age group would have a larger percent of knowledgeable answers.

I told Bob (who was one of the three mentioned above with the most accurate answers) that I personally would have thought everyone would have said that a quartz watch is simply a "battery watch." Bob said, "Nowadays most watches have batteries *anyway* so we just presume they have batteries and just don't think about it much."

With the information from this survey in mind, we should not assume that our customers know all that we know about quartz watches. Without embarrassing our customers we should help inform them. By this we do not mean to technically educate them, but just give some information that will apply to their potential watch purchase. Until the "quartz era," our customers had just a few choices in selecting their watches. Now, in addition to case color, dress or water resistance, etc., the watch dial itself may have hands (like those old ones), which we now call "analog," or it may be LCD (Liquid Crystal Display), which may have just a few features or many features, or it may be a combination of LCD and analog! The LCD watches have many more features available than do the analog watches, and all of those LCD multi-features must be explained to our customers.

Just a glance at Figure 1 indicates some of the possible LCD or LCD and analog combination features available. The top row of pictures (across the page) show a few of the possible "appearance features." Each column going down the page shows the various modes of each of the four of these watches pictured in the top row. If we were showing these

watches to our customer, we would need to explain the features of each of these watches, but in this article we will just explain the simplest watch shown here, which is the one in the left column.

Bear with us as the next four paragraphs of information must be relayed to our customer, even though we have heard it over and over and have probably reached the point of presuming the customer already knows how to use these functions. We may feel that if they buy it, then they will figure out these functions by reading the directions at home.

1-A: The "dial" shown here depicts a simple LCD style. While in this regular "time" mode we can also show the customer the "night light" feature. Just push a button.

2-A: Displays no flashing colon, which indicates this watch is in the "date" mode, and display shows the month and date.

3-A: Another push of the pusher button and the seconds will appear. A second push of this same button, causes the display mode to change back to "time."

4-A: We also tell our customer that it is necessary to make this additional "push" to change the seconds back to the "time" mode; however, while in "date" mode, the date will automatically return to the time mode in just a few seconds.

We just described these features (for our Column "A" watch), to make a point. The point is that although all this sounds easy to us, we must very diligently and patiently explain these directions, in a manner to be easily understood, to our customer. Also, we will need to explain the "setting" procedures which are even more difficult for our customer to understand and remember. Also, all of the other "displays" of watches shown in Figure 1, Columns B, C, and D, become more difficult to explain.

Even though we may get excited about all of these nice features, like

alarm, timer, chime, dual time, calculator, stop watch (with 1/10, 1/100, or 1/1000 second divisions), etc., our customer may not be interested and may not want to learn how these extra features work. Still, they may like the appearance of that certain "multi-function" watch and will buy it if we will "program out" these unused features. Maybe we simply set the "dual time" feature to match the "current" time, so regardless of what "pusher" button they push, the correct time will still show.

In the case of the alarm, the customer may want us to turn off the alarm, which is easy for us to do.

After we have repaired or just installed a new power cell, we should ask which features should be "on" and which ones "off" so we can better perform this service for our customer. If we did not sell the particular watch and they happen to have a "cheap type," it is most likely the alarm can be accidentally reset into an unwanted mode, whereas this is not possible with watches sold by us. By pointing this out, perhaps the next one they choose to buy will be from us. As we know, this is one of the features in the "cheap" watches that are discouraging some potential customers from buying another quartz watch, especially an LCD.

This is a good time to mention "trade-ins." Many times customers will

consider trading in their watch for a better one. The amount given in return for the trade-in may be quite small, but still may help close the sale by explaining to the customer that we are not going to resell the trade-in watch, but it has some value to us as a "loaner" watch.

In order for a person to buy a new and probably higher-priced watch from us, they must be convinced that a higher price means a better watch. We must explain that the good quartz watches we sell have screws instead of rivets, and these removable parts can be repaired and we can take care of the service. Also we have (or can get) material parts, including the lens crystals, band parts, etc. If any of these parts (such as "built in bands," etc.) should not be available to us, and we still decide to sell these brands of watches, we must inform the customer accordingly.

Since we buy for our customers, we in turn are "customers" of the watch factories, either directly or through a sales representative. As a "customer" we are entitled to all the available information that will help in us making knowledgeable decisions.

These decisions are reached by us asking questions like the following: What is the company's service policy? Can we buy parts, and if so, which ones are available and are they available for

immediate delivery? Or will it take as long to get them as if we had sent the watch in to the factory? If we do send the watch in to the factory, how long will they take to service it? Is this style likely to be discontinued shortly, and if so, how long afterwards will materials still be available? Is the lens crystal available? What is the price? How about the case and/or the band—can a new one be purchased? These are just a few of the important questions we must answer.

The all-important question we should ask ourselves is: "Why should we buy this brand for our store? Is it a watch line we are proud to carry because of the quality, their service, their advertising, and their availability?"

If we are a small buyer and buy only one watch line and we have 30 watches total, we probably think that our little account is not important to a "big" factory. Maybe another store has 10 times as many watches as we do, but if they are buying 12 lines, they probably have fewer watches than we do in this one line. So, we are important and our enthusiasm, ability to sell, and turn-over may make our value to this one factory very important, so we should indeed expect to receive our share of good factory service. Remember, we are the liaison between the factory and our customers. A customer knows very little about the watches we are selling (especially the new quartz, as was indicated by the "survey" shown earlier in this article). The customer depends on us. They trust us and they are willing to buy from us and they will expect just as much service from their quartz watch as we have given them in the past on their old mechanical watches.

Therefore, we must be equipped to handle these repairs, they being more numerous than we would have originally thought. The chart in Figure 2 show some of the most common repairs. This chart does not show power cell replacements which of course represent the overwhelming majority of all quartz repairs.

Although we are showing percentages in this chart, this survey was on too small a scale to be a real indicator

Figure 1

LCD HAVE MANY FUNCTIONS AVAILABLE WHICH MUST BE EXPLAINED TO CUSTOMERS

	A	B	C	D
1	1:10	ALARM 2 CH STOP 2:11:50 AM	2:11:24 > < X	2:31 07
2	4-12	ALARM 2 CH STOP 12:00 OFF	5:30 > < X	:00 07
3	:32	ALARM 2 CH STOP 00 OFF	00 S	00:00 00
4	! : 10	ALARM 2 CH STOP 00 15 20 X	0:01:40 X	2:37 04

Figure 2

REPAIR WORK ON QUARTZ WATCHES (Percentages of total repairs done by trade shop.)	
Cleaning or Clg. Train	15%
Remove Rust	10%
New Circuit	2%
L.C. Panel	1%
Nite Light	1%
Coil	4%
Oscill. Crystal	1%
Stem and Crown	18%
Lens Crystal	29%
Clg. Pushers, etc.	9%
New Pushers	2%
New Modules	1%
Miscellaneous	7%

Figure 3

REASONS FOR NOT REPAIRING OUR CUSTOMERS' QUARTZ WATCHES			
	REASONS WE GIVE TO CUSTOMER	THE REAL REASON (That we should use with our customer).	SOLUTION
1.	No, we can not repair your watch.	Not equipped to work on them.	Get equipment or either tell them the reason. (Honesty still pays), or recommend a "friendly" competitor who does this work.
2.	You probably have a defective part or something.	Just cannot figure out what's wrong.	Read and study quartz and take courses, and get equipment necessary to repair quartz.
3.	Your watch is not worth repairing.	You know it's not an expensive watch but we should quote price.	Let customer decide based on the quoted price.

Honesty pays and there should be no embarrassment in admitting that we are not set up with equipment or the knowledge necessary.

These figures are from a "trade shop" operation. One interesting fact is that this shop has received a number of watches with the case back loose, indicating the store's failure to replace the back after fitting a cell.

Notice from this chart that lens crystals, stems and crowns, cleaning and removing rust, are among the highest percentages of jobs done. All of these jobs closely relate to the "conventional" watch jobs, indicating that many of the jobs we are doing on quartz are the same ones we have been doing for years on the older watches. Of course, there are many jobs of a completely different nature needed for these new quartz units. Also, other miscellaneous items not mentioned on this chart include replacing alarm springs, straightening backs, adjusting cell straps, and replacing C-clips, cell contacts, etc. These repairs can also be accomplished with our regular tools.

In working with our customer it is so important for the customer to understand that quartz watches can be repaired. The good ones are worthwhile and the very low-priced ones may not be practical. However, it is a bad practice to scare our customers by saying "no" when we really mean one of the following reasons that are shown in Figure 3. This chart shows the reasons we DO give, the reasons we SHOULD give, and a SOLUTION. Customers keep us in business, whether we sell or repair. If I may repeat my opening sentence: *The ultimate goal of any transaction is to please the customer.*

ETIC

NELSON

(Continued from page 12)

changes in a way it has not in all recorded history. "Pride of possession" will always be with us. People who desire the finer things in life will continue to buy the more costly watches, even if they don't keep any better time than the throw-away types.

Will electronic watches, whether solid state or electro-mechanical watches, ever completely replace spring wound watches? Yes, in a matter of time, and for all practical purposes. A few mechanical spring wound watches will continue to be made for a limited market for some time to come; but for general timekeeping purposes in parts of the world where timekeeping is important, electronic watches will replace mechanical watches in the next decade.

These are the predictions from one who has loved fine mechanical watches all his life. Me.

ETIC

ETIC QUARTZ SYSTEM

ETIC Speedy-Trim Mark I Quartz Timer is the heart of the ETIC System. An entire system for the repair of quartz watches which costs less than the price you would usually pay for just a timer.

Just as importantly, the ETIC System offers a program approach to the repair of quartz. All the essentials in equipment, tools, supplies and parts are available to you.



Working exclusively through authorized wholesalers, we can give you the supplies you need, when and where you need them. Moreover, ETIC offers a hands-on course in quartz watch repair, with technical follow-up to make digital and analog repair easy. But don't just take our word for it. Send \$1.00 to ETIC-USA, 11718 W. 91st Street, Overland Park, KS 66214, and we'll send you a complete catalog and information packet which could save you hundreds up front and make you thousands in the future. ETIC-USA, Div. Albert Froidevaux & Sons/USA. (913) 888-3131.

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- TOOLS
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- REFERENCE MATERIALS
- ANSWERS



QUARTZ WATCH BATTERY REPLACEMENT COURSE




















Store personnel with no previous training whatever can, in one day, be taught the necessary skills to enable them to replace batteries in the majority of quartz watches on the current market—this important fact has been established by a recent experience at the CFH Institute in Switzerland.

Launched in 1982, the course on battery replacement was initially of a two-day duration and organized only at the CFH Institute in Lausanne. Two reasons for this were an in-depth approach to the various aspects of the business in hand, and the difficulties involved in transporting the original course material (sets of tools and instruments, watch tightness testing machines, etc.).

The new course with a shorter program and limited equipment is the version that has recently proved so successful. The 12 participants (11 sales girls, one man) were delighted.

For any jeweler who does not have a workshop on the premises, or if he has one, prefers not to disturb the workshop staff for such relatively simple jobs, the ideal solution is to give sales staff skilled training in battery replacement and thereby ensure a more efficient, rapid and economic after-sales service for customers.

The CFH will organize specific courses on request. Please write to: CFH Institute, Case postale 206, CH 1001 Lausanne, Switzerland, or call 21/20-12-01.

<div style="text-align: center;">  BERGEON </div> <p>Rivetting stakes Hardened steel 36 holes Current quality</p>  <p>No. 1902 \$6.00</p>	<p style="text-align: center;">GENUINE DUMONT TWEEZERS</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th colspan="2" style="text-align: center;">DUMOCCELL</th> <th colspan="2" style="text-align: center;">CARBON STEEL</th> </tr> <tr> <th></th> <th colspan="2" style="text-align: center;">Regular - Sale</th> <th colspan="2" style="text-align: center;">Regular - Sale</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"></td> <td>No. 1</td> <td>\$9.10 \$7.50</td> <td>No. 1</td> <td>\$8.45 \$7.00</td> </tr> <tr> <td style="text-align: center;"></td> <td>No. 2</td> <td>10.80 8.25</td> <td>No. 2</td> <td>9.00 7.50</td> </tr> <tr> <td></td> <td>No. 3</td> <td>10.80 8.25</td> <td>No. 3</td> <td>9.00 7.50</td> </tr> <tr> <td></td> <td>No. 3C</td> <td>10.80 8.25</td> <td>No. 3C</td> <td>9.00 7.50</td> </tr> <tr> <td></td> <td>No. 4</td> <td>12.20 9.75</td> <td>No. 4</td> <td>10.50 8.25</td> </tr> <tr> <td></td> <td>No. 5</td> <td>13.00 11.00</td> <td>No. 5</td> <td>11.25 10.50</td> </tr> <tr> <td></td> <td></td> <td></td> <td>No. P</td> <td>7.50 6.25</td> </tr> </tbody> </table>		DUMOCCELL		CARBON STEEL			Regular - Sale		Regular - Sale			No. 1	\$9.10 \$7.50	No. 1	\$8.45 \$7.00		No. 2	10.80 8.25	No. 2	9.00 7.50		No. 3	10.80 8.25	No. 3	9.00 7.50		No. 3C	10.80 8.25	No. 3C	9.00 7.50		No. 4	12.20 9.75	No. 4	10.50 8.25		No. 5	13.00 11.00	No. 5	11.25 10.50				No. P	7.50 6.25	<p style="text-align: center;">AWC High Dome Crystals One gross assorted Specifically made up to your order Minimum three pieces per number Totals 48 different sizes In a cardboard box \$29.95 Available separately at \$2.50 per dz. Available in low dome at the same price</p>
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<p>Extensible and reversible movement holder For calibre 3 3/4" - 11". Nickelled and sanded.</p>  <p style="text-align: right;">No. 4039 \$6.00</p> <p>For calibre 8 3/4" - 19". Nickelled and sanded.</p>  <p style="text-align: right;">No. 4040 \$6.50</p>	<p>Dial Washers 1 grs. per size, Sizes 2, 2 1/2, 3, 4, 5 - \$1.50 per box</p>  <p style="text-align: center;">Bracelet Crowns yellow & white</p>  <p style="text-align: center;">Bracelet Crowns yellow & white T7, T8, & T10 Sizes: 4.00 mm 5.00 mm 4.50 mm 5.50 mm Available in: Flat, Bevelled & Recessed All \$4.50 per dozen</p>	<p>Holder with slide locking steel jaws No. 30432 Nickelled brass handle. \$5.00 Steel chuck. Opening 0 - 1.5 mm</p>  <p style="text-align: center;">O' Ring Waterproof Crowns with deep recess Gold Filled & Stainless Steel \$5.95 per dozen</p>  <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>No.</th> <th>Dia.</th> <th>Tube</th> </tr> </thead> <tbody> <tr> <td>1120</td> <td>4.0 mm</td> <td>2.0 mm</td> </tr> <tr> <td>1120-2</td> <td>4.5 mm</td> <td>2.0 mm</td> </tr> <tr> <td>1120-25</td> <td>4.5 mm</td> <td>2.5 mm</td> </tr> <tr> <td>1121-2</td> <td>5.0 mm</td> <td>2.0 mm</td> </tr> <tr> <td>1121-25</td> <td>5.0 mm</td> <td>2.5 mm</td> </tr> <tr> <td>1122-2</td> <td>5.5 mm</td> <td>2.0 mm</td> </tr> <tr> <td>1122-25</td> <td>5.5 mm</td> <td>2.5 mm</td> </tr> </tbody> </table>	No.	Dia.	Tube	1120	4.0 mm	2.0 mm	1120-2	4.5 mm	2.0 mm	1120-25	4.5 mm	2.5 mm	1121-2	5.0 mm	2.0 mm	1121-25	5.0 mm	2.5 mm	1122-2	5.5 mm	2.0 mm	1122-25	5.5 mm	2.5 mm																					
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<p>Needle for auto oiler 3 pcs. - \$6.25</p>  <p>No. 2718P</p>	<p style="text-align: center;">OIL CUP</p>  <p>Ref. 11289 \$4.75 Oil cup, body made of wood 3 glass wells of different sizes and colors, red, blue and green.</p>	<p style="text-align: center;">Dustproof Crowns Tap 10 Sizes: 3.00mm 4.50mm 3.80mm 5.00mm 4.00mm All available in white & yellow \$6.75 per dozen</p> 																																													
<p>K & A WATCH SUPPLY CO. ALEX HELLER, INC. Watch Material - Tools - Jewelry Store Supplies 10 West 47th Street - Room 402 New York, N.Y. 10036 Tel. 212-575-8940 - 41 Your center for all genuine materials and hard-to-find items.</p>		<p style="text-align: center;">SPECIAL!! Crown Assortments All perfect mixed lots Includes: Bracelet crowns Waterproof crowns Dustproof crowns \$9.50 per 100</p> 																																													
		<p style="text-align: center;">Watch Crowns for Quartz Watches i.e. Seiko mvmt. No. Y950 (T11-.76mm) Citizen mvmt. No. 1300 (T12-.66mm) Extra thin threads for special watches No. 90 - dustproof 4mm diameter No. 83 - dustproof 3mm diameter \$6.75 per dozen</p> 																																													

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WATCH REPAIR

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accuracy of your fine watch



- Modern
- Heirloom
- Antique
- Electronic
- Quartz



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FINE WATCH REPAIR SERVICE!**



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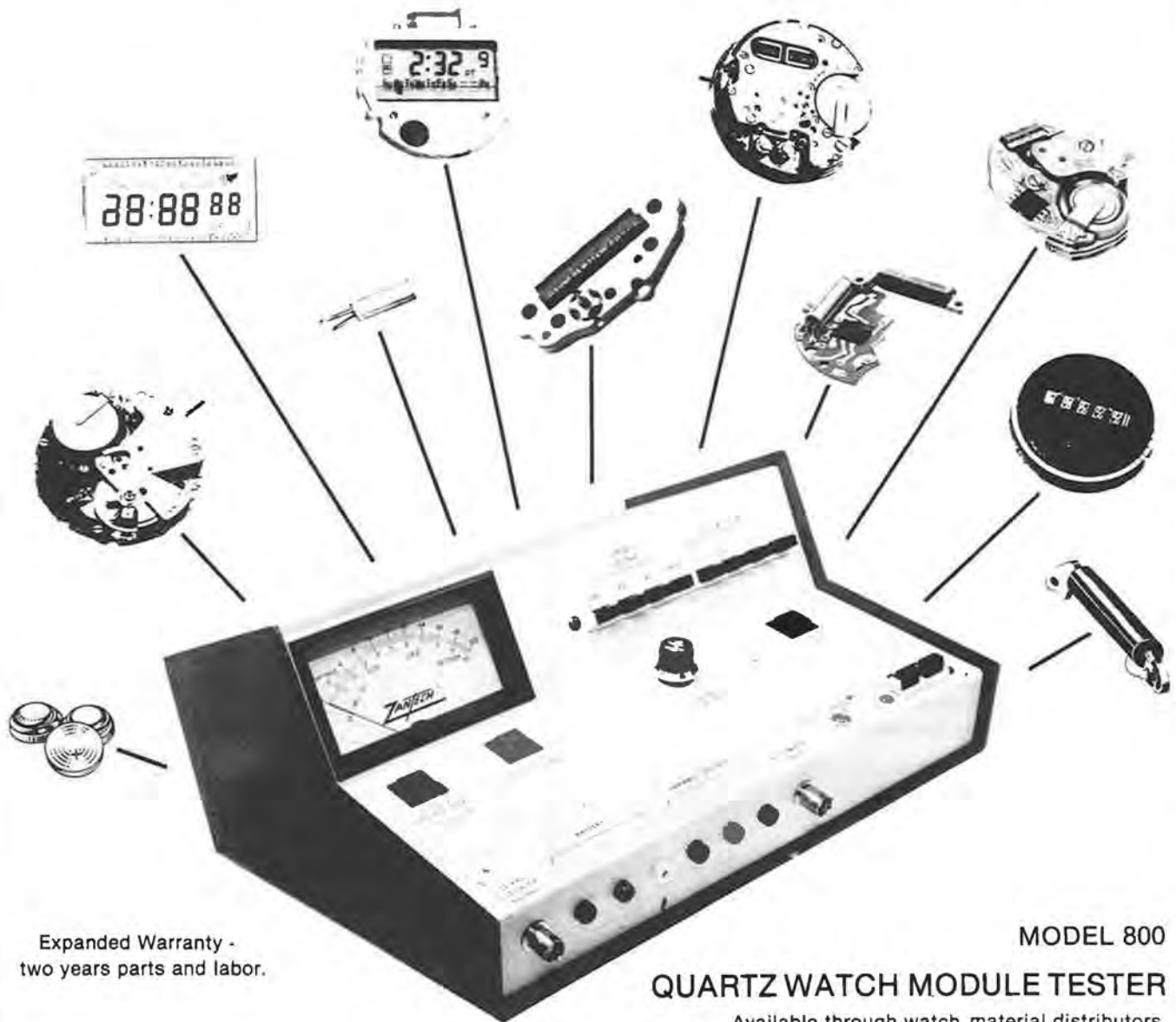
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Replacement Movements

Mechanical Movements



AS 1977-2

(Replaces AS 1012)

FF 59-21

FHF 69N

(Replaces FF 60)

Quantity	Caliber	Size	Features	Cost
—	AS 976	5x7	17 Jwl Incabloc	45.00
—	FF 59-21	3 ³ / ₄ x10	17 Jwl Incabloc	26.00
—	AS 1977-5	5 ¹ / ₂ x6 ³ / ₄	17 Jwl Incabloc	22.50
—	FHF 69N	6 ³ / ₄ x8	17 Jwl Incabloc	17.00
—	ETA 2512-1	7 ³ / ₄ L Round	17 Jwl Incabloc	26.00

— Marvin 160A 5L-Replaces AS 976-Comes with Dial & Hands-Specify Round-Square 40.00

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ESA 961.001—Quartz Replacement for FF 60—(Dial Feet Must Be Shortened) \$16.50.

ESA 102.001—Quartz Replacement for FF 59-21—Same Dimensions and Dial Feet \$27.00.

ESA 950.001—Quartz Replacement for ETA 2512—Same Dimensions. Dial Feet must be changed \$32.00.

ESA 301.001—Quartz Replacement for AS 1012-1677-1977 Bulova 5AH—Same Dimensions & Dial Feet \$16.00.

ESA 977.001—Replaced by ESA 588.001 \$16.50.

Popular Analog Quartz

Qty.	Caliber	Size - Features	Cost
—	Y 480	6 ³ / ₄ x8 Analog Quartz	14.50
—	Y 481	6 ³ / ₄ x8 SS Analog Quartz	16.50
—	Y 561	11 ¹ / ₂ L SS Shaped	17.50
—	Y 590	5 ¹ / ₂ L-Replaces 432-Different Dial Hands	17.50
—	INT301-001	5 ¹ / ₂ L-Use for AS 1012	18.00
—	FE 6320	6 ³ / ₄ x8-FF60 Replacement	11.95

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JA'S 1983 CONVENTION PROGRAM WILL FEATURE "THE CHANGING AMERICAN WATCH MARKET"

The Chief Executives of four major watch companies will be the panelists for Jewelers of America's Convention Program on Monday, August 1, at the Ziegfeld Theater. The program, "The Changing American Watch Market," will offer to the audience the viewpoints of these authorities on what they think will be the direction of the American watch market in the next five years. The panelists are:

Robert Pliskin
 President
 Seiko Time Corp.

Larry Grunstein
 Executive Vice President
 North American Watch Corp.

Lemuel Tarshis
 Executive Vice Pres. - Operations
 Timex Corporation

Andrew Tisch
 President
 Bulova Watch Co.

THE DIGITAL WATCH REPAIR MANUAL

2nd Edition



A complete manual on the repair of LED and LCD watches

by
LOUIS A. ZANONI
 \$19.95

This 76-page, handsomely printed and easy-to-read version contains all of the practical information of the original plus added features, including a glossary of electronic terms and milli ampere hour battery chart. This fully illustrated "How to do" manual covers the most frequently encountered repairs required of both the LED and LCD watches. The information in this book is fundamental and pertinent to all quartz watches.

FREE with order:

"The Digital Watch Troubleshooting Guide"

Send check in the amount of \$19.95 to:

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 Cincinnati, OH 45211

Name _____

Address _____

City/State/Zip _____

BURCKHARDT

(Continued from Page 35)

where it belongs - on your wrist!

We could go on and on listing benefits. These things may seem minor to us, but we're not the ones buying the watch. Think of the thousands of customers that have had these problems. They are the ones to which you will appeal. Look at the roughed out ads, Figures 1, 2 and 3. If you were buying a watch, which ad would get your attention?

POINTS OF PURCHASE DISPLAY

This is what the customer sees in your store. It's a very important type of advertising. If your watches are just thrown in the showcases or windows in a helter-skelter manner, they won't make much of an impact. Treat them like the fine pieces of jewelry they are. Keep your stock clean. Use a counter pad when showing watches. A small card placed near a watch listing a benefit derived from the particular piece can be very effective. It may be just enough to start them thinking and to show an interest in the article.

Your entire store is a showcase. If it looks like a tornado passed through don't expect to sell fine quality timepieces. Of course, if a tornado did just pass through, and the watches are still in good shape, this would be a good thing to use as an additional benefit!

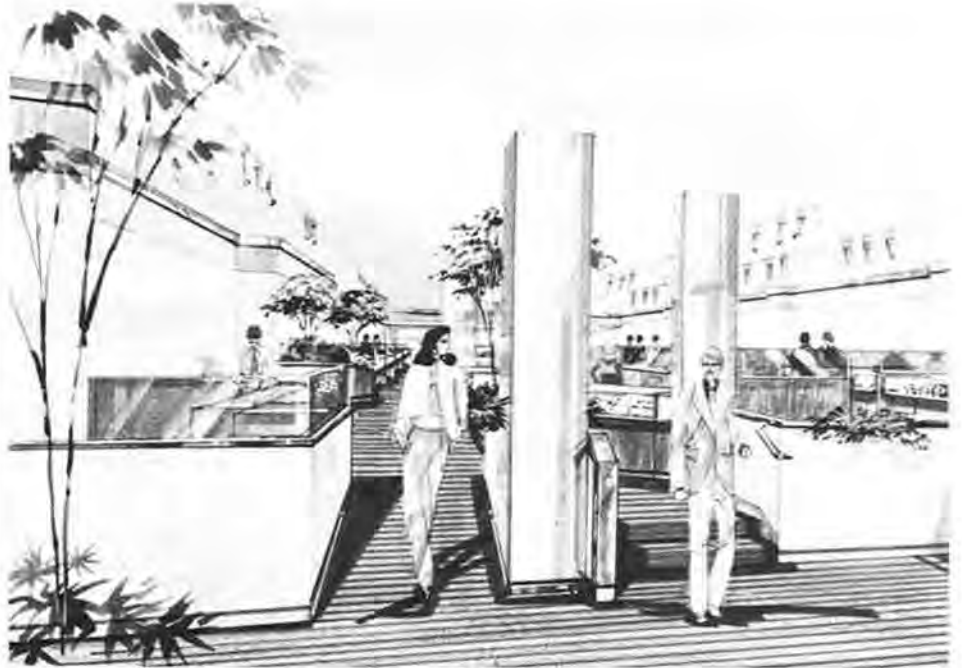
In all your advertising, you'll have to offer something that nobody else offers. Think of why a person should buy a watch from you instead of from the store down the street. What is unique about you, your store, or your watches? These are the things on which you must capitalize.

Over 65 million watches are expected to be sold this year in the United States alone. How much of this business will be yours? *Only you can answer that question!*

Figure 3

FOR YOU!
LADIES QUARTZ DRESS WATCHES
\$59.95 WATER RESISTANT
CRYSTAL RESISTS SCRATCHING
OR BREAKAGE
ACCURACY WITHIN A MINUTE A YEAR
NO WINDING - EVER!
JO JO JEWELERS

TIME



The Chicago Jewelry & Diamond Exchange, a unique concept for selling jewelry, to open at 21 N. Wabash in late summer of this year, will feature 65 individual booths for jewelers, designers, and watchrepairmen. See story on page 48.

Silver Futures
The Maxell battery bonus that adds up the more you stock up.

In addition to unequalled performance, Maxell has an invaluable bonus that's free with every 100 batteries ordered. Call your Maxell battery distributor for details. Or call us for the name of the Maxell distributor nearest you. Hurry! Quantities are limited.

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Encouragement Could Well Be The Answer

By the time this report reaches you, it will be nearly time for our annual meeting. If you are a delegate and have not as yet received your packet, please get in touch with your president, executive secretary, or any other person to whom this material may have been sent. Transversely, if you now have this packet in your possession, please see that it gets into the hands of the proper person. This is very important. I won't go into it any further in this column, but you will receive a letter from me in your delegate's packet.

I just came back from our quarterly board of director's meeting for the Watchmakers Association of Ohio. If your association is anything like ours, you have some small problems—not the least of which is diminishing membership, which can be attributed to several factors: (1) The greatest number of today's watchmakers learned their trade in the mid to late 1940's which puts them in the retirement (or close to it) bracket, and this means that they are now retiring (or going to that great repair shop in the skies); (2) Because of the low pay as compared with other occupations, fewer people are inclined to enter our trade; (3) The advent of the electronic timepiece has made the throwaway watch a thing of reality; and (4) A general indifference of most people concerned.

There is nothing that can be done about number 1 because no one can reverse nature (but if you find a way to do it, please let me be the first to know). As to the low pay, we have no one to blame but ourselves. If you feel that you are making a sub-standard wage, then ask for more or seek a better place of employment. The solution to problem number 3 is very simple: Learn how to repair all of the new timepieces. This is your problem and it is very easy to solve. The indifference refers to that indifference which is shown by everyone concerned, and when you can find the solution to this problem let me know how you did it.

I received a letter from our affiliate, the Central Arizona Horological Guild, and they say: "We are finding that with a little encouragement, many of our local members have something to offer their fellow members on various aspects of watchmaking that they have pursued more than the average person, and that it makes a fine program at our meetings. We recommend this to other guilds." It points out just what I have been saying all along: some of your finest experts are right in your own organization; all they need is a little encouragement. Thanks Arizona.

TIMES



...from all around the ASSOCIATION...

ONTARIO

Members of the Ontario Watchmakers Association had the "Atmos Experience" presentation at George Brown College recently. Fifty-three watch and clock repair persons and students saw this two-hr. program which was put together by the Bay Area Watchmakers Guild and presented to AWI. Jay Foreman

actually took a clock apart and repaired it completely in the presentation.

At the Annual Meeting, 2 slide lectures were given: Fitting Mineral Crystals, and Case Problems and How to Solve Them. At the same meeting, John Blankenburg and Robert Phillip demonstrated Microfiche material systems.

OHIO

The Watchmakers Association of Ohio, Inc. will hold their annual convention July 29-30-31, 1983 at the Marriott Inn, Columbus, Ohio.

Material house displays, a swap and shop table and the traditional hospitality room will be open from 1 to 6 p.m. on Friday. An Hawaiian Dinner and dancing will round out the evening.

Robert Moengen of Jewelmont Corporation, Minneapolis, MN will launch the business program at 9 a.m. Saturday. He will be followed with talks by Don Foltz and Jack St. Cyr and Michael Jenner of Media Digital Corporation, Media, PA. Dinner and the President's Ball will be featured in the evening.

President Al Brehl and WAO Convention Chairman, Norm Basch ask all members to register immediately. No reservations will be accepted after July 18.

The Cincinnati Watchmakers Guild recently held a meeting at the Holiday Inn, Eighth and Linn Streets, in Cincinnati. The program was an AWI slide presentation "Fitting Mineral Crystals."

ARIZONA

The Fifth Annual Convention of the Arizona Horological Association was held recently at the Francisco Grande Resort in Casa Grande, Arizona. The convention included a lecture on Cash Management by Maria Elba Molina; a Round Table Discussion by Terry Smith (Accutrons), Olbie Mott (Quartz), Bjorklund (Clocks), Benny Saunders (Profitable Trade Shop); and a popular program "Ask Henry Fried," by Mr. Henry Fried.

The Central Arizona Horological Guild, Inc. recently held a meeting at the Salt River Project Building, Phoenix, Arizona. Langert Brothers gave an update on the Microfiche and AWI Slides.

COLORADO

At a recent seminar of the Colorado Horological Society Archie B. Perkins, CMW, presented a two-day course on "How to Use the Watchmaker's Lathe."

Perkins has been an instructor of watch and clock repair at Emily Griffith Opportunity School for more than 30 years and is a nationally known lecturer and writer.

NEW YORK

Mr. Dave Peyton, Jewelry Repair Instructor at the Bulova School of Watchmaking, spoke recently at the May meeting of the Horological Society of New York, Inc. Mr. Peyton has 40 years of teaching experience in both practical and design aspects of the jewelry business. Among his numerous credits is a 24 years post as Chairman of Industrial Arts at Levittown H.S. His topic was "Repair and Soldering of Watch Cases and Jewelry."

At a recent meeting of the Horological Society of New York, Jack Schecter of Seiko Watch Company opened the program by introducing Scott Chou, Manager of Technical Information Services, as the main speaker. The theme of the evening was an explanation of how a new device within the integrated circuit will maintain the correct time rate without the use of a trimmer. The question and answer period was largely devoted to questions of lubrication.

TEXAS

The TWA Annual Convention was held recently at the Green Oaks Inn in Fort Worth, Texas. On the first day of this three-day convention, Mr. Calvin Sustacheck presented an AWI Bench Course on the "Bulova Quartz 262 and 2500." The following day of the convention consisted of several informative talks: "Servicing the Exterior of a Seiko," given by Jack Schecter (of Seiko Time Corporation); Bob Moengen of Jewelmont Corporation with his presentation on "Fitting Mineral Crystals and New Things in the Material Business," Bob Mandrioli of Interantional Watchmakers presenting "Lubricants and Their Use in Timepieces," and Wilard P. Walkling of New Hermes, Inc. gave a talk on "Hints and Tips on How to Profit By Engraving."

The convention also included a talk by Guest Speaker Marshall F. Richmond, and on the last day a Panel Discussion consisting of all the speakers from the previous day.

OREGON

At a recent meeting of the Oregon Watch and Clockmakers Guild, plans for a proposed Mini Convention of the Oregon Guild was discussed. The seminars given recently by James Broughton ("Citizen LCD Multi-Alarm" and "FHF 965") and

Cal Sustacheck ("Bulova Quartz 262 and 2500") were a success.

FLORIDA

Plans are being made for the Florida State Watchmakers Association 38th annual convention. It will be held October 14-16 at the Holiday Inn in Plantation, Florida, which is located just west of Ft. Lauderdale.

James Broughton was recently in Orlando with an AWI bench course. Mr. Bob Bishop was recently in Florida also to present an AWI bench course, this one in Ft. Myer and covering quartz watch repair, a two-day course.

ILLINOIS

Jerry Palmer, gemologist, spoke at the recent meeting of Central Illinois Watchmakers Association. The meeting was held in Springfield. Palmer showed equipment to test gems and discuss the field in which he has had 20 years of experience.

The Seiko Chicago Service Center in Elk Grove was visited by members of Central Illinois Watchmakers. Rick Boucher, manager, and John Toy, shop foreman, arranged a special tour through the facility. Actual use of the center's highly sophisticated technical equipment was offered for all interested. Co-hosts were members of the newly-reorganized Northern Illinois Watchmakers Assn., with 68 members and growing. The program allowed time for a "rap session" with Boucher, Toy and NIWA members.



Your fellow members want to know. Send in the news . . . as fast as it happens.

NEW JEWELRY EXCHANGE TO OPEN IN CHICAGO

The Chicago Jewelry & Diamond Exchange, a unique concept for selling jewelry and watches will open at 21 N. Wabash Ave. in Chicago in late summer of this year. Already successful in New York and Los Angeles, the Jewelry & Diamond Exchange offers jewelers, setters, designers and watch repairmen the advantage of operating with a minimum of overhead and expenses.

As the only one of its kind in Chicago, the Exchange offers an exclusive downtown, street-level location in a primary shopping district near Marshall Fields, Carson Pirie Scott, Crate & Barrell and Chas. A. Stevens. It features 65 individual booths for lease to retail, wholesale and repair jewelers.

Approximately 6,000 sq. ft. of space will be available for occupancy.

Patricia Chandler, retail properties broker of Arthur Rubloff & Company, has been named exclusive leasing agent for the Chicago Jewelry & Diamond Exchange.

"I think it is timed perfectly with the advent of the 'off-price boom' in the clothing market as customers who shop at the Exchange will now be able to negotiate the price of fine quality jewelry, gems and brand-name watches," said Ms. Chandler.

"After having traveled to New York and Los Angeles to personally inspect the existing Exchanges in those cities, I believe that Chicagoans will be tremendously impressed with this concept," she added.

The grand opening and ribbon cutting, set for September, will be timed with the 1983 Christmas season.

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BATTERY NUMBER SYSTEM

Refer to your BNS booklet to make the following monthly up-date:

Correction:

S02 (AWI): change 8033 (Sears) to read 8038

Additions:

M01 (AWI): add PX625 (Maxell)
L04 (AWI): add DL1220 (Duracell)
L08 (AWI): add DL1620 (Duracell)
L10 (AWI): add DL2016 (Duracell)
L12 (AWI): add DL2025 (Duracell)
L14 (AWI): add DL2032 (Duracell)
L18 (AWI): add DL2420 (Duracell)
L20 (AWI): add DL2430 (Duracell)

New Listing:

S29 (follows S27, AWI): 1.50 (voltage),
 9.5 (diameter), 2.7 (height),
 SR927W (Maxell)

SERVICE IDEAS

"The Business of Watch Batteries," which appears in this same issue, contains information on **testing, selection and replacement** procedures, **substitutions, shelf-life, charges, and warranties**. This article may help you to make your battery business bigger and better!!

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C (a)	Citizen LCD Multi-Alarm	Broughton
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C (c)	Pulsar	Broughton
D	Seiko Quartz Analog and LCD	Smith
E	Intro. to Solid State Watch Repair	Nelson
F	Fundamentals of Solid State Watch Repair	Opp
G	Repairing the ESA 900.911 Digital/Analog	Biederman
H	Clock Restoration	Benesh
I	Introduction to Striking Clocks	Baier
J	Common Sense Quartz Watch Repair	Bishop
K	Introduction to Clock Repair	Benesh & Whitney
L	Bulova Quartz 262 and 2500	Sustachek
M	Striking Clocks—Advanced Seminar	Baier

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5	A	San Mateo, CA	Jaeger
6-10	K	Cincinnati, OH	Whitney & Benesh
12	D	Denver, CO	Smith

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screen or other areas not intended. This will render the coil inoperative, and our effort for naught. Good judgment must prevail in this type of repair.

Another electronic test we must master is for current consumption. A step-motor watch is engineered to operate at precise current consuming levels. Current consumption is always a factor in electronic watch repair, but when and how often we make it could vary between solid state and electro-mechanical watches. In solid state repair it is always one of the first tests after visual observation. It would probably also be a good habit to do this in electro-mechanical repair. I must confess I do not make it that early a test in step-motor watch repair. I feel problems which can be remedied through other tests may also eliminate a high consumption reading. That is to say: in an electro-mechanical watch, should a high consumption reading have occurred at an early test, its cause may have been eliminated by previous tests and resultant repair.

The current consumption test requires equipment that will power the watch through the probes of the ammeter while simultaneously registering the consumption. There are module testers available which have been specifically designed and developed for electronic watch repair. I have often been chastised because of my use of gimmicks and gadgets. It is my contention that once we understand the basic repair procedure and master the use of these different attachments we will, when work volume warrants, go to more comprehensive equipment. You may now have in your possession the equipment and attachments that will do the job. Figures 5, 6, and 7 show equipment that has the current consumption reading capability.

Current consumption varies from calibre to calibre. Today's step-motor watches have a working current consumption somewhere around 2 microamps (2 uA). As you get more involved in step-motor watch repair you will become familiar with different movements and their characteristics. Attempt to get a technical bulletin for every watch you undertake as they will indicate the tests to be made and the values to expect. The technical bulletins will probably call for two different consumption tests: one for working current and another for quiescent current. The working current is the current drain with the stem in the far-in position and the step-motor coil being energized. The quiescent current is that current drain present with the stem in the hand-set position. The quiescent current maintains the oscillator system, the quartz crystal, the divider circuit, etc. It is the lesser of the two currents.

The current consumption tests will tell you a number of things. If the coil has the proper resistance and current drain is high, look for moisture or foreign matter somewhere on the electronic module. Clean the module with Rodico® or similar paste cleaner and examine the module under high magnification. A grounded coil should have been eliminated from a previous test. Examine the main plate and be sure it is scrupulously clean. If the current drain is 10-20% high and the watch functions, it will probably be satisfactory. Be aware that the watch will need more frequent cell replacement. If it is in the area of 30-50% over the recommended consumption, a new electronic module is in order. With all aforementioned cleaning and repair completed, you will find very few movements exhibiting this high current drain.

The next electronic test would be to find the lower-working voltage limit. To complete this test you will need the capability to reduce the voltage to the movement. Figures 6 and 7 show meters with attachments with which this test can be performed. Begin at 1.5V and gradually reduce the voltage until you can visually observe the step-motor or when the train ceases to function. Individual

calibres will have specific lower-working voltage limits which are acceptable. Lacking a specific technical bulletin, 0.2 Volts (two tenths of a volt) below the normal-working voltage is quite acceptable as a lower-working voltage limit. Should the train not function at this reduced voltage, look for excess train friction or total blockage.

There are many mechanical repairs which directly relate to electronic malfunction; physical contact of electrical joints is one of the most overlooked. Drawing down a screw improperly is a good example. It shows up as an electronic malfunction but is actually mechanical in nature. Improper placement of cell leads and cell replacement is a mechanical error which too manifests itself as an electronic malfunction.

Cleaning the step-motor watch also requires some difference in technique. We have developed a mechanical watch cleaning procedure that is not suitable for step-motor watch cleaning. To some it may seem to be a regression as many involved in step-motor watch repair do not use mechanical cleaning aids, such as cleaning machines. Many do not use the usual commercial clean and rinse solutions. Many clean some of the metallic components in the regular manner, and others do not.

Electronic components, such as the circuitry, the coil, and the step-motor, are not cleaned in a manner requiring immersion. Most conducting portions should be cleaned with paste-type cleaners such as Rodico® or similar cleaning agents. If this is not sufficient, then wiping with a cloth moistened with alcohol or benzine followed by air drying works fine.

The main plate and step-motor can be scrubbed with a brush using benzine as the cleaner, followed by a clean benzine rinse, and air-dried. Check all step-motor magnets carefully for clinging metallic residue.

The watches which have a day-date mechanism incorporate many plastic components. These are, as a general rule, not to be subjected to many of the commercial solutions, or to the intense heat of the commercial drying chambers. Most can be brushed in alcohol and air-dried. There are many of the plastic parts that can stand the normal mechanical cleaning processes. Unless otherwise stated in specific technical manuals, it is best to take the cautious approach. In using alcohol, prolonged exposure is to be avoided. When hand-cleaning and using alcohol and benzine as cleaning agents, pyrex petri dishes serve as excellent solution containers. The lids fit loosely enough for easy removal, yet still provide containment of fumes when not in use.

On reassembly after cleaning, the normal watchmaker cautions apply. Many of the trains are extremely small and uprighting the wheels is difficult. Many bridges are not fully jeweled. When guiding a pivot into an unjeweled pivot hole it is very easy to raise a burr around and in the unjeweled hole. Be sure you check the train for complete freedom. Some of these burred pivot holes can only be noted under high magnification. The rotor presents another unique problem. It is highly magnetized and not only attracts itself to the stator but to your tweezers. Non-magnetic tweezers are a must. We never demagnetize a movement with the rotor in place. Unfortunately, some of the "non-magnetic tweezers" require frequent demagnetizing.

Last and far from least, we must consider lubrication. I was told personally by the manager of one of the largest manufacturers service centers that "over oiling" was the largest single contributor to step-motor watch failure. I mentioned previously in this article the advisability of securing "General Service Manuals For Analog Quartz Watches." I also suggest you secure at least two "Specific Calibre Manuals." I recommend these because of

(Continued on page 52)



How To Clean Electronic Parts!

Since this June issue of the "Horological Times" is devoted to quartz technology, I was hoping to review some new electronic tips for this month's column. Unfortunately, we haven't received any, so here are a few of mine.

First, I did not realize what a good tip Mr. Louis Zaroni gave us in the October 1982 issue of the "Horological Times" (about repairing the analog coils) until it was tried. At last count, to this date, I have repaired five open coils at a savings to me of \$18.00 and up per coil; add it up—that's saving money. Go back and review the article; it will sure save on expenses. The silver epoxy he speaks of will do a good job if the instructions are followed. Be sure to read "No visible damage" and the repair method under 3-C. It works!

When mixing this silver epoxy it will get mealy and will be hard to mix since it has a short shelf-life unless kept frozen. I have found if you use a little tad of alcohol to thin the silver epoxy when mixing, it can be applied much easier, but then it won't set up hard as it should. A simple method to remedy this is to put a thin coat of fast curing clear epoxy over the silver epoxy one or more hours later. You now have a permanent bond. Come to think about it, why don't the manufacturer coat coils with epoxy to guard against damage?

Haven't you often thought that it would be nice if someone would come out with a small glass brush that the watchmaker could use to get into small places to remove rust or clean "green" corroded contacts? Well, there is one on the market. It is manufactured by Bergeon, order by part No. 6240. The glass brush part is 2 mm in diameter and can be fed out as needed. The holder is the size of a standard lead pencil. This little glass brush also does a wonderful job of removing metal marks that are shorting out on ceramic between a printed circuit. You will find many more uses for this handy glass brush.



Have you ever had anyone tell you how to clean a circuit board or other electronic parts safely? Watchmakers like to see parts in a watch clean and shiny, like new. But all manufacturers say not to clean in watch cleaning solution, because it will destroy them. So what do we use to clean electronic components?

(Continued on Page 53)

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JAEGER
 (Continued from page 50)

their detail, the first one being Technical Communication #29, available from ETA Industries, Inc. Their address is 608 Fifth Avenue, New York, NY 10020. The other is the technical guide for the "Seiko Quartz, Cal. 0903A," and the address is: Seiko Time Corporation, Technical Services Department, 555 West 57th St., New York, NY 10019. Both of these manuals go into great detail on lubrication. Even though they deal with specific calibres, the procedures generally apply to all step-motor watches. As a general rule, use about one-half the oil you have been using in mechanical watch repair. Until you develop your own procedures and preferences, rely on the recommendations of those who manufacture the step-motor watches.

Your continuing study is vital to you. New difficulties are being uncovered daily. Increased use of plastics in casing and module retainers have led to unusual static electricity problems. Crowns are being bonded to stems. The new very low current consuming calibres require special attention when casing. These are just a few of the things we, as the repair people, must be able to recognize. Only through constant study can you continue to be recognized as an expert.

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BENCH TIPS

(Continued from Page 51)

There is a commercial cleaner you can buy to clean electronic components that will not harm them. It's called Oakite BCR (Buffing Compound Remover)[®], which is a detergent-type liquid developed originally for the removal of buffing and polishing compounds. It's formulated with special wetting-out, penetrating and emulsifying properties for quickly breaking the bond of various metal polishing materials such as tripoli, rouge and other contamination.

Oakite BCR will not attack or discolor any kind of metal or plastic—even aluminum or zinc. It rinses from all materials spot-free regardless of the concentration it is mixed, ranging from 3% to 20% by volume in water.

When used as a jewelry and case cleaner, 26% aqua ammonia can be added to remove tarnish or green corrosion caused by perspiration. For ultrasonic cleaning, use 10% Oakite to 90% water and add 6 oz. of ammonia to make a gallon.

To clean electronic components do not add ammonia because it will destroy the circuits! Two safe methods to use are: (1) Mix 20% Oakite by volume with water in a pyrex dish. Warm not more than 140 degrees F. Hand clean the electronic parts by first soaking them for about five minutes in the solution and then carefully holding the parts with stainless steel tweezers to agitate about one minute by hand, and then rinse under warm tap water set at not over 140 degrees. Hand dry with a hair dryer set on low heat. If not overheated, Oakite has a long shelf life and only needs changing when it becomes dirty; (2) The second method to clean electronic components is in an ultrasonic tank or watch cleaning machine that has ultrasonic agitation. To avoid damage to the electronic parts that are machine cleaned, compartments can be made from fine stainless steel mesh screen to hold the parts securely racked in the watch basket. 10% Oakite is sufficient to clean ultrasonically. Rinse under 140 degrees tap water and immediately spin dry in the watch cleaning dryer. Do not heat over 140 degrees. A good practice is to heat dry for two minutes; turn off the heat and continue spinning for three more minutes.

(Continued on page 57)

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with them to the course. Cal Sustacheck will be the instructor for this new course. Mr. Sustacheck will be assisted in this, the introductory course by Gerald Jaeger, instructor at Milwaukee Area Technical College.

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Q I have been looking into digital watch repair with very little success. Could you help me locate a manufacturer that would supply me with modules, and whatever else I would need. I have written to quite a few manufacturers and the most of them will only supply modules. Thank you.

Duane G. Callahan
Hood River, OR

A To obtain information on digital watches, techniques, parts, etc., write to: Louis Zaroni, ZANTECH, 13 Greentree Rd., Trenton, NJ 08619. He is one of the leading teachers of watchmakers interested in repair of digital watches.

Also, you should join the American Watchmakers Institute and subscribe to their correspondence course in the repair of such watches. It is about the best such course offered.

Mr. Zaroni has quite an assortment of replacement modules, parts for

repair, tools, materials and equipment needed for the servicing of these watches.

Q I am planning on visiting Nuremberg, Germany next summer. Could you please give me any information on some famous clocks I should see?

I would deeply appreciate any information I would receive. Thank you.

Ronald Oswaldel
Altoona, Pennsylvania

A In Nuremberg you ought to visit the statue to Peter Henlein, a native who is chauvinistically given the credit for the first mainspring timepiece (which appeared before he was born in northern Italy). In Nuremberg, visit the horological exhibits in the Germanisches Nationalmuseum, Kormmak 1, and Gewerbemuseum de Landesgewebreanstalt Bayern at Gewerbemuseumplatz 2. There are some local clocks (public) which you might ask your guide or the museum people to suggest.

Nearby, Regensburg also has an interesting public clock that is animated. While you are so close to Munich, get

there before 11:00 a.m. to see the most animated clock in Germany at the city hall square. It puts on an elaborate show, best at 11:00 am.

Our group was there about four years ago and it was a most enjoyable tour. This year's will be just as exciting—at least. Best wishes.

Q Your name was given to me by a jeweler in North Wales, PA when I approached him with this question.

I am the owner of an automobile with an alarm system that notifies me by a pocket pager when the car's alarm goes off. I'd like to know if there is currently being made a wristwatch which could pick up the signal of the car alarm.

Fred Rosenberg
Ambler, PA

A The small area in a watch at present does not have the requisite power to supply amplification to trigger an alarm signal in a solid-state watch. In the future, we do surmise that the sophistication of the circuitry, economy of energy requirements and new technological breakthroughs in small size electrical energy cells may make such concepts a reality.

Henry B. Fried

Clock and alarm - clock bushing tool No. 6200

Swiss made.

This precise bushing tool is robust and practical and allows the bushing of plates \varnothing 50 to 220 mm and height of pillar of 70 mm.



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Your AWI membership card signifies that you are entitled to the many services offered by your association. However, we must have the correct information from your card to be able to serve you most efficiently.

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1983

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TIMES

BENCH TIPS
(Continued from Page 53)

I will not be responsible for any electronic components you may destroy by not being careful while cleaning. Oakite and water will not harm electronic circuits; careless workmanship will. Use at your own risk. So far I have not harmed one IC and they sure do come out sparkling clean like the rest of the watch.

To order Oakite BCR in the USA call 1-800-526-4473 in order to contact a sales representative in your location, or write for information to: Oakite Products, Inc., 50 Valley Road, Berkely Heights, NJ 07922. In North Carolina order from Jim Thomas, Sales Rep. of Oakite Products, Inc., Triangle Warehouse, 1600 W. Lee St., Greensboro, NC 27403. The minimum order is five gallons.

Send your tips to: Jingle Joe, 265 North Main St., Mooresville, North Carolina 28115.

TIMES

It's about time ...

The Digital Electronic Watch

Tom M. Hyltin
Formerly of Texas Instruments

224 pp., illus., 6 x 9, \$19.95



It's about time someone wrote a complete, non-technical guide to help you keep up with the digital watch revolution. Here, in this one book, you'll find all you need to know about how they work, how they're designed, and how to repair them. You really can't afford to be without this handbook, written by one of the original developers of electronic watches.

Horological Times

PO, Box 11011, Cincinnati, Ohio 45211

Yes, please rush me "The Digital Electronic Watch." I am enclosing \$21.45 (cost \$19.95 plus \$1.50 for postage) U.S. funds only. Please allow approximately 4 weeks for delivery. Price subject to change.

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Paris, Texas 75460

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3700 Harrison Avenue
Cincinnati, Ohio 45211

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Address _____
City, State & Zip Code _____

European Fair A Success

The 11th European Watch, Clock and Jewellery Fair closed its doors on Monday, April 25, 1983, marking the last time it will be staged together with the Swiss Industries Fair. Starting in 1984 the two events, which have been held concurrently since 1973, will go their own ways. The EWCJF will take place for the first time as an independent trade fair from April 5 to 12, 1984—in Basle, Switzerland, as usual.

The European Watch, Clock and Jewellery Fair 1983 once more proved itself to be a most important event. Trade buyers from more than 100 countries were registered. The proportion of new trade visitors increased by 10% compared to last year. The EWCJF drew 60% of its registered visitors from Europe, 18% from Asia, 17% from America (mainly USA), 3.5% from Africa and 1.5% from Oceania. About 1/3 of them were retailers, a further 1/3 wholesalers and importers, 1/6 manufacturers and 1/6 came from other professional sectors in the watch, clock and jewelry industries.

The large majority of all exhibitors in the "Watches" sector was able to report the same or a better result than 1982. The main demand was for quartz watches with analog faces, while interest in digital watches has diminished. Business was somewhat more brisk with wrist-watches than with clocks (wall clocks, etc.).

In the "Jewelry" sector, most exhibitors reported better sales than last year, especially in the middle price categories. Gold and silver continue to be the precious metals most in demand.

GEMOLOGY GRADUATION AT PARIS JR. COLLEGE

Twenty-seven students received certificates for completion of Paris Junior College's professional gemology program at ceremonies held recently, according to Malcolm Heuser, instructor of gemology at PJC.

The graduates included Benjamin Lee Freeman of Paris, Virgil Edwin Hudson of Blossom and Elnor L. Pettiet of Clarksville, all in Texas. Others completing the program were Texans Joe L. Adams of Perryton, Dana D. Boyer of Lamesa, Dana L. Clay of Gainesville, Jerry Ditmore of El Paso, Patricia L. Duran of Dallas, Matthew T. Hawkins of Boerne, Steven Emil Hyman of San Antonio, C.M. Koehler of Carrollton, Martha E. Meeks of Dallas, Charlene L. Mitchell of Beeville, Zina Christine Pape of New Braunfels and Jimmy C. Williams of Dallas.

Other graduates included Oklahoma residents, Nicholas Jay Hilton of Ponca City and Deborah Sue Hobbs of McAlester; Arkansas residents, Jeffery C. Penson of Fort Smith, Sanford Schor of Yellville, Todd R. Slaughter of El Dorado and Rex Joseph Turner of

Jonesboro; Margaret A. Kendrick and Robert Scott Stover, both of Knoxville, TN; J. Keith Baggett Jr. of Montgomery, AL; Debi L. Chiasson of Lockport, LA; Nancy L. Clayshulte of Mesilla, NM; and Blaine D. Gunderson of Sioux City, IA.

The graduating students were congratulated by PJC President Louis B. Williams; Dr. Harley Davis, dean of applied sciences instruction; and Paul Clayton, who is on medical leave as chairman of the division of jewelry technology, horology and gemology. Hoyle Barr, administrator in the division, presided at the graduation, and gemology instructors, Heuser and James Overstreet, presented certificates.

FIRST INAMORI JEWELRY DESIGN COMPETITION

Inamori Jewelry Division of Kyocera International, Inc. will sponsor a jewelry design competition to be administered and judged under the auspices of the Gemological Institute of America, the foremost educational institution for professional jewelers.

The competition will feature jewelry designed with man-

made gems from Inamori including Inamori emeralds, rubies, opals, alexandrites and padparadschas. Cash prizes will be awarded with a combined total of \$9,000.

For more information write: Inamori Jewelry, Division of Kyocera International, 8611 Balboa, Ave., San Diego, CA 92123.

E.&J. SWIGART NAMES SALES REPRESENTATIVES

The E. & J. Swigart Co., a Cincinnati based supplier to jewelers, watchmakers and clockmakers, has announced new Area Sales Representatives.

Tony and Amy Riggio, of Scottsdale, AR, will be the new area representatives in the Arizona and New Mexico area. Bill Tolbert will be representing Swigart in North and South Carolina. He currently resides in Millers Creek, NC. The new representative in Tennessee is Bob Berry of Fairfield, TN. Paul Rush of Somerset, KY will represent the states of Kentucky and West Virginia.



Livesay's, Inc., a watch material and jewelry distributor of Tampa, Florida, recently sponsored a Zantech Quartz Watch Repair Seminar at the Ramada Inn North in Tampa, Florida. Attending the seminar were (standing left to right): Louis A. Zanoni, President of Zantech, Inc. and instructor; Sidney Smith, watchmaker for BocaWatch Shop; Henry Livesay, President of Livesay's, Inc.; Richard Scheaver, watchmaker for Shrode Jewelers; Clyde Edgecomb, owner of Edgecomb Jewelers; John Nailos, owner of Certified Watch and Clock Shop; Michael Judy, watchmaker for Dubose Jewelers. (Seated left to right): Wolfgang Schon, watchmaker - Trade Shop; Dwight Holt, watchmaker - Trade Shop; Joseph Barquin, Livesay's material salesman; and Lynn Hunt, store manager, Lewis Jewelers.

NELSON SYKES NAMED DIRECTOR OF CORPORATE COMMUNICATIONS

Gedaliao Grinberg, President of North American Watch Corporation has announced the appointment of Nelson Sykes as Director of Corporate Communications. Mr. Sykes' responsibilities will include public relations, special events and sales promotion.

Prior to his new assignment, Mr. Sykes was Director of Consumer Products Advertising and Sales Promotion at Union Carbide Corporation, Director of Public Relations at the William Esty Company advertising agency and managing director of Video Communications, an independent production company.

North American Watch markets Piaget, Corum, Concord and Concord Collection fine gold watches.



Nelson Sykes

JEWELERS OF AMERICA TWO-DAY CONVENTION

Mike Roman, JA chairman, has announced plans for a two-day Convention Program, in New York, Sunday and Monday, July 31 and August 1, at the Ziegfeld Theatre.

Starting at 9:00 a.m. on Sunday, July 31, the program will be "Jewelers of America Presents. . . New Opportunities to Increase Your Promotional Power." This will be a three-part presentation which will feature: (1) JA's National Spokesperson Program; (2) "Rhapsody in Gold," presented by International Gold Corp. (Intergold); (3) "Christmas Dia-

mond Couture," presented by Diamond Promotion Service on behalf of DeBeers.

On Monday, August 1, starting at 9:00 a.m., the program will be "The Changing American Watch Market."

For more information contact: Jewelers of America, Inc.; Rockefeller Center, 1271 Avenue of the Americas; New York, NY 10020.

WILLIAM W. HEER DIES

William W. Heer of Frenchtown, NJ, former president of Concord Watch Corporation, New York City, died recently in Keene, NH after a brief illness. He was 85.

Born May 19, 1897 in Bienne, Switzerland, Mr. Heer served in Concord management positions for 55 years. When the corporation was acquired in 1970 by North American Watch Cor-

poration, he remained as president until his retirement in 1977. He served for four years in the Swiss army during World War I. In 1922 he came to New York City as a representative of the Concord Watch Company of Bienne. He was active in numerous trade associations including the 24 Karat Club of New York City.

In lieu of flowers it is suggested that contributions be sent to the Development Fund of Cheshire Health Foundation, Box 522, Keene, NH 03431.

PAPPAS NAMED SENIOR VICE PRESIDENT AT AC&R ADVERTISING INC.

Constantine P. Pappas has been promoted to senior vice president, account supervisor at AC&R Advertising Inc., according to Stephen Rose, board chairman.

Mr. Pappas, the account supervisor on Seiko watch brands, Seiko clocks, Jean Lassale and Jaz Paris in the United States and Canada, joined the agency in 1974. He had previously been brand manager at Burlington Industries, New York and prior to that was with Doyle, Dane Bernbach; Standard Brands and Dancer-Fitzgerald-Sample, Inc.

Mr. Pappas, a graduate of Northeastern University, spent four years prior to his advertising career as a regular United States Army commissioned officer and commanded a NATO company in Heidelberg, Germany.

AC&R (a member of Ted Bates Worldwide), together with its subsidiaries for public relations, direct mail and audio/visuals, provides communication services for some 70 clients with billings approaching \$100 million.



With the Pierre Hotel's Grand Ballroom as the setting, the Diamond, Jewelry and Watch Division recently held its annual dinner for the UJA-Federation Campaign, which saluted Milton Gralla, executive vice president of Gralla Publications and Robert Pliskin, president of the Seiko Time Corporation. The event raised \$1,200,000 for the campaign. Seated (left to right) are Larry Prigozen, Robert Pliskin, Milton Gralla and Mort Weisenfeld. Standing (left to right) Andrew Tisch, dinner chairman; Paul Bialo, cash chairman; Jerome Grossbardt, vice chairman; Jeff deLange, co-chairman; Mickey Low, major gifts chairman, and Stanley Schechter, co-chairman.

Bulova's New Microfiche System

A new microfiche system providing interchangeability information and a complete movement parts list for 520 Bulova models dating from the mid-1950's to the present has been made available by the Bulova Watch Company, it was announced by Ben Matz, Manager of Technical Information Services.

A time, space and money saver, the system puts in sequential order all Accutron®, Bulova and Caravelle® calibers. A master index and columnar heading provide "at-a-glance" reference capability.

Mechanical, tuning fork, stepping motor quartz, and solid state movements are covered in the system, which also features:

- Hundreds of unpublished

interchangeability cards

- Explanations of Bulova's reference systems
- The previously published, revised and corrected 1971 Bulova ABC Interchangeable Parts Catalogue with 208 pages, and the 1974 Supplement with 64 pages
- Table of male and female stems
- Cross reference Power Cell listings by number and model.

This system is in 48X magnification, making it compatible with all current standard microfiche systems. A two-part set of microfiche on movement parts is available for \$8.00 from the Technical Information Service Department, Bulova Watch Company, Bulova Park, Flushing, NY 11370. Phone: (212) 565-4707.

THREE NEW KITS FOR JEWELERS & WATCHMAKERS FROM BESTFIT

BESTFIT, a division of B. Jadov and Sons, Inc., has announced three new Kits for Jewelers and Watchmakers. These Kits contain

Spring Dustproof Crowns for the very popular Quartz watches and many dress watches now also popular. Kits and refills are always available from BESTFIT wholesalers. Write: B. Jadov and Sons, Inc., 53 W. 23rd St., New York, NY 10010.



ZX1-865 \$25.95

Contains 2 each Yellow and 1 each White (Total 18 pcs.). Yellow and White spring type dustproof small diameter crowns as used on NEW THIN QUARTZ Dress watches.

ZX1-864 \$35.00

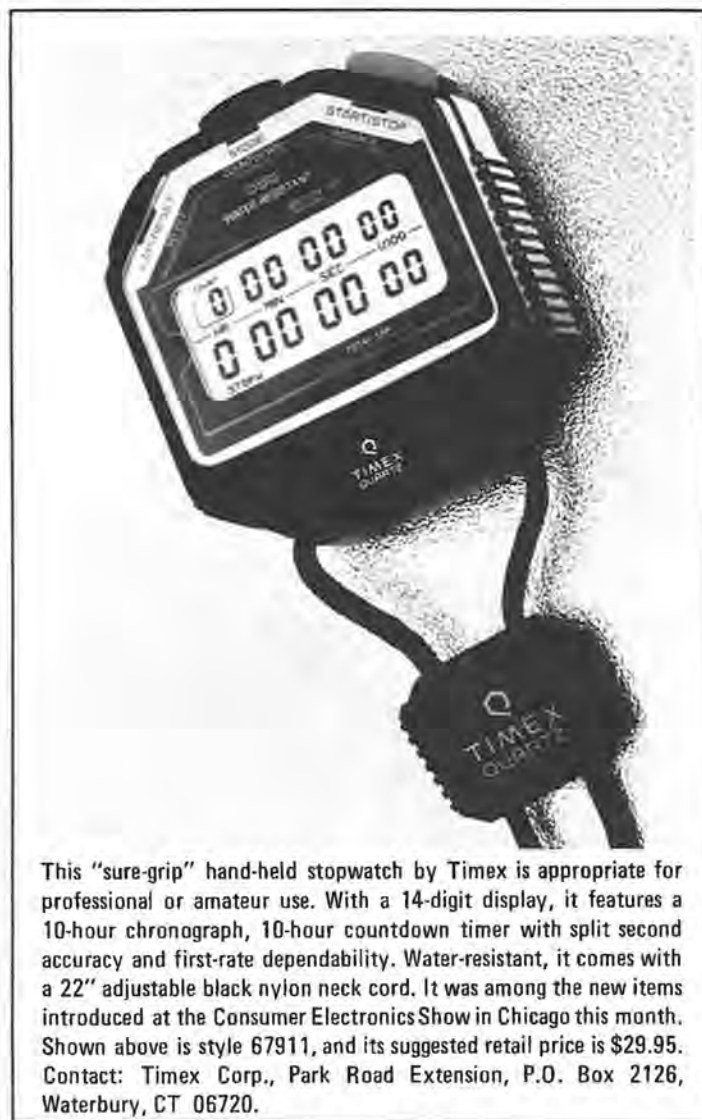
Contains 12 spring type Yellow dustproof crowns w/stone. Stones in Blue or Black with either a low or high profile.

ZX1-864A \$22.50

Contains 6 low profile crowns. High profile crowns can be added as needed.

865#	8100#	Diam.	Thread	865#	8100#	Diam.	Thread
1	1941V	2.75mm	90mm	7	1941W	2.75mm	90mm
2	1942V	3.00mm	90mm	8	1942W	3.00mm	90mm
3	1943V	3.25mm	90mm	9	1943W	3.25mm	90mm
4	1944V	3.25mm	100mm	10	1944W	2.25mm	100mm
5	1945V	3.50mm	90mm	11	1945W	3.50mm	90mm
6	1946V	3.50mm	100mm	12	1946W	3.50mm	100mm

864#	8100#	Stone	Diam.	864#	8100#	Stone	Diam.
1	1806Y	Blue Low	3.5mm	7	1814Y	Blue High	3.5mm
2	1806Y	Black Low	3.5mm	8	1815Y	Black High	3.5mm
3	1810Y	Blue Low	4.0mm	9	1816Y	Blue High	4.0mm
4	1811Y	Black Low	4.0mm	10	1817Y	Black High	4.0mm
5	1812Y	Blue Low	4.5mm	11	1818Y	Blue High	4.5mm
6	1813Y	Black Low	4.5mm	12	1819Y	Black High	4.5mm



This "sure-grip" hand-held stopwatch by Timex is appropriate for professional or amateur use. With a 14-digit display, it features a 10-hour chronograph, 10-hour countdown timer with split second accuracy and first-rate dependability. Water-resistant, it comes with a 22" adjustable black nylon neck cord. It was among the new items introduced at the Consumer Electronics Show in Chicago this month. Shown above is style 67911, and its suggested retail price is \$29.95. Contact: Timex Corp., Park Road Extension, P.O. Box 2126, Waterbury, CT 06720.

WEARABLE PANIC BUTTON FOILS HOLDUP

In true 007 James Bond fashion, a new, patented and recently FCC-approved wearable, walk-around Electronic Panic Button made by the MicroAlert Co. of Glendale, CA has just proved its worth by foiling a daring daytime holdup in a South California jewelry store.

"Exactly how this new device works, which is easily concealed on anyone's person, can't be revealed in print," retired Navy Commander and safety expert Davis Lott said. "Write us, and after proper identifi-

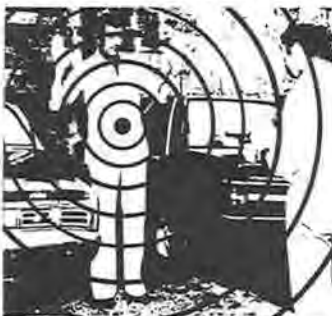
cation, allow us to reveal exactly how this device lets you call for help, even with your hands in the air or tied behind you," Lott said.

The MicroAlert System proved its worth by preventing an attempted robber in a South California jewelry store. Two holdup men who attempted the daytime caper were captured by local Laguna, California police who had been called to the scene when the two jewelers, who had been alone in their retail store at the time, had still managed to set off the pre-recorded telephone call to the police even while facing the armed

robbers' guns without them noticing anything had been done.

For information on this device, contact: c/o Lott-Western Publications of Marina del Rey, CA 90291, or call collect to: (213) 397-4217.

He is calling the Police...



- without moving hands, arms or legs
- without making a sound
- without going to an alarm button
- even from outdoors

WITH THE REVOLUTIONARY NEW
MICROLERT
600XL

CONCEALED, WEARABLE
Hands-free silent alarm

BUYER'S GUIDE FROM SWIGART

A comprehensive 260-pg. Buyer's Guide featuring findings, jeweler's supplies, tools, watch and clock materials, watches, watch bands, crystals, optical materials, boxes and packaging is available free of charge by writing The E. & J. Swigart Co., 34 W. 6th St., Cincinnati, OH 45202, or calling toll-free 1-800-543-0309; in Ohio, call 1-800-582-1706.

THE L & R 2014

L&R Manufacturing Company, a world leader in ultrasonic cleaning systems and solutions, is presently marketing a new ultrasonic cleaning unit: the 2014. The 2014 boasts enormous cleaning strength while remaining re-

markably quiet. Transistorized "state of the art" circuitry provides this unit with ultrasonic power that can be immediately seen by the surges of cavitation taking place in the tank.

The size, power, strength and silence of the 2014 makes it remarkably suitable for use as a countertop cleaning machine in any work area. The overall dimensions are 12 1/4 x 8-1/8 x 9 1/4". Tank dimensions are 9-3/8 x 5-3/8 x 4" with a tank capacity of 3.2 liters, 3-3/8 quarts.

Mr. James Lazarus, President of L&R, described the development of the 2014 as "another progressive step we've taken to provide the maximum cleaning strength with minimum sound. Our ability to produce ultrasonic cleaning systems that are powerful yet amazingly quiet has become a trademark we're proud of."

For more information, contact: L&R Mfg. Co., 577 Elm St., Kearney, NJ 07032.



NEW FIBER OPTIC ILLUMINATOR

The new Fiber Optic Illuminator from Gem Instrument Corporation, Santa Monica, California, features low voltage, tungsten-halogen light. It provides whiter, brighter illumination to more accurately identify the true color of diamonds and colored stones.

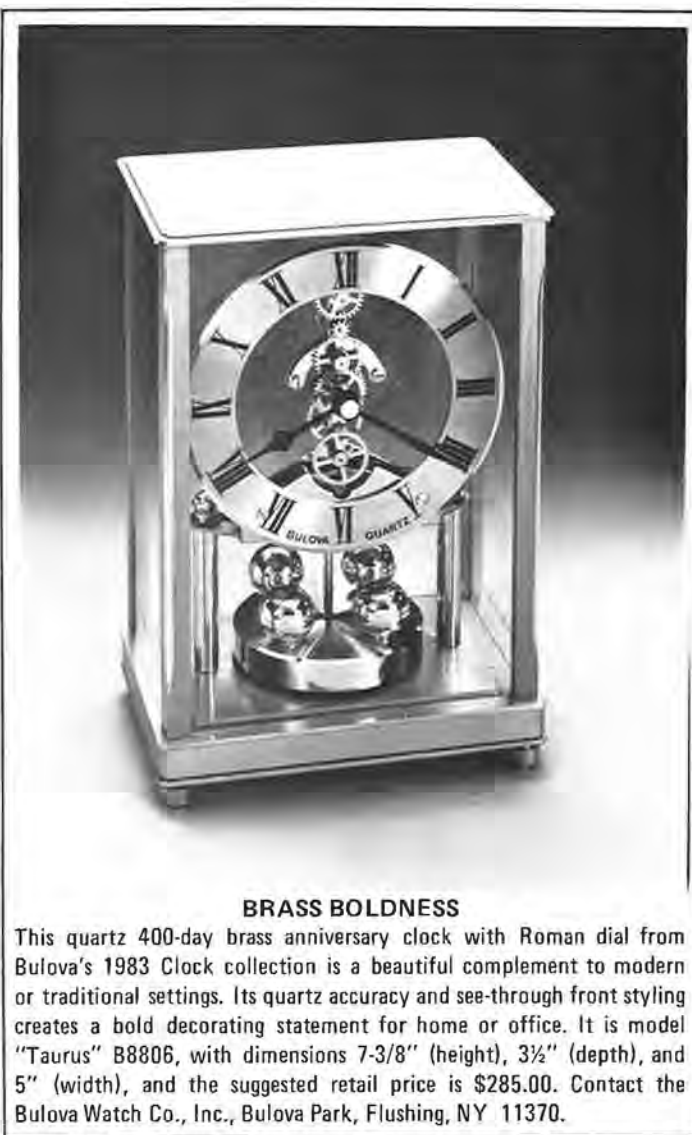
The Fiber Optic Illuminator, used with the Gemolite

Microscope, is excellent for gem photography. It can be used in place of a Vertical Illuminator and each unit includes a monochromatic filter for use with the refractometer. Two flexible, fiber optic cables emit high intensity, cool light to provide optimum lighting from two different directions. The light intensity can be regulated and focused as desired.

The tungsten-halogen light source is neatly packaged in a compact unit with a convenient handle located on the top of the metal housing for ease of handling. It plugs into any nearby outlet and operates on standard 110V electrical current.

For more information on

the new Fiber Optic Illuminator, write to Gem Instruments Corp., P.O. Box 2147, Santa Monica, CA 90406; Phone: (213) 829-5491.



BRASS BOLDNESS

This quartz 400-day brass anniversary clock with Roman dial from Bulova's 1983 Clock collection is a beautiful complement to modern or traditional settings. Its quartz accuracy and see-through front styling creates a bold decorating statement for home or office. It is model "Taurus" B8806, with dimensions 7-3/8" (height), 3 1/2" (depth), and 5" (width), and the suggested retail price is \$285.00. Contact the Bulova Watch Co., Inc., Bulova Park, Flushing, NY 11370.

Classified Ads

REGULATIONS AND RATES—Ads are payable in advance \$.50 per word, \$.60 per word in bold type. Ads are not commissionable or discountable. The publisher reserves the right to edit all copy. Price lists of services will not be accepted. Confidential ads are \$4.00 additional for postage and handling. The first of the month is issue date. Copy must be received 30 days in advance. (e.g. February issue closes for copy on January 1st.)

HOROLOGICAL TIMES, P.O. BOX 11011, CINCINNATI, OH 45211. (513) 661-3838

For Sale

Esemblo-Graph Library. Volumes 1 through 24. Never used, \$80.00. C. Van Dyke, 1030 Route 163, Oakdale, CT 06370.

COMPLETE WATCH REPAIR MATERIAL AND TOOLS, TIMER LATHE INCLUDED. FILLED CRYSTAL CABINETS. VERY REASONABLE. W.K., 314 ST. THOMAS DR., TOMS RIVER, N.J. 08753. 201-341-7211.

Watchmaker's tools and materials, send SASE for complete list and prices. Tom Green, 22819 Deberry, Grand Terrace, CA 92324.

CLOCK REPAIRMEN. Our 1983 catalog is ready! Over 2000 items for the clock repairman. \$2.00 postage paid. TIMESAVERS, Box 171, Wheeling, IL 60090. 312-394-4818.

LOWEST PRICES on the Tochigi Tokei Quartz movement. FREE DELIVERY! Send for free information. TIMESAVERS, Box 171, Wheeling, IL 60090. 312-394-4818.

L & R Varimatic cleaner with ultrasonic and 205T tank, \$650. Vibrograf B200 watch timer. \$595. Zantech quartz timer, \$395. Greiner Chronografic timer, \$450. Electric winder for automatics, \$75. J. Johnson. 914-356-7877.

New parts for OLD BIG, BABY BEN, TRAV-ALARMS, WESTCLOX. Almost all parts available. Send old part and model. Rebuilt mvts. exchanged. Gilbert, P.O. Box 2636, Lakewood, OH 44107. 216-226-5177.

Closing out watch repair department. Cleaning machine, timer, lathe, accutron testmeter, flexible shaft tool, jewelry tool, staking tool, all materials and much more. Barnhart Jewelers, 313 E. Colorado, Pearsall, TX 78061. (512) 334-2312.

Florida established watch and clock. 1200 sq. ft. Take over business for negotiable long-term lease and small inventory. 904-829-5003.

CUCKOO CLOCK parts "Regula" movements. One-day, \$21; Eight-day, \$26.50; with chains. Other bargains. SASE for list. Clockdoch, 42 Birchwood Terr., Nanuet, NY 10954.

Portescap VC10 cleaning machine, \$800. Excellent condition. Am retiring. C. Lund, 1385 Forest Park, Muskegon, MI 49441. 616-780-2156.

Pocket Watches bought and sold. Railroads, Repeaters, all kinds. Finders fees paid regularly for leads on collections or individual watches. Estates, jewelry stores, watchmakers. Total buy-outs a specialty! Sell to a willing and able investor/collector. Call Miles Sandler at (913) 383-2880 or write 9071 Metcalf Suite 108H, Overland Park, KS 66212. Have watches will travel!

BE ALL THE CLOCKMAKER YOU CAN BE WITH CHRONOS TOOLS. Wheel cutting engines start at \$409.00 \$2 for catalog. KEN LAW, CMC, Camp Wood Star Route, Prescott, AZ 86301.

CLOCK TIMER. Regulate your clocks electronically with the new C.T.I. Clock Timer. Can be used on almost any clock with mechanical escapement. Pendulum clocks large and small, lever or cylinder escapements, anniversary clocks, etc. For information write: Can Tho Instruments, P.O. Box 80113, San Diego, CA 92138.

U.S. HEADQUARTERS FOR ALL SCHATZ PARTS. PARTS FOR THE NEW 400-DAY ELECTRONICS. ALSO FOR KUNDO ELECTRONIC. GREENHILL CLOCK SERVICE, P.O. BOX 172, SANTEE, CA 92071.

ESEMBL-O-GRAF LIBRARY in 28 volumes, Pittsburgh, 1955. Chronograph repairing is made easy by step-by-step procedure. Each small step of removing and replacing each part and making adjustments is clearly illustrated. No concentrated study is necessary. \$200. Write EOG, P.O. Box 11011, Cincinnati, OH 45211.

Metal Cutting Lathes, Bench Mills, Drillpresses, Unimats (accessories also), Maximats, Sherline, Cowells, Enco, the Maximat Super Eleven. Lathe Catalog, \$1.00. Precision tools inch or metric, aluminum, brass, steel, all shapes, miniature screws, taps, drills, saws, collets. Tool catalog, \$1.00. Campbell Tools, 2100M Selma Road, Springfield, OH 45505. Phone (513) 322-8562.

For Sale—Timing Machines, Watchmaster Timers, Vibrograph Timers. Factory rebuilt. All machines guaranteed. Terms available. Also available Ultrasonic Watch Cleaning Machines. Write Vibrograf sales representative Robert Swensgard, 2630—A Jett Hill Road, New Richmond, OH 45157. Or phone (513) 553-2113. Territory: Kentucky, Michigan, Ohio, Tennessee and western Pennsylvania.

New Hermes Cutter Grinder. Like new, \$400. C. Van Dyke, 1039 Route 163, Oakdale, CT 06370.

EXCELLENT BUY Reconditioned Micromat Timing Machines by Greiner. Parts and service available. For information contact Holden, Box 13, Boalsburg, PA 16827.

STRAPS — 10% SUMMER DISCOUNT. NOW BUFFALO AT \$1.17 EACH AND CALF AT \$2.48 EACH. DETAILS WRITE FLORO DISTRIBUTOR, 12-08 151 PLACE, WHITESTONE, NY 11357.

MOST UP TO DATE PRICE GUIDE Computer listings of over 1,000 Pocket Watches that are for sale or have sold within the past 3 months. Our computer listings of Mfg., Size, Jewels, Serial No., Model No., Case and MOST IMPORTANT PRICE AND CONDITION. Master list includes Ball, Elgin, Hamilton, Howard, Rockford, Waltham and Misc. Complete list, \$9.00; any of above \$2.00 each. Send Cash or Check COMPUTER SEARCH AND FIND, P.O. Box 367, Butler, WI 53007.

Tradesman

NEW MOVEMENTS CUSTOM FITTED. To Diamond, Gold, Antique Cases. Swiss, 17 jewels, shock protected. Includes dial refinish to original. Alfonso Zamora, 395 Bernhardt Buffalo, NY 14226. (716) 839-5091.

Balance Staffs Custom Made and Fitted. Call or write Lucian L. Lynch & Co., 1148 Brookside Dr., Hanahan, SC 29406. Phone (803) 747-2586.

CUSTOM BALANCE STAFFS, cut and fitted. Since 1922. Certified Master Watchmaker No. 6766R. James Bourne Co., P.O. Box 215, Ladysmith, WI 54848. (715) 532-3166.

Clock Repair-Restoration, Wheel and Pinion Cutting, etc. Free estimates. Fast service. No watch parts. David G. Arnold, CMC, CMBHI, 556 Ann St., Elgin, IL 60120. 312-695-1689.

EXPERT WATCHMAKER—45 years experience. Makes parts for watches and clocks. Repeaters, antiques, all others. Also, tradework, all makes, all models. Phone (602) 986-6150 or write D.E. Simpson, 7726 E. Garnet Ave., Mesa, AZ 85208.

Quality Crystal Fitting—All types - Glass, Plastic, Mineral, GS, Perfit and Genuine refills. Spring Bars and Crowns at good prices. Send for catalog and mailing label. Send work to: Crystal Fitters Inc., 21 North Street, Middletown, NY 10940. Phone 914-343-4434.

CLOCK WHEEL AND PINION CUTTING, repivoting, retoothing, escapement work. J.C. Van Dyke, CMW, CMC, CMBHI, 1039 Rt. 163, Oakdale, CT 06370.

CLOCK and MUSIC BOX parts, mainsprings, material and tools. Custom made to order or repair of gears, pinions and parts catalog \$2.00. Tani Engineering, Box 338, Atwater, OH 44201. (216) 947-2268.

Pearl and Bead Restringing. All types. Fast service. Jean A. Gruenig, P. O. Box 12007, 1279 Inglis Ave., Columbus, OH 43212.

Wheels, pinions, barrels or whatever, repaired or made new. Repivot arbors. No watch parts. Ken Leesberg, Ken-Way Inc., 19 W. 672 Army Trail, P.O. Box 219, Addison, IL 60101.

Superior Tweezer Resharpening. \$2.50 each, including return first class postage. Minimum of three tweezers. Advance payment required. Harvey C. Watkins, CMW, P.O. Box 1738, 1204 West Cason Street, Plant City, FL 33566.

PULSAR WATCH REPAIRS. Complete repairs on all LED PULSARS except calculators. Prompt service. Leo G. Kozlowski, 55 E. Washington Street, Chicago, IL 60602. (312) 236-8052.

CLOCK SERVICES wheels, gears, barrels, retoothing, repivoting, mainspring winding, bushing, jeweling. Send sample for estimate. SASE. Roy H. Niegel, CMC, CMW, 21837 Woodbury, Cupertino, CA 95014. (408) 253-4927.

LED & LCD MODULE REPAIRS complete module repairs on all Bulova, Pulsar, Hamilton, Gruen, Elgin & Waltham, Benrus, and non-brand name modules. E & M Associates, 109 Bank St., Waterbury, CT 06702. 203-753-5715.

Custom made Horological Parts and Tool repair by: Precision Instrument, P.O. Box 70004, Charleston, SC 29405. Phone (803) 553-1198.

DIAL REFINISHING, CRYSTAL FITTING & WATCH REPAIR. Fast Services on Dial Refinishing & Crystal Fitting. Finest quality. Quantity works welcome. Send your works to: Kirk Dial & Crystal Co., 4th & Pike Bldg., Suite 625, Seattle, WA 98101.

THE QUARTZ SPECIALISTS. All services on Analog, LCD, LED, Accutron. Lowest prices on batteries. Free information packet. McBee Laboratories, 302-D S. 16th, Bozeman, MT 59715.

Help Wanted

Two positions for high class horologist open. Must be able to make a watch from scrap. WATCH WHEEL CUTTING, REPIVOTING & STAFFING CO., P.O. Box 1314, Highland Park, NJ 08904; Tel: (201) 985-0685

SALES REPS - Wholesale jewelry supply and watch materials distributor hiring experienced jewelers or watchmakers, one each to travel the following states: Illinois, Virginia, Georgia, Alabama, Mississippi, Florida, and individual states west of the Mississippi. Base plus commission, liberal benefits. Excellent opportunity. Candidates can be carrying non-competing lines. Respond to HT Box HW 6831, 3700 Harrison Ave., Cincinnati, OH 45211

INSTRUCTIONAL POSITION - Instructor for Clockmaking, Jewelry Manufacture and Repair needed. Prefer Watchmaking Jeweler, Clockmaker who has aptitude for teaching adults. Person selected will be required to become State Certified Teacher and will be employed by the School Board of Orange County, FL, in Winter Park, FL, adjacent to Orlando and Disney World. Classroom is adequately equipped to teach professional jewelry techniques with emphasis on quality restoration of antique timepieces. Remuneration will be determined by School Board policy based upon previous work experience as teacher or clockmaker jeweler. Inquiries with accompanying resumes should be mailed to Richard Migliore, Director, Webster Adult Education Center, 901 Webster Ave., Winter Park, FL 32789; Ph. 305-647-6366.

WATCH SCHOOL INSTRUCTOR-Require a CMW, CW or individual with equivalent bench experience to instruct students of a rehabilitation facility in the basic theory and construction of watches, repair and regulation of both mechanical and electronic watches. Salary \$17,000 per year. Submit resume or call: JoAnn Decker, 10600 Springfield Pike, Cincinnati, OH 45215; Ph. (513) 771-4800.

Wanted To Buy

Floor or wall jewelry cases. 200 mile radius of Dubuque, Iowa. 319-252-2496, Jim.

Horological Times Magazines. 1977 - January, February, March, May, July, October and November. 1978 - January, February, March and December. 1979 - March, June and September. Time Plus, Village Shopping Center, 2882 Unit B West Walnut St., Rogers, AR 72756.

Good used vacuum unit, for use in casting. Also interested in burnout oven (at least 9"x9"x9"). Patrick Snyder, 116 E. Walnut, Watseka, IL 60970. Phone 815-432-3053.

STERLING FLATWARF STOCKS-new or used needed. Call us before you sell for scrap. Also wanted: silver, diamonds, gold scrap, coins and coin collections. Call or write: Mr. Neff, HT, WFN Enterprises, 2300 Henderson Mill Rd., N.E., Suite 318, Atlanta, Georgia 30345. Phone 404-938-0744.

IMMEDIATE CASH PAID!! Old Mine and Old European cut diamonds. Especially needed: Stones over 1 carat. Ship with phone number for highest offer, or call Mr. Neff, (404) 938-0744, WFN Enterprises, Inc., HT, 2300 Henderson Mill Rd., NE, Suite 318, Atlanta, GA 30345.

IMMEDIATE CASH PAID for Gold, Silver, Platinum, any form! Jewelry scrap, filings, gold filled, sterling! Immediate top dollar cash offer return mail! Satisfaction guaranteed. Ship insured/registered mail to: American Metals Co., St. Andrews Branch, P.O. Box 30009H, Charleston, SC 29407.

Miscellaneous

DIGITAL, QUARTZ TRAINING - Learn the Zantech 60 second method of testing quartz analog watches. Zantech, the originator of the Two Day Digital Watch Service Program, is now also offering a Two Day Quartz Analog Repair Course with expert instructors, Louis A. Zanoni and Anne Louise Brackbill. For application or information call or write to Zantech, Inc., 77 Shady Lane, Trenton, NJ 08619; (609) 586-5088.

Schools

Parkland College one year clock repair program to begin August 29, 1983. Brochure on request. 2400 W. Bradley, Champaign, IL 61821. Phone 217-351-2288. Attention: W. O. Smith, Jr.

Correspondence courses in Quartz-Accutron-Watchmaking-Jewelry. Free folders. Watchmaking Institute of Canada, 1012 Mt.-Royal East, Montreal, H2J 1X6. Telephone (514) 523-7623.

Books

CLOCK PRICE GUIDE. 1983 Official Price Guide to Antique Clocks by Roy Ehrhardt. (23096). 572 p. color cover paperback. The most dependable source for complete, accurate listings (10,000). All the pricing information you've been looking for. Satisfaction guaranteed. Buy it-Use it-Become an expert. \$10.95 postpaid to Heart of America Press, POB 9808ht K.C., MO 64134. For charge cards, call 816-761-0080.

Dates To Remember

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JUNE

- 6-10—Introduction to Clock Repair Bench Course (AWI); Whitney & Benesh, instructors; Cincinnati, OH
- 20-23—AWI Research and Education Committee meeting; Drawbridge Inn and Convention Center; Ft. Mitchell, KY
- 24—AWI Affiliate Chapter meeting; Drawbridge Inn and Convention Center; Ft. Mitchell, KY
- 25-26—AWI Board of Directors meeting; Drawbridge Inn and Convention Center; Ft. Mitchell, KY

JULY

- 17-20—Canadian Jewellery Trade Fair; Hilton Harbour Castle Hotel Convention Centre; Toronto, Canada
- 19—Oregon Watch & Clock Makers Guild Meeting; Portland, OR
- 27-30—Franklin Area Chamber of Commerce 18th Annual Gemboree; Community Facilities Bldg., Franklin, NC
- 30-Aug. 3—Jewelers of America Fall International Jewelry Trade Show and Conference; Hilton and Sheraton Centre Hotels, NY
- 31-Aug. 2—International Gem Show; Waldorf Astoria Hotel, New York, NY

AUGUST

- 6-8—Heart of America Jewelry Show; Inn at Executive Park; Kansas City, MO. Information: Claudia Roth, 7416 Larsen St., Shawnee Mission, KS 66203
- 13-15—Fall Pacific Jewelry Show; Century Plaza Hotel; Los Angeles, CA

- 15-21—JEWELTIME '83; World Trade Centre, Singapore, for Jewelry, Watches and Clocks; Additional inf. from: Kallman Associates, 5 Maple Ct., Ridgewood, NJ 07450; (201) 652-7070

SEPTEMBER

- 15-18—Gemological Institute of America Doorstep Course; Memphis, TN
- 17-18—Common Sense Quartz Watch Repair Bench Course (AWI); Bishop, instructor; Huntsville, AL
- 18—Fundamentals of Solid State Watch Repair B. C. (AWI); Opp instructor; Columbia, MO
- 19-22—Striking Clocks-Advanced Seminar Bench Course (AWI); Baier, instructor; Cincinnati, OH

OCTOBER

- 1-2—Common Sense Quartz Watch Repair Bench Course (AWI); Bishop, instructor; Toronto, Canada
- 1-2—Iowa Jewelers and Watchmakers Assn. Fall Convention & Trade Show; Des Moines Marriott Hotel; Des Moines, IA
- 18—Oregon Watch & Clock Makers Guild Meeting; Portland, OR
- 18-23—BARNAJOYA '83, the First International Jewellery, Clock And Watchmaking and Silversmithery Show; Barcelona, Spain

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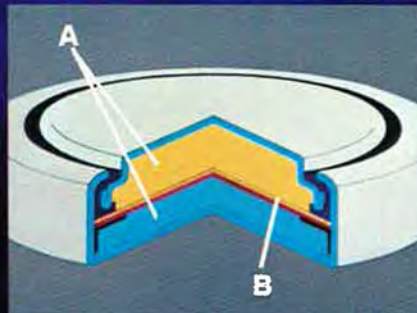
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