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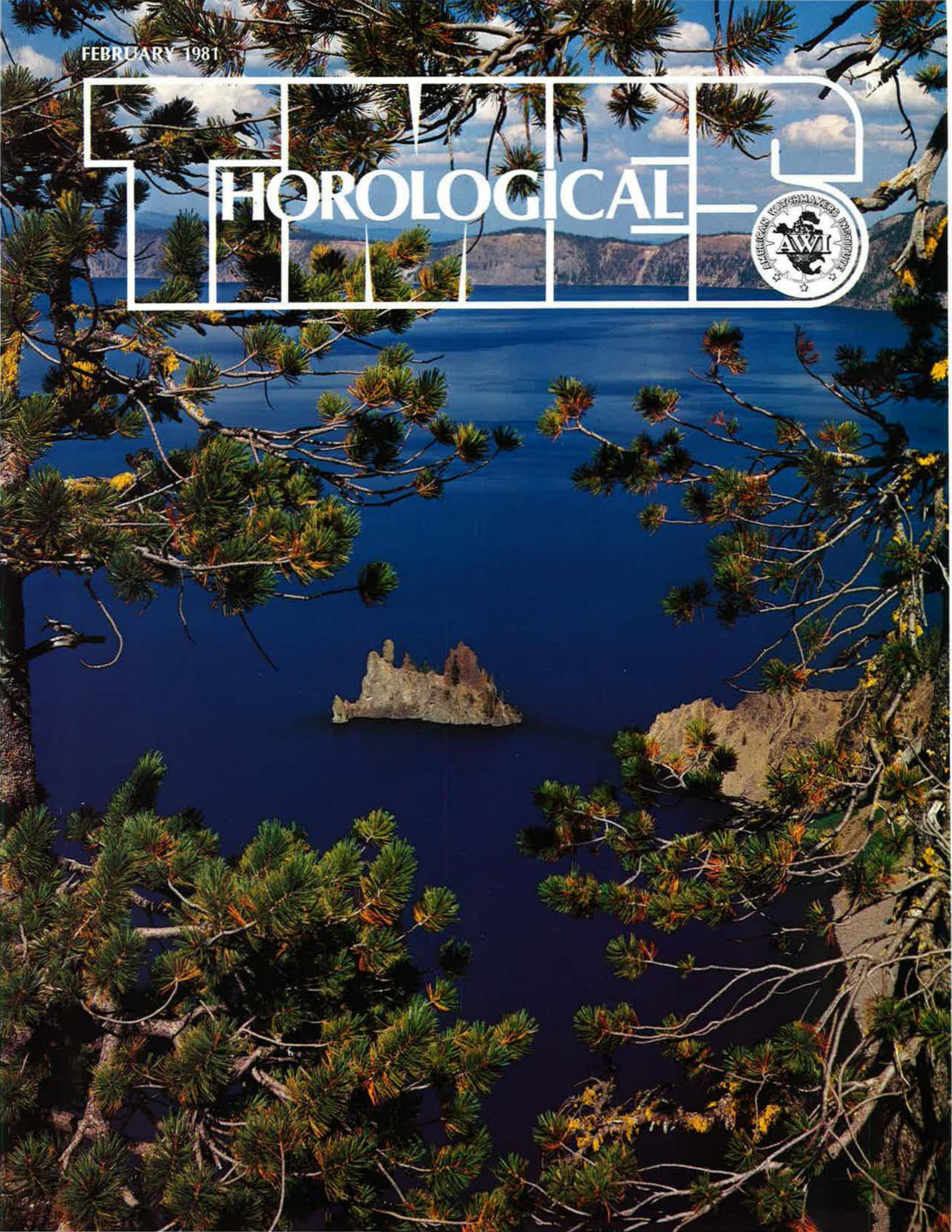
HOROLOGICAL



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Editorial

Prognosticators gazing into their crystal balls have predicted many different directions for the watch of tomorrow. Some are foretelling by design and others by "seat of the pants" gut feelings; a few are relying on opinion polls for their predictions.

Since yesterdays can predict tomorrows at least as accurately as these other systems, let's review the last twenty-some years in watch movement production. First there was the Elgin electric that never broke out of the starting gate. Next, Hamilton came along with the 500 and 500A. Then they improved it and called it the 505. Bulova modified and refined a piano-tuning tool and produced the Accutron. The Swiss improved it by removing the gravitational error. All this time, Timex was turning into the real high roller, but like they say, it's easier to get to the top of the mountain than to stay there. Pulsar was the culprit that produced the watch that lit and showed the time through a maroon crystal. It was easier to read the darker it was. Then Texas Instruments grabbed onto it. The perch on the mountain became an even more precarious position. Next came the LCD at middle-range prices. It was easier to read the lighter it was. Then it became low-priced, and a new baby was born called the quartz analog.

Through this entire span of more than twenty years, the jeweled-lever mechanical has lumbered on, and on, and on.

What you must do is decide the direction you are to take—or tool yourself for all products and educate yourself for all products and then find a way to prevent diversity from wrecking efficiency. Whether you like it or not, you too must prognosticate the coming state of the art and science.

On the front

Our February cover features a view of the Phantom Ship in Oregon's famous Crater Lake. Although the craters of extinct volcanoes quite often accumulate enough rainwater to form lakes, Crater Lake in Klamath County, Oregon, is considered the most remarkable example of this natural phenomenon. Its waters reach a depth of 2,000 feet and appear an almost unnaturally vivid shade of blue.

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President's Message / Joe Crooks

Tempus Fugit

Many watchmakers are approaching retirement age, and schools are rapidly producing replacements for those leaving the trade. To those reaching the point of retirement, we offer some pertinent advice.

We encourage these new "Senior Citizens" to review their health insurance protection and make sure it is adequate *or a prolonged illness could wipe you out!*

Increases which went into effect under Medicare January 1st include a raise from $180.00 to $204.00 in the hospital insurance deductible (which is an "up-front" charge); expenses from the 61st day through the 90th day rose from $45.00 to $51.00 a day, and beyond 90 days, the cost went from $90.00 to $102.00 per day for each "lifetime reserve day" that is used up.

For a stay of more than 20 days in a skilled nursing facility, the patient's share of costs under Medicare has risen from $22.50 to $25.50 per day, up to the 100th day.

If you are about to retire, first become thoroughly familiar with how the Medicare program works–what it covers and what it doesn't. Then, when you leave your present insurance plan, make sure to sign up for Medicare A, which is free, and Medicare B, which isn't free but is the best insurance buy a senior citizen can get.

You should fill in the gaps that Medicare A and B don't cover by shopping for a comprehensive "wrap around" policy–one that pays all deductibles and co-payments and keeps on paying after Medicare stops. It should include skilled nursing facility and licensed nursing home coverage as well.

All this gets pretty complicated and you should proceed with caution before buying a supplementary insurance policy. Put it to the test of whether it fills in the Medicare gaps or duplicates what you already have.

Some will want to consult with the family lawyer, a known, trustworthy insurance agent, or friends who have had experience in this field. This is all well and good, but your best bet is to take a sample policy to your hospital administrator and let him have the business office check out exactly what the policy will and will not pay. Also shop around for the best price and policy.

Now you may think that the premium is more than you want to pay, but since hospital costs continue to go up every year and Medicare seems to pay less and less, could you afford a long stay in a hospital without a supplementary health policy when you retire?

Most insurance companies terminate individual health policies at age 65; they know a prolonged illness is many times more likely as we grow older. It's much better to have the security and be safe than to put the money in the bank and later be sorry. TIMES

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Technically
WATCHES

By Archie B. Perkins, CMW, FNAWCC

THE DETACHED LEVER ESCAPEMENT © 1981

Part IV

There are two methods that can be used in adjusting or setting up the detached lever escapement. One of these methods is known as the ELGIN METHOD and the other method is the BANK TO DROP METHOD. To fully understand the escapement and its adjustments, the watchmaker should know both methods. One of these methods can be used against the other as a check in making sure the escapement is set up correctly. Both of these methods will be discussed separately starting with the ELGIN METHOD.

Sometimes the escapement only needs one or two minor adjustments to make it function correctly, but other times it may be so far out of adjustment that it needs to be set up or readjusted completely.

Before attempting to set up an escapement, regardless of which method is used, certain conditions should be checked to make sure they are correct; otherwise it will be impossible to set up the escapement so it will function correctly.

The pivots on the escape wheel, pallet arbor, and balance staff should be checked to make sure they are straight, smooth, and highly polished. The jewels on these three units should be checked to make sure they are not cracked or chipped around their holes. These jewels must also be checked to make sure they are level and tight in their mountings.

The side shakes and end shakes on the balance, pallet, and escape wheel must be of the correct amount. The side shake on the balance and pallet fork should be .01 mm and the end shake should be .02 mm on both. The side shake on the escape wheel should be .02 mm and the end shake should be .02 mm also.

The roller jewel must be tight in the roller table and must be square with the roller table when viewed from the front as in View A, Figure 1. The roller jewel must also be square with the roller table when it is viewed from the side as in View B, Figure 1. If the roller jewel should be tilted away from the balance staff toward the fork, this would make it necessary to open the banking pins more in order for the roller jewel to pass in and out of the fork slot. This condition makes it appear that the fork is too long. When the banking pins are opened to compensate for the tilted roller jewel, the pallet fork will take too much angular motion, causing too much total lock to the escapement. If the roller jewel should be tilted toward the balance staff and away from the fork, it would be necessary to close the banking pins to avoid having too much corner freedom. When this is done, the fork will not have enough angular motion.

Figure 1

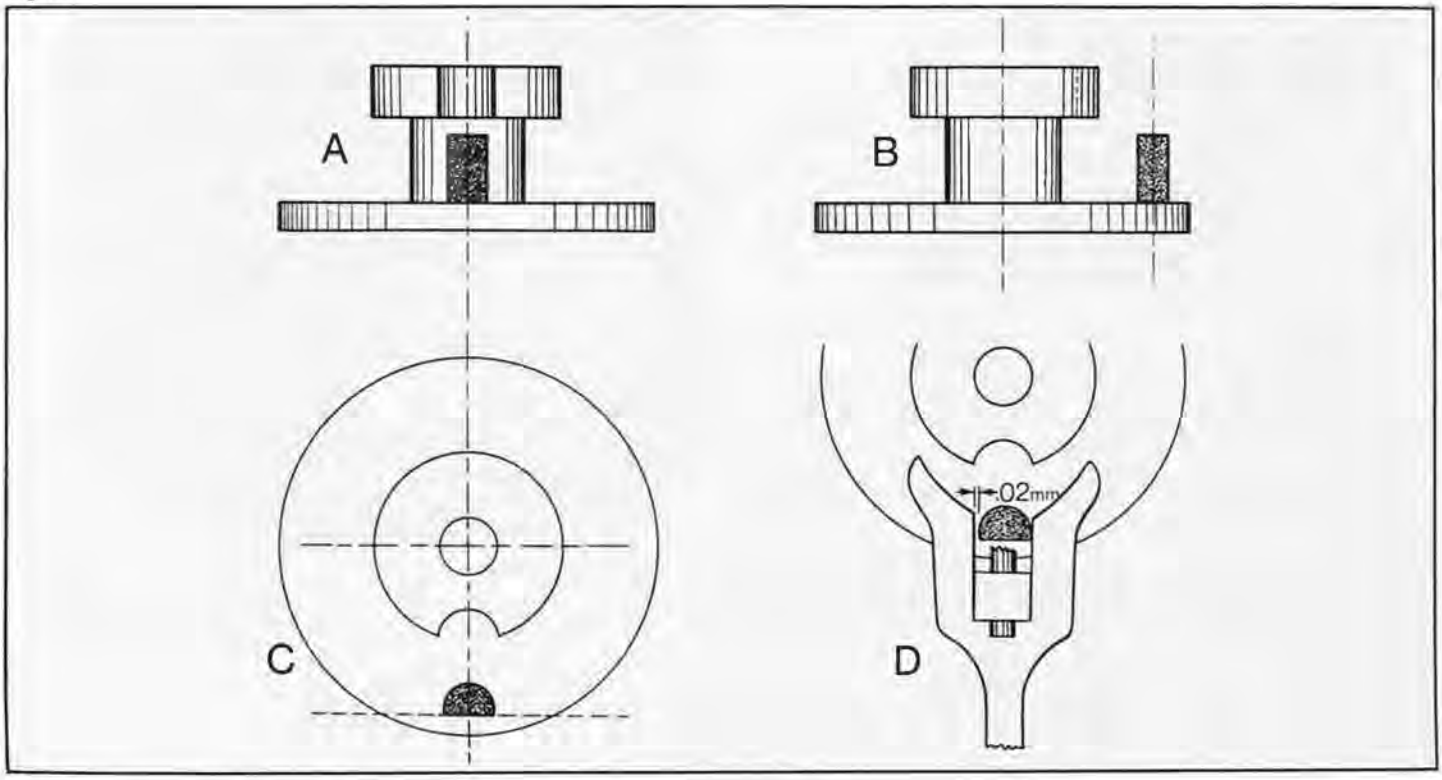


Figure 2

Figure 3

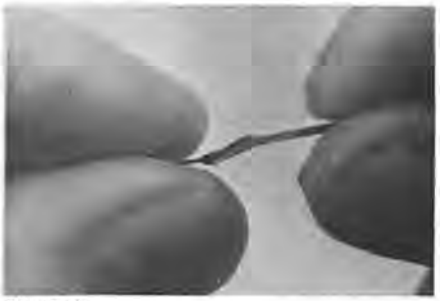


Figure 4

This could make it impossible to get a safe drop lock and still have sufficient slide. This condition makes it appear that the fork is too short.

If the roller jewel is tilted in the table, it can be made vertical by the use of a combination tool and an alcohol lamp. This is shown in Figure 2. The impulse roller table is clamped in the jaws of the combination tool, and the tool is then heated with the alcohol lamp. When the shellac around the jewel becomes soft, the jewel can be moved until it is upright with the table. If the roller jewel is loose in the roller table, it is possible that the shellac holding the jewel has deteriorated. In this case, the old shellac should be removed from the roller jewel and hole in the roller table by soaking them in denatured alcohol. After the old shellac is removed, the roller table is clamped in the combination tool, and the tool is heated until the roller table is warm enough to melt the new shellac. Shellac is applied to the jewel hole in the roller table until it melts and fills the hole. The jewel is inserted into its hole while the shellac is still melted. Then the roller jewel is straightened so it is upright with the table, and then the table is removed from the combination tool and left to cool. Any excess shellac on the roller jewel and table should be removed with a shellac scraper made from a small brass or nickel silver rod that has been filed to a point from three sides forming a sharp, triangular point.

Not only is it important for the roller jewel to be upright in the table, but the face of the roller jewel must be set square with the center line running through the center of the table and center of the roller jewel. This is shown in Figure 1, View C.

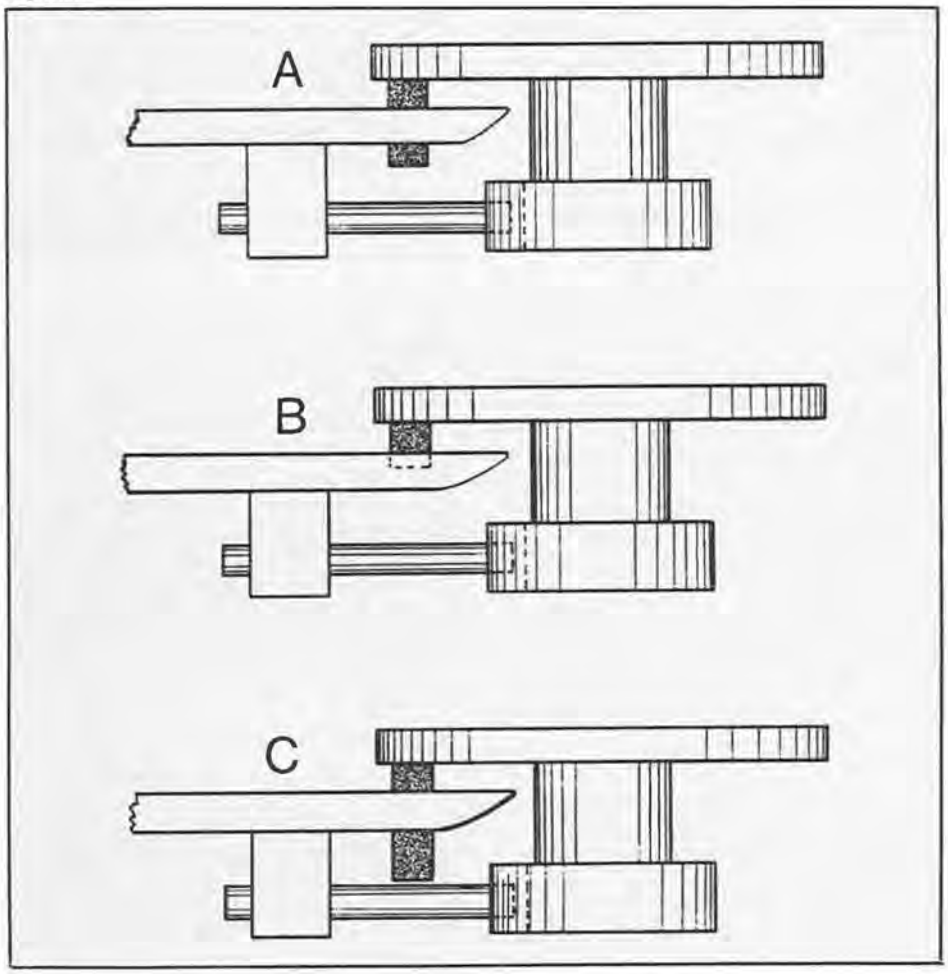
If the face of the roller jewel is out of square, it can be made square with the tweezers while the shellac is warmed with the combination tool and alcohol lamp.

Another important factor in the proper performance of the detached lever escapement is the proper fit of the roller jewel in the slot of the pallet fork. This is shown in Figure 1, View D. There should be .02 mm freedom for the roller jewel in the fork slot. Less freedom than this could cause the roller jewel to bind in the slot. More freedom than this would cause some of the impulse to be lost. When the roller jewel is too small for the fork slot, there is a delay in the slot catching up with the roller jewel to impulse the balance wheel after the tooth is unlocked onto the impulse face of the pallet stone; therefore, the tooth will slide part way down the impulse face of the pallet stone before the fork slot catches up with the roller jewel to push it. This leaves less of the impulse face of the pallet stone to be acted on by the tooth during impulse. This condition causes poor motion of the balance wheel.

If the roller jewel doesn't fit the fork slot correctly or is broken or missing, then the following procedure is used in selecting a new jewel. First, make sure the sides of the fork slot

(Continued on page 12)

Figure 5



Questions and Answers / Henry B. Fried

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

Novelty Watches

If you have any questions for Mr. Fried, please include your name and address written clearly and a self-addressed stamped envelope.

Q Enclosed you will find a photo of a watch that belongs to one of our customers. It has one hand for each hour and shows 10:45 in the photo. It is a pin lever, Richard, Swiss, approximately 19 ligne. It is put into setting position by depressing the small pin on the edge of the case. By the way—who was Richard?

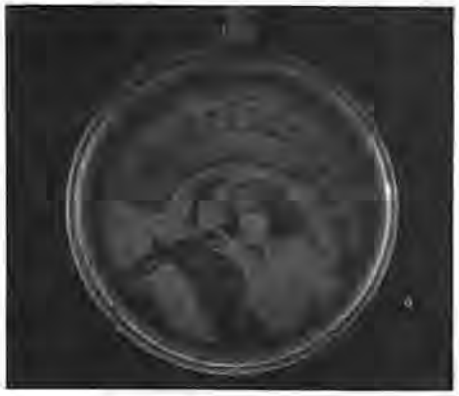
When was this watch manufactured? Any idea how many were made and for how long they were produced? Does the picture on the dial have any significance? Is it mentioned in any books that is currently available? The customer will appreciate any background you can supply.

Melvin Mast
Phoenix, Arizona

A *Your watch is known as a "wandering hour" watch. The very first of these were introduced in the late 1670 period just after the invention of the hairspring when minutes as well as hours could be displayed. These very first wandering hour watches are now very desirable collectors' items.*

Yours, however, is a very cheap (Roskopf) copy of this system introduced again in the early part of this century with dismal success. Your watch is a survivor of this revival. Despite its twentieth-century reintroduction and demise, your watch, despite its quality, is a nice item. I collect watches, even cheap novelty ones, but I do not possess one of these.

The photographs on the dial have no special significance since many watches of that period had family photographs reproduced on the procelain or metal dials. These were done to order at a nominal expense; sort of a tintype. This, most likely, is a family picture of the owner's daughters. Richard was merely a name, popular in Switzerland.



Q I have a triangular Masonic watch for which I wish to have a new dial made. However, I can no longer make out the inscription on the dial. Can you advise me as to where I can find out how this should read?

I enjoy your "Questions and Answers" each month in the *Horological Times*.

Thank you.

E. A. Charlton, Jr.
Newport News, Virginia

A *I have some familiarity with these triangular Masonic watches. I have one in my collection, but without the inscription on it; otherwise, I would traipse down to the bank and look it up. These were made by the Majestic Watch Company of Tramelon, Switzerland. Some were 8-day watches. Your watch bears an inscription taken from the tenets of the Masonic order. The first line reads, ". . . your Fellow Man." I cannot make out the rest. I've tried to look up your watch in my library of auction catalogs, but to do this thoroughly would take much more time than I can devote. Perhaps one of your Masonic lodge member friends can fill you in, as it must be a popular slogan. Also, you might try the Schwalm Dial Company, 510 2nd Ave., Lancaster, Pennsylvania 17603. They have made Masonic dials in the past and might be better able to help you.*

I'm glad you enjoy my column. Of course, only a representative fraction of the letters I receive appear in print. P.S. After sealing this letter, I came across a recent catalog of the Parke-Bernet-Southeby auction of watches which I attended. A watch like yours is pictured, and the complete inscription on the dial reads as follows: "Love Your Fellow Man, Lend Him A Helping Hand." You see, we really do try to help our fellow AWI members!

Q Can you give me some information on a pocket watch, double hinged with the name "New Era" on the back plates of the movement. "Lancaster" is on the procelain dial. The movement number is 84348.

Thanking you for your cooperation and past favors.

R. E. Braun
Fort Pierce, Florida

A *The New Era was a model of the Lancaster Watch Company which was founded in August, 1877 and was in business one year until it was reorganized under the name The Lancaster Pennsylvania Watch Company. This company failed the following year, but was again reorganized using the original name, Lancaster Watch Company. This company was purchased by the Keystone Standard Watch Company, and then finally sold to the Hamilton Watch Company in 1891. The whole business was conceived and founded by Adams & Perry Watch Mfg. Co. in 1874. In this 1874 unit, their first model was made by Ezra Bowman. Bowman can still be remembered as the founder of the watch school bearing his name, still operating in Lancaster. Other models which they produced, in addition to the New Era, were the Franklin, Record, and West End. I would say that your watch was made about 1878.*

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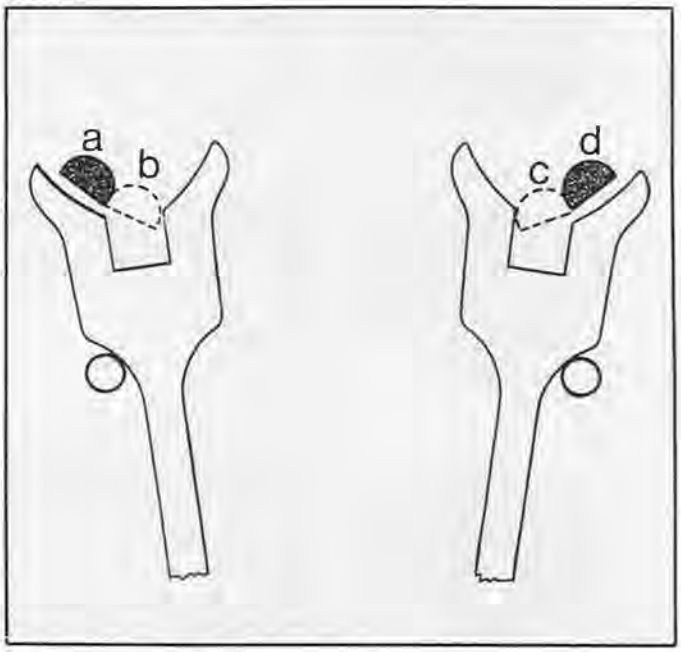
are smooth and polished. Then use the roller jewel or fork slot gauge to measure the fork slot. This gauge is shown in Figure 3. This gauge has seventeen different thicknesses of prongs graduated .02 mm apart from .26 mm to .60 mm. One at a time, these are inserted into the fork slot until one is found that fits the slot closely without any side shake. Then a roller jewel is selected that is .02 mm smaller than the slot measures. Figure 4 shows the gauge being used to measure the fork slot. The slot can also be measured with the gauge while the fork is in the watch. Roller jewels are made in different lengths for single and double rollers. The longer ones are for single rollers and the shorter ones are for double rollers. In any case, the roller jewel must be the proper length for the roller table. Figure 5, View A shows a roller jewel of the correct length. View B shows a roller jewel that is too short. When the roller jewel is too short, there is danger of it going over the top of the fork and becoming disengaged from the fork slot and stopping the watch, especially if the end shakes are different between the balance wheel and the pallet fork. View C, Figure 5 shows a roller jewel that is too long. In this case, there is danger of the end of the roller jewel hitting the guard pin as it passes over it. This causes the balance to take poor motion or may cause the watch to stop.

When using the ELGIN METHOD in setting up the escapement, the following procedure is followed. First, set up the corner freedom. This is done by opening or closing the banking screws or banking pins to establish the proper amount of clearance between the corner of the roller jewel and the corner of the fork slot as the roller jewel is entering or leaving the fork slot. The amount of corner freedom needed is .03 mm to .05 mm on wrist watches and .05 mm to .08 mm on pocket watches. This amount of freedom can vary from watch to watch depending on how closely the pivots of the escapement fit their holes To check the corner freedom, a small feeler is needed to move the pallet fork back and forth. A small sewing needle in a small pin vise or some kind of handle is good for this purpose. A small watch oiler also makes a good tool for this purpose. When checking the corner freedom, it is best to have the hairspring removed from the balance wheel. This makes it easier to see the fork and roller jewel position. The procedure used in checking the corner freedom is as follows: While holding the movement on a movement rest or holder, use the index finger to move the balance wheel around until the corner of the roller jewel is in line with the corner of the fork slot. Now use the point of the needle to move the fork back and forth, and note how much movement there is to the fork. This movement will be the movement of the fork from the banking pin to the point where the corner of the fork slot contacts the corner of the roller jewel. This is shown in Figure 6. The corner freedom should be checked when the roller jewel is in positions "a" and "b." Then turn the balance until the roller jewel is in positions "c" and "d" of Figure 6 and check the corner freedom. These freedoms should be equal at all of these positions and should be within the established amounts mentioned previously. When the corner freedom is insufficient, the banking pins need to be opened to establish the correct corner freedom. On the other hand, when the corner freedom is too much, the banking pins need to be closed to correct the condition. Note: Before opening or closing the banking pins, it is advisable to make sure they need to be moved, especially if they are not of the screw type. When banking pins are set friction tight into the watch plate, they need to be bent in order to change the corner freedom. It would be better if the corner

(Continued on page 39)

Figure 6



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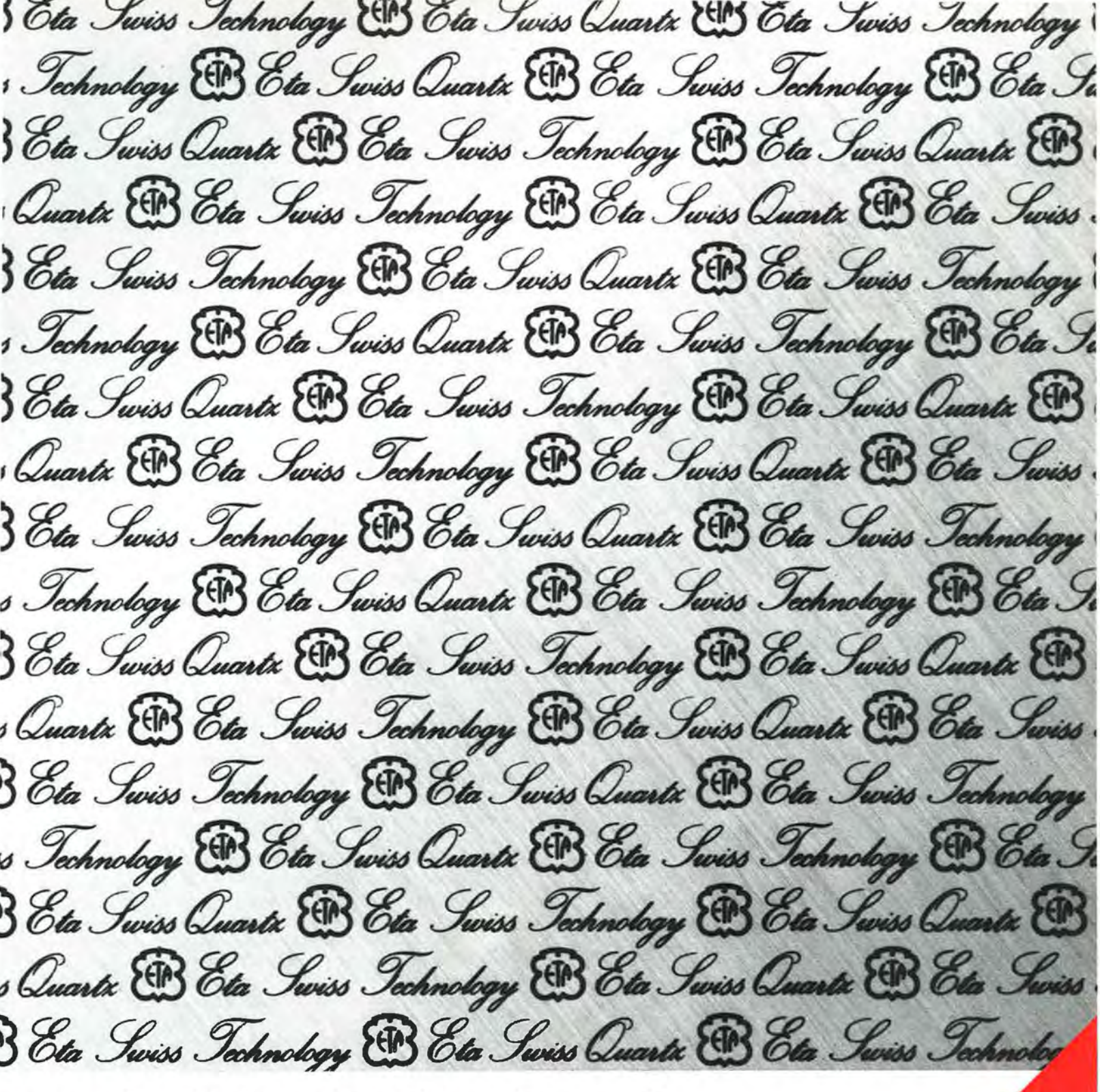

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By Marvin E. Whitney, CMC, CMW

American Chronometer Makers

Part IV

Thomas S. Negus and Company — T.S. & J.D. Negus

The Negus firm of New York City was probably the most prolific American chronometer manufacturer during the latter half of the 19th century and the first quarter of the 20th century. The firm first appeared in 1848, as Thomas S. Negus and Company, 100 Wall Street, New York City. Thomas Stewart Negus, who received his training in England, immigrated to America because he was intrigued with America's development of finer tools and machines which gave artisans greater control over their products. Shortly after the formation of his business, Negus became an agent for Kullberg chronometers which most knowledgeable horologists of the time considered to be the best English chronometer ever made.

In 1850, Thomas moved to 84 Wall Street where he remained until 1853 when he moved to 140 Water Street. While at the Water Street location, his brother, John David, came to America; they entered into a partnership and the firm became known as T. S. & J. D. Negus. Around the turn of the century, the firm moved to 69 Pearl Street where it remained until Max Low, of 44 Fulton Street, purchased the firm in 1962.

John had two sons, John Charles and John Stewart, who also became members of the firm. Both of these young men were exceptionally fine mechanics and established themselves within the maritime trade as highly competent compass adjusters. Not only were they competent, but they were willing to go out to the ships to do their adjusting instead of bringing the work into the shop. John Charles developed a keen interest in sidereal time and is credited with the improvements in the firm's Sidereal Break-Circuit chronometers.

In the early years, the firm of Negus purchased their ebauches from Kullberg and then did their own springing and finishing. See Figures 1 and 2. Later Negus produced chronometers which were made entirely by the firm. Negus produced nearly 3,500 chronometers. Negus also had a large, viable repair business and endeared themselves to the various sea captains by their willingness to loan out a chronometer to temporarily replace the one in need of repair.

The problem of lubrication has always been a great concern among horologists. As we all know, a great deal of research and myriad elaborate procedures have been devised in order to test various lubricants and the conditions under which one can achieve optimum performance.

Thomas was a great admirer of Breguet and believed in Breguet's classic statement to Napoleon, "Give me a perfect oil and I will give you a perfect watch." Not having the capabilities nor the expertise to analyze the various oils, Thomas was unable to do much in the area of improving the oil *per se*. However, he firmly believed that there were certain mechanical concepts that could be applied which would aid and enhance the lubricating properties of oil in a timepiece. Thus he incorporated some of these ideas in his chronometers.

Negus's instruments were characterized by very fine and highly polished pivots, running in large jewels. Some of his chronometers were fitted with an oil shield on the lower pivots so that when the instrument was turned over, the oil would not run down the pivots. Another distinguishing feature of Negus's chronometers was the distinct lacquer color finish which was applied to his beautifully finished sand-casted brass chronometer bowls. The Negus's were of that breed of craftsmen possessing intense, personal points of view and dedication to turning out products that were distinctive works of craftsmanship.

Negus not only manufactured and repaired chronometers, but the firm also repaired, calibrated, and sold other navigational instruments and timepieces. They also handled U.S. Government charts, books, almanacs, and other nautical supplies. They were agents for the famous Ritchie of Boston compass. One of their advertisements emphasized that they were "Adjusters of Compasses in Iron Ships and Steamers." An 1874 advertisement carried the pronouncement that they had in stock a "full assortment of Gentleman's and Ladies' Sizes, Key and Pendant Winding Watches, In Hunting Cases and Open Face with Flat Crystal Glass."

Before the U.S. Naval Observatory took over the full responsibility of repairing, rating, and issuing chronometers, T. S. & J. D. Negus for many years were the agents for the care and rating of government chronometers in New York.

In 1934, the U. S. Coast Guard was interested in purchasing fourteen new chronometers from Negus. Negus wrote the Superintendent, U.S. Naval Observatory, that they would be happy to supply them, but not for trial under Navy specification 18C7c, dated February 2, 1931. Oddly enough, Hamilton told the Navy exactly the same thing when they were approached in 1940 to produce a marine chronometer. The Navy had been derelict in keeping their chronometer specifications current.

Negus's letter to the Observatory stated, " . . . In the years past, when we sold so many chronometers to the Navy Department under trial at Washington, every chronometer we sent was seasoned—most of them for two years. A new chronometer would not have a chance because new chronometers gain on their rates and it takes from one and a half to two years to settle down to a steady rate.

"A chronometer that we made that is a month old would answer all the purposes of navigation because the change is very gradual and easily checked-up.

"We have been kept going for 86 years and we do not wish to be humiliated by having chronometers returned to us under such a severe trial for new instruments.

"After the war [he was referring to World War I, *ed.*], the Navy Department had more chronometers than they could use and it would seem a matter of economy if fourteen of these chronometers were turned over to the Coast Guard and save quite an expense."

The Navy Department accepted Negus's recommendation and transferred fourteen chronometers to the Coast Guard.

Figure 1. T. S. & J. D. Negus, Number 2245, 2-day chronometer, circa. 1890. (Not the original box.) Courtesy of the Smithsonian Institution.

Figure 2. Movement of T. S. & J. D. Negus, Number 2245, 2-day chronometer. Courtesy of the Smithsonian Institution.

Manufacturers wishing to offer new chronometers for sale to the U.S. Government could submit them to the Naval Observatory for trial twice. If the instrument failed the second trial, it could not be resubmitted for any further trial. Competitive trials for new chronometers were halted at the U.S. Naval Observatory at the conclusion of World War I in 1918, and no new chronometers were purchased until 1939. Trials for repaired instruments continued and the records of these trials were contained in the annual report of the Superintendent, U.S. Naval Observatory, until 1930. After that date, the practice of publishing reports of trials was discontinued. During the Civil War and World War II, the Navy waived the timing specifications in order to meet the heavy demands of a rapidly increasing force.

On February 1, 1864, Captain James M. Gilliss, U.S.N., Superintendent of the U.S. Naval Observatory, in a reply to Rear Admiral Charles H. Davis, U.S.N., Chief, Bureau of Navigation, regarding the manner in which new chronometers were being tested at the Observatory, stated:

" . . . When it became necessary to obtain chronometers to supply our vastly increased number of naval vessels and they could not be delayed by the ordinary year's trial at the Observatory, it was necessary to adopt a more severe though probably less safe test than the diurnal scrutiny of our own office. Makers were called upon to send to the Observatory the rates of their best instruments during an interval embracing extremes of temperatures—never less than four and usually six months. Daily rates were called for, but not always obtainable.

"Up to this time, no instrument has been accepted if its daily rate fluctuates more than one (1) second during the whole interval for which the records were furnished.

"The test has never been communicated to the dealers, and as attempts have been made to pass interpolated differences for the results of daily comparison, it is hoped that until we can return to the process of determining rates at the Observatory, the Bureau will

not make known a test so easily evaded by unfair dealers."

The scientific demands created by the various expeditions into America's unknown territories and the necessity of determining the longitude of various uncharted places, brought forth new challenges to this fledgling firm. The need arose for an instrument which would not only provide accurate time, but which would be capable of producing an audible "tick." The Negus's accepted the challenge, and from their creative minds came the development of a break-circuit device which operated off an additional wheel staked to the chronometer's forth wheel.

Since their design called for an additional wheel mounted on the forth wheel against which a contact spring operated, some chronometer makers and scientific personnel were of the opinion that this additional appendage would adversely affect the rate of the chronometer.

Negus thought otherwise, but to satisfy the "doubting Thomases," he conducted a series of tests whereby the break-circuit chronometers were tested with and without the mechanism operating and also with the mechanism completely removed. Negus proved that the action of the break-circuit contact spring against the wheel was so light and that the angles of the wheel teeth against which the jewel operated were so perfect that the friction was negligible and any reservations were without foundation.

Lieutenant George M. Wheeler, U.S. Corps of Engineers, who was in charge of the exploration west of the 100th meridian, sent Negus a letter regarding the performance of their break-circuit chronometers which were used during the expedition:

". . . In response, I have the honor to state that during the past season your break-circuit chronometer No. 1511 was used at several points in the Colorado Territory by Dr. F. Kumpt in temporary field observatories, and that No. 1491 was used by J. H. Clark, astronomical observer, at the fixed Morman Observatory, Salt Lake City.

"The computations of results are sufficiently advanced to show that the working of these chronometers has been satisfactory. The rate of No. 1491 was affected in a slight degree by the extremes of temperatures when first taken from your office (where it was running very nearly on sidereal time) into the field. Number 1511, having been for the entire season in a permanent observatory, was not subjected to so many variations in temperatures or to the irregular motion of transportation, held its rate through the whole season with as much certainty as an astronomical clock. In connection with the Harkness Cylinder Chronograph, it has worked admirably, both the regular and irregular breaks being clear and well-defined.

"I am pleased to add this testimonial in behalf of the reliability and accuracy of your break-circuit chronometers."

The firm of Negus not only gained recognition as a very excellent chronometer manufacturer, but also as experts in the repair of compasses and other nautical instruments. The Navy Department thought very highly of Negus's capabilities and ability to produce when called upon. The Naval Observatory often solicited their views on various subjects concerning navigational instruments.

The Naval Observatory often requested Negus to inspect instruments and make recommendations as to whether or not it was ". . . advisable to retain at constant expense instruments which can no longer be of service to the Navy."

The American Civil War, the tragic conflict between the states, occurred during Negus's reign as one of America's foremost chronometer makers. Many ships on both sides of the conflict were outfitted with Negus chronometers. Rear Admiral Charles H. Davis, who later became Superintendent of the Naval Observatory, at the conclusion of the Civil War wrote Messrs. T. S. & J. D. Negus:

"With reference to the superiority of your chronometers in maintaining regularity of rate under the effects of the concussion of heavy or-

(Continued on page 26)

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By Joseph Rugole, CMW

Adjustments To Temperature

It can be argued that adjusting watches for temperature variations is no longer necessary since all modern watches use alloy hairsprings and balances which do not change rate appreciably with changes in temperature. However, I believe that a knowledge of variations due to temperature is still essential for every practical watchmaker for at least three reasons: First, there are still thousands of watches with compensation balances in circulation either as family heirlooms or as collectors' items. Every once in a while, we are required to service such a watch. Without the necessary knowledge about temperature effects on timekeeping, a watchmaker can inadvertently damage the fine adjustments and make a mediocre timekeeper out of a fine watch.

The second reason is that modern watches are not perfectly compensated for variations due to temperature. The very best ones still use a form of compensation balance, although the majority use no adjustments other than the type of material used for the hairspring and the balance wheel. Minor variations are overlooked.

The third reason why this knowledge is essential is simply the realization that this is knowledge about our trade, and the more we know about it, the better we are as craftsmen. The fact that we might only occasionally use this knowledge should make no difference in our desire to know.

The effects of temperature on the timekeeping of watches were not investigated until watches became accurate enough for the problem to become noticeable. The first successful attempt to adjust a watch to temperature was made by John Harrison who used a bimetallic regulator in his Marine Chronometer No. 4. This chronometer was used to determine the longitude at sea and brought Harrison the premium of £20.000 from the British Admiralty in 1761. Although this invention was not widely accepted among watchmakers, the principle of automatic compensation for temperature variations was firmly established.

Temperature fluctuations were the largest single cause of errors in timekeeping of watches and had to be dealt with. It has been calculated, as well as experimentally proven, that a watch equipped with a brass balance wheel and steel hairspring will vary about 11 sec./24h for 1° C change in temperature. About 9 sec./24h is attributed to the change of elasticity of the hairspring, and approximately 1.5 sec. to 2 sec./24h to the expansion or contraction of the balance wheel. Thus there are two reasons for variation: **The thermal expansion of the materials** and the **change of the elastic force of the hairspring**. This can be seen from the formula for time of one vibration of the balance. We will call this formula No. 1. The simple form of it is $T=\pi\sqrt{\frac{I}{S}}$ where:

T= time of one vibration
π= Constant= 3.1416 . . .
I= moment of inertia of the balance
S= elastic strength of the hairspring

The inert force "I" is the product of the mass of the balance wheel "M" and the square of the radius of gyration "R." This we will call formula No. 2: $\therefore I = MR^2$

The mass of the balance wheel is always constant in every temperature. It represents the number of molecules of the material from which it is made. The radius of gyration, however, will depend on the thermal coefficient of the material from which the balance wheel is made. Most materials expand when heated and contract when cooled, but not for the same amount. The expansion is measured in the number of units per million change for 1° C variation in temperature. For example, if we had a brass rod which measured 1,000.000 cm long at 20°C, it would measure 1,000.019 cm at 21°C. In other words, brass expands 19 parts per million for 1°C temperature variation. This is known as the *Coefficient of Expansion*. Some alloys expand and contract very little, and it is possible to create alloys with negative coefficients of expansion, i.e., such that will expand in cold and contract in heat.

If the radius of gyration increases when the tempera-

ture increases but the elasticity of the hairspring remains the same, the watch will lose time. A regular brass balance wheel such as is found in some pocket watches with cylinder escapements, will increase its radius of gyration so much that the watch will lose 1.5 to 2 sec./24h per degree Centigrade increase in temperature. Such watches also use steel hairsprings which are affected by the temperature, but the effect on the hairspring is somewhat different and more complex. The elasticity of the hairspring depends on the length, breadth, and thickness of the spring as well as on the elastic coefficient of the material from which it is made; also a factor is a constant which depends on the units of measurement chosen.

The formula for the elasticity of the hairspring is: $S=\frac{Ct^3bE}{l}$

C= constant
t= thickness of the coil
b= breadth of the coil
l= length of the spring
E= elastic coefficient

As in the case of the brass balance wheel, the steel hairspring will also expand when the temperature is increased. The important thing to remember is that the increase will take place in all three dimensions. The coefficient of expansion of steel is 11 parts per million. The increase in length will slow down the time of one vibration, but the increases in the other two dimensions will speed it up. Mr. T. D. Wright, one-time head of the British Horological Institute, calculated in 1882 that the increase in the breadth of the spring causes the hairspring to increase its elasticity by about the same amount as the increase in length causes the loss, so that the two cancel each other out. The increase in thickness would then be the only dimension to consider, and it would produce a gaining rate if the elasticity remained the same. The calculations indicate that this increase would amount to about 33 parts per million. It has been experimentally determined that at the normal range of temperatures, the steel hairspring loses about 240 parts per million of its elastic strength for every degree Centigrade increase in temperature. By taking away the 33 p.p.m. from 240, we find that the net effect of the temperature on steel hairsprings is a loss of about 207 p.p.m. per degree Centigrade. This is translated by further calculations into about 9 sec./24h loss of time attributed to the hairspring.

To summarize briefly, we can conclude the following:

1. The variations in timekeeping of watch balance wheels and hairsprings caused by the variations in temperature are the results of two natural phenomena:
   a) the expansion and contraction of materials.
   b) the variation in the elastic strength of the hairspring.
2. The expansion of the balance wheel will result in loss of time.
3. The expansion of the hairspring in all three dimensions will cause a small gain if the elasticity remains constant.
4. The major cause of variation due to temperature is the loss of elasticity of steel hairsprings with the increase of temperature and vice versa.

The principles adopted for automatic compensation can also be found from the formula for the time of one vibration. By combining formulas 1 and 2, we get $T=\pi\sqrt{\frac{MR^2}{S}}$

If the variation of elasticity (S) is predictable, then by changing the numerator, i.e., MR^2 in the formula, we should be able to maintain the ratio constant. As long as the ratio $\frac{MR^2}{S}$ remains constant, the value of (T) will not change. Since the elasticity of the hairspring changes automatically, the change in the numerator must also be automatic. An automatic change in the mass of the balance is obviously not possible. The only alternative is the appropriate change in the radius of gyration (R). This method was adopted by Julien LeRoy who invented the bimetallic balance.

As was mentioned before, John Harrison chose a different solution to the same problem. He elected to keep the elasticity of the hairspring constant. This is evident from the formula where $S=\frac{Ct^3bE}{l}$. The only component of the formula which could be made to change automatically in the proper and desired direction was the length of the spring (formula No. 1). Harrison chose to manipulate this component and invented a bimetallic regulator which could change the effective length of the hairspring if properly adjusted so that the elastic force of the hairspring would remain constant over a normal range of temperatures.

Both principles of compensation use the same scientific discovery, namely the difference in the coefficient of expansion of different materials.

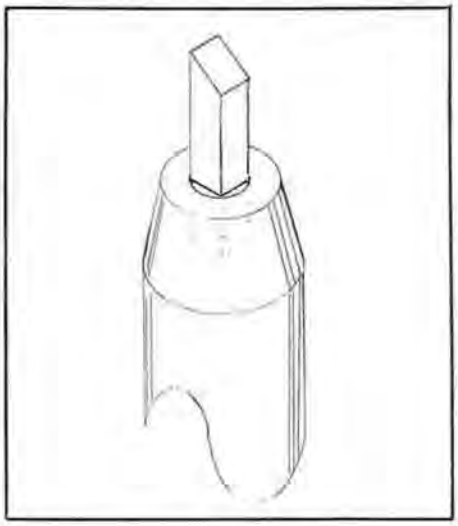
To be continued next month.

Bench Tips / Joe Crooks

An Electronic Tip

Well, well, what do you know! My prayers have been answered! An electronics tip—and from none other than that international figure, Mr. Henry Fried, and co-sponsored by our AWI Executive Secretary, Mr. Milton Stevens!

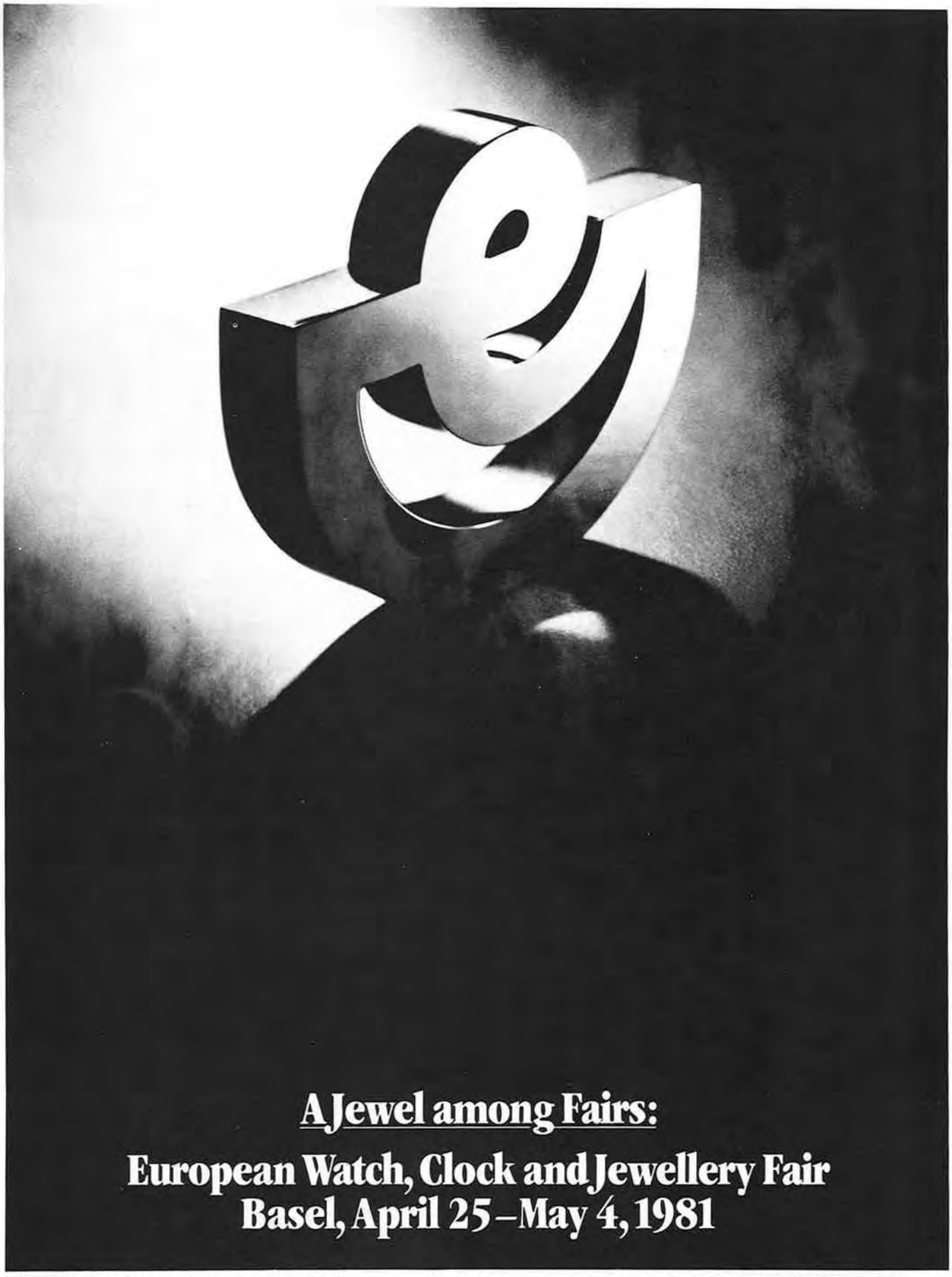
The other day, while at AWI headquarters discussing digital quartz watch repair, I mentioned the need to scrape metallic smears across and between two conductive paths on the ceramic substrate. Because the ceramic is so hard, slips of the tweezer or screwdriver often cut the metallic paths, dragging metal across to the adjacent metallic path. This causes either a weak signal or no signal on the cut path, as well as creating a short-circuiting path between the two metallic lines.



Efforts to scrape this smear off with a hard tool or graver aggravate the condition, as the ceramic abrades more metal from the scraper.

I mentioned the need for either a diamond or sapphire scraper with a sharp point. Milt Stevens quickly said, "Why not use a small exit pallet jewel; it is of the right size and has the required scraping angle and edge. It could be set into the end of a brass rod, filled in either with epoxy or brazed in, and the end hole would be just large enough to accept the jewel. Pallet jewels are sapphire, next in hardness to diamond and, of course, harder than the ceramic substrate."

As you can see, our Executive Secretary has more than an occasional good idea! *(Continued on page 64)*



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Part I

THE DIGITAL WATCH TROUBLESHOOTING GUIDE

By Louis A. Zanoni

This step-by-step Digital Watch Troubleshooting Guide takes us on a sequential path through each section of the watch in an attempt to locate a problem. All sections and branches must function well and be properly interconnected in order to have a complete, working watch.

Troubleshooting any electronic system can be simplified by dividing the system into testable sections or branches and sequentially testing each section. The digital watch is divided into sections and branches as illustrated in the flow charts, Figures 1 and 2. The LCD Digital Watch Component Flow Chart (Figure 1) should be referred to when using the step-by-step guide that follows.

It is presumed that the person using this guide has a reasonable understanding of the basic functions of the digital watch and that he has read the *Digital Watch Repair Manual* by this author, or has attended the Zantech Digital Watch Repair Course.

You will find that each step in the analysis procedure is numbered like a clock–in hours, tens of minutes, and minutes. The hours define each step; the tens of minutes define the branches of that step. The minutes then define the twigs of the branch.

Although it may require some time to read these directions and follow this procedure, a thorough and efficient failure analysis will result. Once this procedure has been memorized and thoroughly understood, only a few minutes will be required to complete the failure analysis of a digital watch.

For details on correcting the faults of the module, consult *The Digital Watch Repair Manual* by this author.

Step 1:00 Visual Examination of the complete watch:
- 1:10 What work is required on the case?
  - 1:11 Is the lens intact; does it need polishing?
  - 1:12 Are all of the buttons functioning properly?
  - 1:13 Does the case require cleaning?
  - 1:14 Is the bracelet in need of repair?

Step 2:00 Open bracelet at the buckle when necessary:
- 2:10 Replace spring bar in original position.

Step 3:00 Remove **case back**:
- 3:10 Place watch face down on non-abrasive surface.
- 3:20 Examine case back:
  - 3:21 Does it fit properly? Too loose? Too tight?
  - 3:22 Is it corroded? Can the corrosion interfere with the required electrical connections?
  - 3:23 Does it use a gasket?
- 3:30 Does it have an **alarm disc**?
  - 3:31 Is it damaged?
  - 3:32 Is it insulated from the case back?
  - 3:33 Is it shorted to the case back?
  - 3:34 Is it an intended short?

Louis A. Zanoni's "The Digital Watch Troubleshooting Guide" has been made available to Horological Times *by the author and will appear in two installments. This guide–which presents a clear and unique approach to troubleshooting the LCD watch–will be included with all new orders of Mr. Zanoni's* Digital Watch Repair Manual *at no extra charge.*

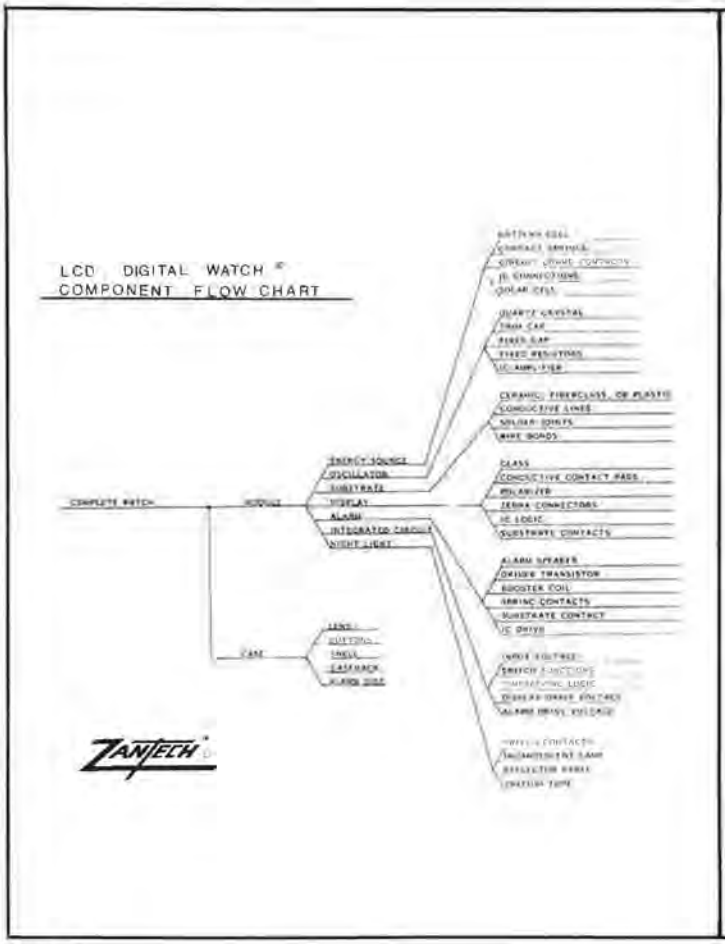

Figure 1

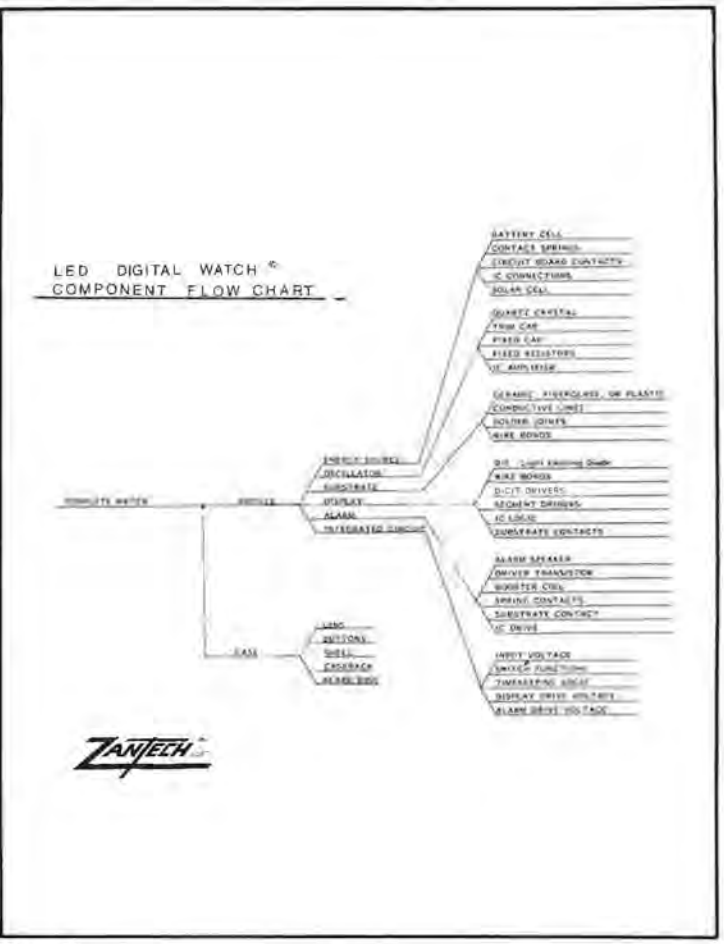

Figure 2

3:35 Does the disc sound off when an AC voltage is applied to it?

3:36 How are the electrical connections made between the module and the disc?

3:37 Are the contacts adequate?

Step 4:00 Examine the **module** in the case:

4:10 What type of batteries are used?

4:11 How are they connected to the module? (Negative up/positive up; side contact/bottom contact; battery strap; caseback springs; etc.)

4:12 Have the batteries leaked? If so, where?

4:20 Is the module electrically connected to the case? If so, how?

4:21 Is there a side contact from the module to the case?

4:22 Does the battery strap contact the case; Is it supposed to?

4:23 Are the alarm contact springs adequate?

4:30 What type of switch contacts are used?

4:31 Are they moveable contacts on the module? (No electrical case contact is necessary.)

4:32 Are they solid metal or rubber contacts? (Electrical case and button contact is necessary)

4:33 Are any of the buttons shorted to the switch unintentionally?

4:34 Do all of the buttons reach their intended switch contacts when pressed? Do they retract when released?

Step 5:00 **Remove Module** from Case:

5:10 Visually inspect all visible areas of the module. (Do not invert the case; loose components may be lying in it.)

5:11 Make a general visiual examination of the complete module. Do this over a clean surface, such as a plain white paper or felt work pad, so that any loose components can easily be recovered.

5:12 Microscopically examine all visible areas of the module–first at low magnification (10X), second under higher magnification. Many, many problems are detected at this point.

5:13 Microscopically (10X or 20X) examine the empty case for loose components, button problems and other debris.

Step 6:00 **Clean the case and caseback ultrasonically** while continuing the module evaluation.

(Continued next month)

THE SHIP'S CHRONOMETER

(Continued from page 18)

dinance, there are, in addition to No. 1254 of your manufacture, which received a severe trial on board the Monitor *Montauk*, Nos. 1103 and 1226 from the Iron Clads *Miantonomah* and *Mahopac*, No. 1326 from the *Seneca*, Wooden Gunboat, No. 1311 the *Casco*, and No. 1231 from the *Sopronia*, which have performed so perfectly that they will be reissued as first-class instruments."

Chronometers were always in demand, particularly during periods of war. This was apparent when we saw the Navy changing their testing procedure in 1864 when the need for more instruments arose through the sudden expansion of forces, and again during World War II when the Navy requested people throughout the land to either loan or sell their chronometers to the U.S. Navy.

The heightened value of chronometers during wartime is dramatized by the fortunes of the British cruiser *Alabama* which ran blockades as a Confederate privateer during the American Civil War. The *Alabama* slipped a blockade from England in July, 1862, but was boarded off the Java coast by Lieutenant Albert R. Wonham, Royal Navy, Commander of the gunboat H.M.S. *Leven*. Captain Semmes, then commanding officer of the *Alabama*, told Wonham that when they boarded ships, apart from provisions and coal, all they took were chronometers. The records at the Naval Observatory show that before the *Alabama* was sunk and took her prize booty of chronometers to the bottom, she had captured thirteen different vessels.

Her sister ship, the *Florida*, captured six vessels before she was in turn captured by the Federals. An interesting note from the Observatory records shows that fourteen box chronometers were taken from the rebel steamer, *Florida*. Listed are the makers and numbers of those instruments taken and later forwarded to the U.S. Naval Observatory during the month of December, 1864. They were: Arnold and C. Frodsham No. 1514; Bliss and Creighton No. 1078; Dent No. 2062; French No. 4920; Henry Frodsham No. 1850; James Bassnett No. 275; James Bassnett and Son No. 897; John Bliss and Son No. 2481; John Glover No. 306; Parkinson and Frodsham Nos. 993 and 1935; Thomas Porthouse No. 6829; T. S. & J. D. Negus No. 1065; and William Wood No. 425.

In response to a Naval Observatory request regarding the availability of clicks, click wheels, and dial screws, Negus wrote Superintendent J. F. Hellweg on April 31, 1936, that:

". . . We make chronometers one at a time as this is a small concern, not a factory. Most of the work on a chronometer is special hand work. We do not make up a stock of clicks and click wheels. They are made separately and fitted for each chronometer as it is turned out. They have to fit the square post and as that varies a little in size, a lot of clicks would probably not fit.

"The sale of new chronometers is very limited. We get a great many repairs, but make very few new chronometers—so far this year we have only made two. We may go three or four years and not make another."

The Negus's were of strong will and spoke their minds. This has already been illustrated in the reply which they sent to the Naval Observatory in 1864 regarding the trial requirements for new chronometers, and is demonstrated again in the following piece of correspondence.

In 1939, Commander E. E. Duvall, of the Naval Observatory, wrote the Negus's, as he did several other firms, inquiring whether or not they were interested in submitting a bid for forty new chronometers that the Navy wished to purchase. The Negus's in their reply of April 8, 1940, wrote:

". . . This calls for considerable thought. The Navy Department has not bought an American chronometer since 1918. From 1848 to approximately 1910, we could be sure of selling the Government a few chronometers every year—never more than twenty, and seldom less than six.

"During the war [World War I] the Navy Department felt that it was necessary to go abroad for chronometers; and since that time if American chronometer makers had had to depend on the Navy Department for an outlet, they would have starved.

"Forty chronometers in eighteen months at present would overtax our current set up, and cripple us for our Merchant Marine trade and repairs."

So upon the conclusion of World War I, the production of chronometers in America in any appreciative numbers came to an end. This situation remained until 1941 when the Hamilton Watch Company, as requested by the U.S. Navy, began producing marine chronometers. However, Bond, Bliss, Negus, and others have certainly etched their names in the annals of American history. We should be ever mindful of the role their chronometers, as well as Hamilton's, have played during periods of conflict and in the great tradition of the maritime service.

Next month, we will cover the history of D. Eggert & Son and other American makers. TIMES

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THE PICKLE BARREL

By Marshall F. Richmond, CMW

INSTALLING INITIALS, EMBLEMS, AND CRESTS

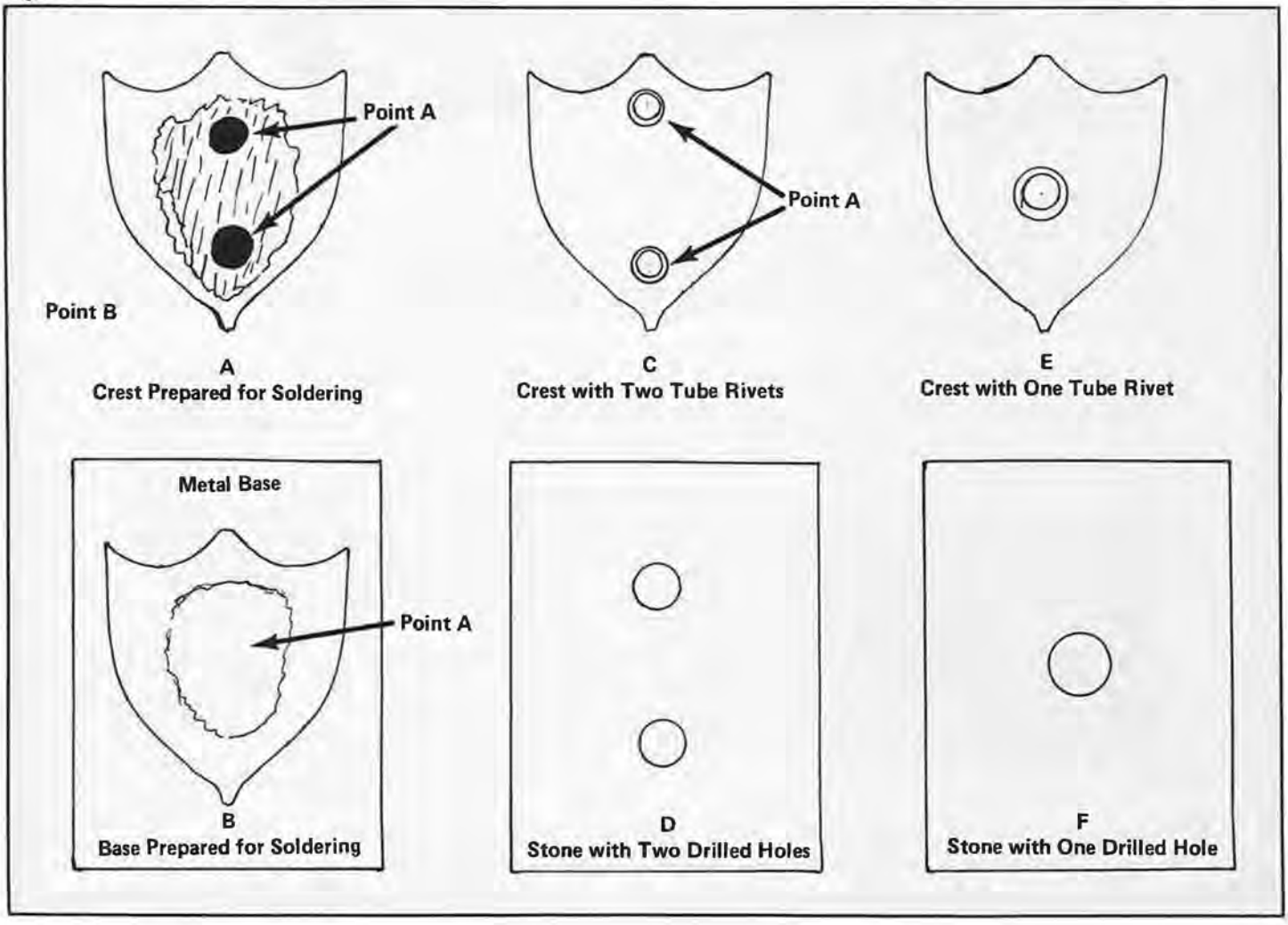
In order to make repairs on jewelry with initials, emblems, or crests, it helps to have an understanding of how these decorations are attached. This article will familiarize you with the methods of attachment and also with techniques for installing or repairing such decorations when they are loose or detached.

Basically, there are three types of fastenings for attaching initials, emblems, and crests to rings, stones, or other pieces of jewelry: these are soldering (hard and soft), tube rivets, and screws.

For many years, one class ring manufacturer used soft solder to attach the crests on all-metal class rings with excellent results. See Figure 1, A and B. The reason for using soft solder is that the crest is hard-enameled, and if enough heat were applied to flow hard solder, undoubtedly the hard enamel would be damaged. Hard solder is usually used when the crest and article of jewelry to which it will be applied are all metal with no enamel.

To reinstall a soft-soldered crest, clean the crest and the article of jewelry, removing all the old solder. The old solder can be removed by fluxing with soft-solder flux (zinc chloride) and heating until the solder flows. While still hot, wipe with a piece of damp tissue. Old solder can also be removed by filing. Once this is done, heat the items slightly and apply soft solder flux with a small flux brush or piece of pegwood to both the crest and base. Heat again until the flux turns white. The surfaces covered should be approximately two thirds of the area of the crest and of the area covered by the crest on the base. Figure 1-A, Point B shows the approximate area that should be covered by flux on the emblem, and Figure 1-B, Point A shows

Figure 1



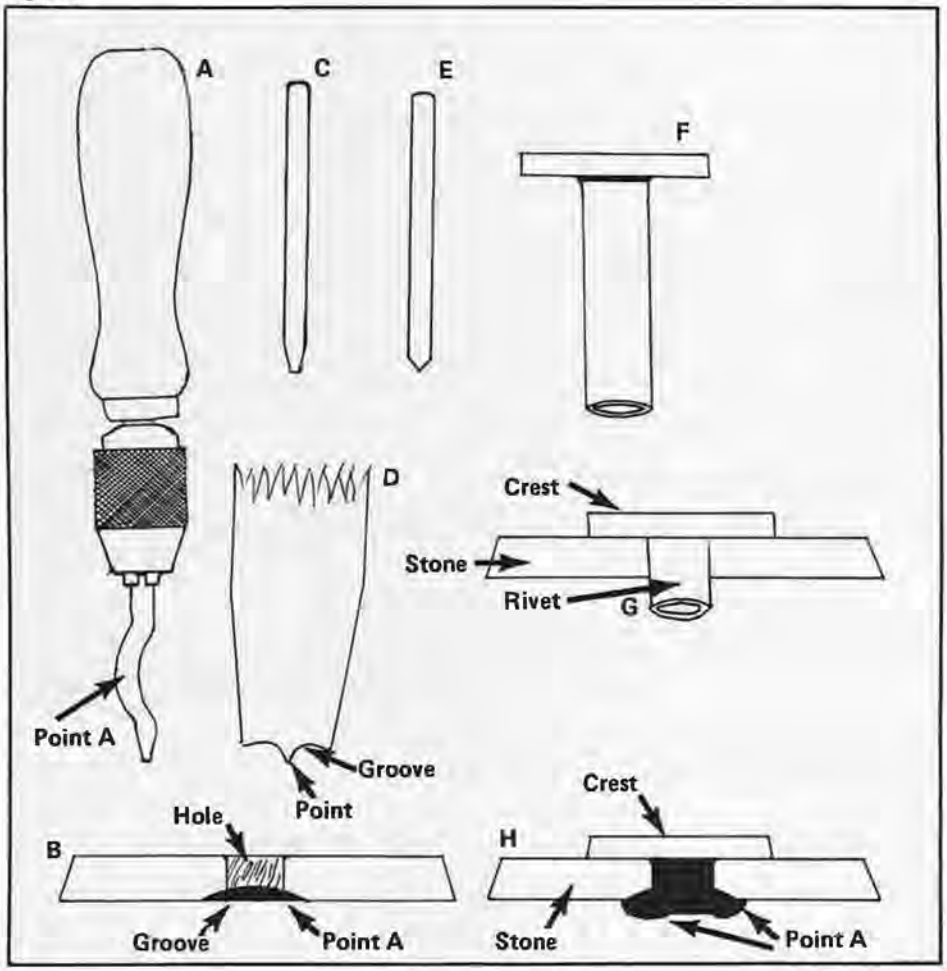
the corresponding area on the base. Place a couple of small pieces of soft solder on the emblem (See Figure 1-A, Point A) and heat until it flows. It should flow enough to cover the area fluxed. Place the crest on the base and grip it with the heavyduty locking tweezers. Check for alignment. When properly aligned, apply heat until the solder flows. Being properly fluxed, the solder should not flow beyond the edges of the crest. You can see the crest settle tightly to the base when the solder flows. Immediately remove the heat and cool by either quenching or air cooling. Check to make sure the crest is tight and properly aligned. Then clean and polish.

Learn to identify soft-soldered crests and emblems on jewelry. This is especially critical on rings that are to be sized, for if in applying heat, enough reaches the soft solder to melt it, the crest may slip out of alignment or come off. To guard against this, shield the crest with wet tissue or shielding compound before applying heat.

Hard-soldered crests or emblems rarely have to be repaired, but installing with hard solder requires almost exactly the same procedure as soft soldering. The one difference is that the decoration cannot be held in place with tweezers, because to flow hard solder, the article must be heated red hot and the tweezers will not stand this kind of heat. It is best to handle this kind of repair by setting up the base on the asbestos pad. When working on a ring, grasp the bottom of the shank with the tweezers to get the base level; then place the prepared emblem in the proper location, heating until the solder flows and the emblem settles tightly on the base. The rest of the procedure is the same as for soft soldering.

Tube rivets are used to attach many crests or emblems to drilled stones such as onyx, agate, ruby, sapphire, synthetics, and even mother-of-pearl. Crests are usually attached with two tube rivets and emblems with one large tube rivet. Diamonds are often set in a square or diamond-shaped flat setting and attached to a drilled stone with a tube rivet. These diamond settings have the hole in the tube extending through the setting; after installation, the culet of the diamond can be seen from under the stone through the hole in the tube rivet. This allows easier cleaning under the diamond, as it can be cleaned from the underside.

Figure 2



Often emblem, crest, or signet rings come into the shop for repair with the rivet(s) broken or loose. If they are just loose, they can be tightened with a center punch (Figure 2-D) chucked in a hand vise (Figure 2-A). Place the emblem on a wooden block or a solid surface with the riveted ends of the rivets up; put the point of the center punch in the hole in the rivet. With a firm grip on the hand vise, push and turn at the same time to create a burnishing effect. In the case of a ring with one tube in the center, the punch will not be vertical—being on one side of the shank; however, by moving from one side of the shank to the other, the rivet can usually be tightened enough to make a satisfactory repair. If the crest is tight but will still turn, this can be corrected by using a screwdriver-shaped punch. Place the punch in the rivet in line with a groove usually found on the underside of the stone on each side of the hole. See Figure 2-B, Point A. Tap the portion of the rivet that is over the groove into the groove on each side; this should keep the rivet and emblem from turning.

If you anticipate many of these repairs, tools can be made easily from a piece of tool steel rod 5 mm in diameter and the length of a staking punch, or from an old worn staking punch. If an old staking punch is used, it must first be annealed by heating cherry red and slow cooling which will make it dead soft. Chuck it in the watchmakers lathe and turn a taper about 10 mm from the end, leaving the end 3½ mm. From the end, turn a groove, leaving a point in the center. See Figure 2-D. This will accommodate the larger rivets usually found in tube-riveted emblems where one rivet holds the emblem. A second punch can be made for the smaller rivets with a straight shank, but the diameter of the end should be 2½ mm. While still in the lathe, the end should be polished to as fine a finish as possible. These punches can be tempered and drawn to a peacock blue, but as all the tube rivets you are likely to encounter will be of a much softer metal than soft steel, it is really not necessary to temper these tools.

As most of the rivets encountered will be in stone rings, the larger punch for the single-rivet stones can be bent, allowing it to be placed on the rivet vertically rather than at an angle. This will produce a perfectly burnished rivet. See Figure 2-A, Point A. To bend this punch, use two pairs of pliers and grasp at each end of the bend. Heat red hot with the torch and bend to the shape shown in Figure 1-A.

Both the larger and smaller punches can be used for riveting the end of the tube rivets in the manner explained previously in this article, but the bent tool cannot be rotated more than about a third of a turn and will have to be used in a back and forth motion until the riveting is done. When finished, the rivet should look like Figure 2-H, Point A. These tools can be used as punches, but in forming rivets against a stone, tapping with a hammer could result in breaking or chipping the stone. You will also lose the burnishing effect, leaving the surface less smooth.

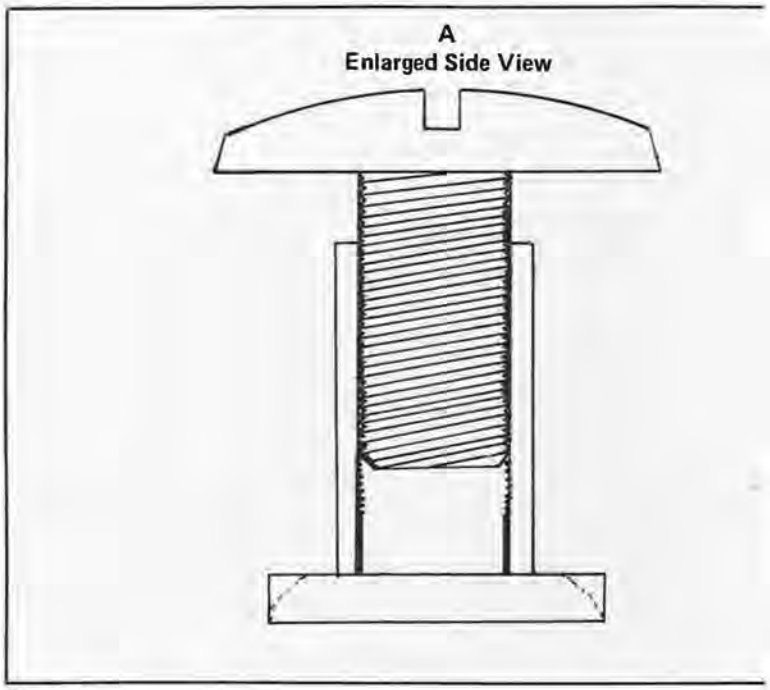
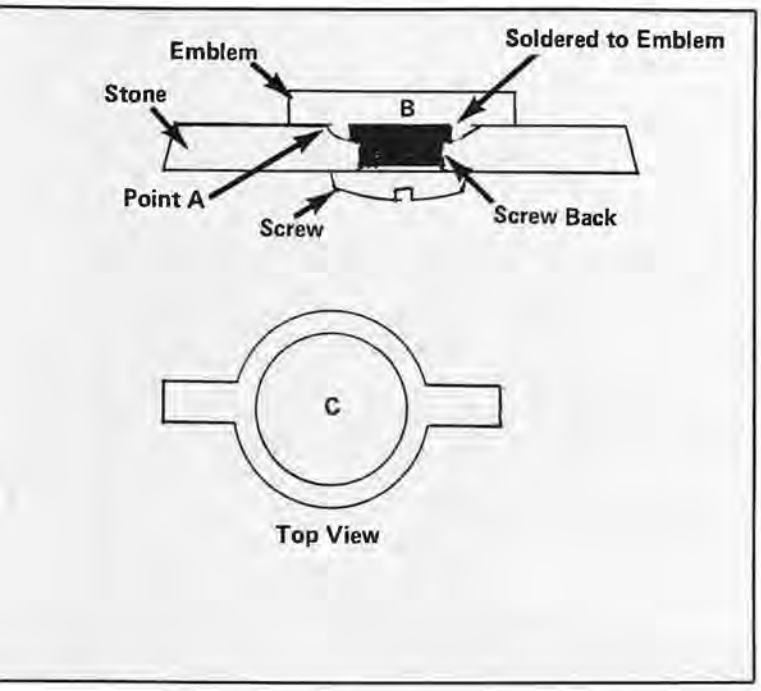


Figure 3

To make a tube rivet, a piece of tubing should be selected that will go through the hole in the stone snugly. As most of this tubing comes in three-inch lengths, one end can be hard soldered to the emblem and then cut off to length with the jeweler's saw. Allow at least 2 mm more in length than the thickness of the stone. To locate the position, if this is a replacement, the old broken rivet must first be removed. Saw it off, not too close to the stone. The hole in the tube will form the center. Use a drill the size of the tube to be installed and drill a depression. Lay it on the asbestos pad, heat, and flux only the drilled depression and the end of the tube. Place a chip of hard solder on the end of the tube and heat until the solder flows around this end. Grasp the opposite end of the tube in the heavy-duty locking tweezers; place the solder end of the tube in the depression in the emblem so it is perpendicular and heat both the tube and the emblem until the solder flows and can be seen all around the edge, forming a good bond with the emblem. If you do not feel that your hand is steady enough to hold this in place while soldering, you can hold the tweezers in a tool made for that purpose.

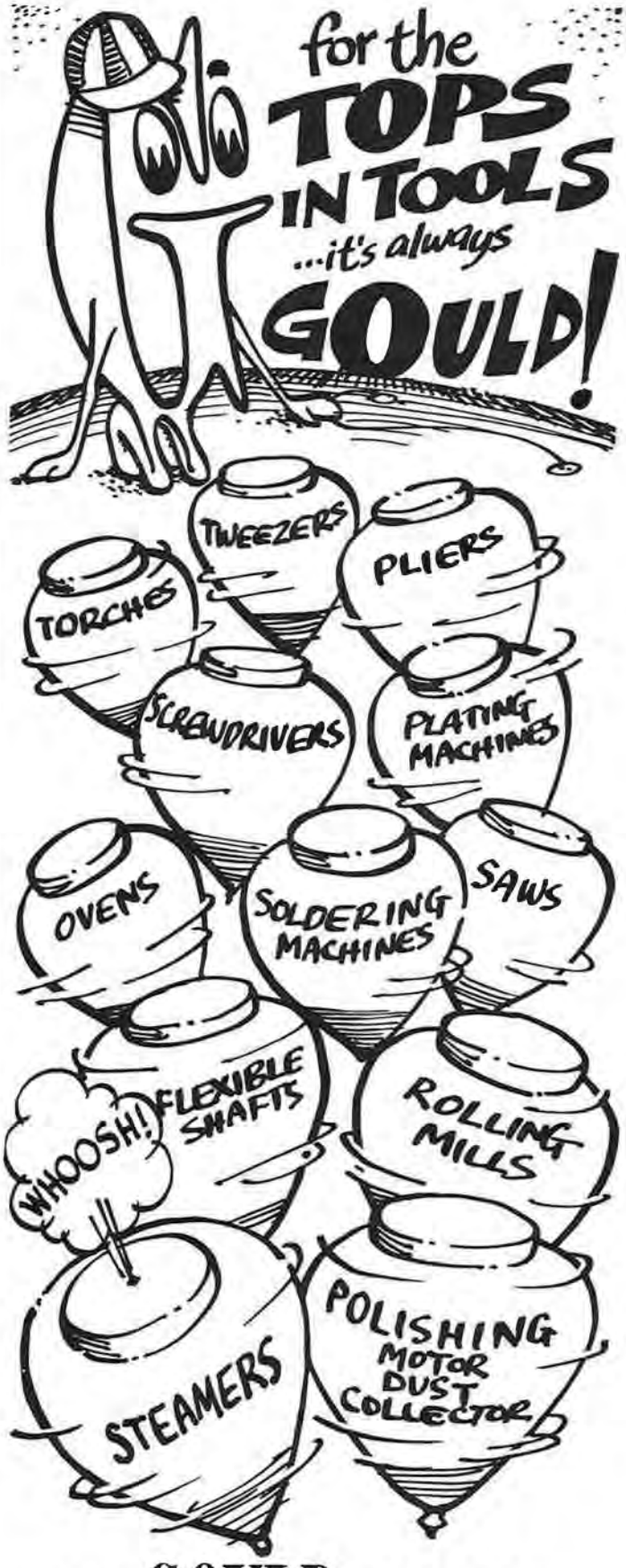


These instructions are for lesser experienced jewelry repairmen; with experience and practice, you will be able to remove the old tubes by heating, and be able to solder on the new tube without drilling the depression. Thin-walled tubing is available from your material distributor in 14K yellow or white gold, yellow gold filled, sterling silver, or nickel silver in sizes from 2 mm to 5 mm in diameter.

After the rivet is installed on the emblem and cut to length, put the emblem on the stone and push the rivet through the hole until the emblem is tight against the stone. Place the emblem face down on a block of wood or other firm surface and burnish the end to make a completed rivet. See Figure 2-H, Point A. As was previously explained, there is a groove in the bottom of the stone; take a screwdriver-shaped punch and tap a notch in the riveted part to go into this depression on both sides. This should make the emblem tight, secure, and unable to turn. The same procedure is used on two-tube emblems, except that you must be careful to align the tubes perfectly. Also, you will find no groove to keep the emblem from turning, as with two tubes this is unnecessary.

Screw backs for emblems or initials are available

(Continued on page 34)



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(Continued from page 31)

from your material distributor. I have found them in two lengths for use with thick and thin stones. See Figure 3 for diagram showing enlarged top view, side view, and assembled view. To install, make sure the emblem is clean, and flux the spot where the screw back is to fit; flux the bottom of the screw back, and flow a very small amount of solder on it. Place the emblem on the asbestos pad and align the screw back in the center so the rectangular protrusions will match the groove in the stone. Stones that are cut for this kind of attachment have a groove in the top of the stone–unlike the rivet-type which has the groove cut in the bottom. When the alignment is complete, heat the emblem and screw back until the solder flows, making a solid bond. Cool, pickle, and rinse in water. The emblem is now ready to install, but sometimes the corners of the bar where it fits in the groove must be rounded so the emblem will be flush with the stone. See Figure 3, Point A. When the emblem is seated flush on the stone, put the screw in and tighten with a screwdriver. In order that the screw does not work loose with wearing, place a small amount of cement on the threads of the screw before installing; when it is tightened and the cement sets, there is little possibility of the screw working loose. If you use a cement such as crystal cement, the screw can still be removed without twisting off; with other cements, such as Aaron Alpha, the bond may be so good that the screw will twist off if it needs to be removed. Polishing and cleaning can be done after the emblem is installed.

In previous articles, I have mentioned the frugal use of solder. This I cannot emphasize too much. In a jewelry repair class, I was showing a jeweler's wife taking the course how to do a particular job, and she accused me of being stingy with the gold solder. She was right. I am stingy with gold solder because: 1. solder is expensive 2. an excess of solder makes a sloppy job and has to be removed by filing and polishing which is time consuming 3. if the solder joint is properly prepared and the solder is used sparingly, it will produce a stronger joint than a poor fit that is filled with solder.

Another application for emblems, initials, and crests is encrusting. Encrusting means that the figure is cut into the stone, filled with gold leaf, and polished smooth with the surface of the stone. Many stones that are encrusted, such as onyx or bloodstone, must be shielded when applying heat to do sizing or repairs; other stones such as ruby, sapphire, or synthetic stones do not need shielding, for they will withstand heat without damage unless cooled too quickly. All encrusted stones should be shielded with wet tissue or shielding compound before the ring is sized, because heat will damage the bonding material that bonds the gold leaf to the stone and all or part of the encrusting (gold leaf) may come out. It is not practical for jewelry repairmen to attempt encrusting, but where only a small part of a design is missing, gold filings mixed with epoxy makes an adequate filler. Mix a very small amount of epoxy cement and add gold filings to make a very thick paste. With a small screwdriver blade or bench knife, apply some of this to the missing encrusting and press it into the cavity. Dry and cure about 2 hours under a heat lamp or in a 250° oven, or just let air dry and cure for at least 24 hours before polishing. When this is completely cured, it can be filed and polished flush with the surface of the stone. As gold leaf is pure 24K gold and the filings you will use will no doubt be karat gold, the color will not be a perfect match under magnification. However, this will look acceptable to the naked eye and should prove serviceable. Encrusted stones can be replaced–and probably even the encrusting can be replaced–but either way, the stone will have to be removed from the setting, probably requiring a new bezel or prongs before resetting, plus the cost of a replacement stone or replacing the encrusting. These factors should be explained to the customer before removing the stone as well as the estimated cost. Let the customer make the decision on how the job should be handled.

The watchmaker-jeweler receives many varied requests for repairs. Some are not related to the watch and jewelry business, but whenever the craftsman can reach back for a little extra knowledge and skill to service these requests, he can create repeat customers and elevate his image in the community. Over the years, I have been called upon to make

pieces for fishing reels, electric trains, communication switchboard relays, and many other unrelated service items. One telephone company serviceman was desperate for a critical part, and when he tried to order it, he was told that there would be a wait of several weeks. He came to me with the old part and a small piece of fiber insulation board, asking if I could duplicate the fiber insultor in the part. I told him that I thought I could and would try. Using the knowledge and skill that I had developed, a perfect duplicate was made using a jeweler's saw, watchmaker's lathe, and needle files. He had the piece in operation within an hour. I not only turned a tidy profit for my time, but have never had a problem with the phone company since! This is an example of how a watchmaker can elevate his image by learning jewelry repair and being able to combine the two skills to broaden his sources of repair and income.

In the next article, we will explain how jewelry repair can be organized on a production basis the same as watch repair. HTIMES

SALES TALK

By Wes Door, CMW

THIRD PARTY APPROACH

The third-party method in selling can be used to real advantage, and perhaps you already use it. Many jewelry salesmen use it all the time; if used honestly, it is a good selling technique.

If you're not clear on what the third-party method actually is, suffice it to say that I just used it in the above paragraph when I said that salesmen use this method in selling. The third party method is simply giving a customer an example of the experience of someone else.

Let me tell you a true experience illustrating how this works: Once upon a time (an original way to start a story), a lady came into my store looking for an August birthstone ring for her husband. I showed her a sardonyx ring. She wasn't sure if she really wanted this rust-colored stone, but the longer she looked at it, the better she seemed to like it. Finally, she thanked me for showing her the ring and said that she imagined it would still be here if she should decide to buy it later.

I agreed by saying, "Yes, I imagine it will be in my stock for a long time if you do not buy it now. I would hate to tell you how long I've had this ring in stock. It has a simple design and most people seem to prefer the fancier designs. I personally like this ring, and you do too; I think you and I have good taste."

At this point, I introduced the third-party approach into my sales talk.

"I should tell you that if you don't buy this ring today, it will not be here later, but that would be a lie. In fact, I'm quite sure this ring *will* be here for a long time—unless it's like a certain watch that we sold last week. You see, a lady came in to buy a certain watch which she had seen in our window. She was surprised to find out that we had sold it, as she had walked by our window regularly and that watch had been there for quite some time. I was just as surprised as she was to find we actually had sold it. We had probably had it in stock about as long as we've had this sardonyx ring that you like."

At this point, I told Mrs. Smith we could hold the ring on lay-a-way or she could take her chances. Guess what! She bought the ring.

We used the third-party selling method, and it worked because we were honest. We did not make up stories such

as, "If you don't buy this now, it will be sold soon as it's a very popular style and several other people are very interested in it."

Let's suppose that, while selling a watch, our customer expresses concern about the quality of the watch and asks if these watches give much trouble. You might answer by saying, "You know, Mrs. Jones, we feel like the Maytag repairman; we are still waiting for something to happen."

This one sentence may be better than a thousand technical words; however, it does preclude that the customer has seen the Maytag commercial.

Jewelry salesmen are masters of the third-party approach in sales; they continually relate to us the experiences of other jewelers, and if their examples are honest, the information can be very helpful.

To test the honesty of the next salesman that you do not really know, try the following: Let's say he's a watch salesman and has a tray of samples on your counter. Pick out one watch which you do not like at all and which you can't imagine anyone buying. If the salesman notices your selection and tells you what a super choice you have made because this watch really is a hot seller, then watch out. However, since he may be telling you the truth, test him again before you decide that he can't be trusted.

This reminds me of an experience I had while looking at new suits. As I was looking at a certain suit hanging on the rack, the owner came over. He said, "Wes, I know you seem to like this suit and we do sell many of this style to college kids. However, may I make a suggestion? Since you are a business man, I think this type would be a nicer choice for you."

He was a good, honest salesman and did not take "the line of least resistance" which would have been to sell me the suit I was examining.

The honest salesman can be illustrated in the following conversation between a diamond ring salesman and a jeweler:

Jeweler: Do you carry a diamond set with a cross design on the sides?

Salesman: Yes, we make only one number like this now and truthfully, it's not a good seller, but if you want it, we can sell it to you.

Jeweler: Thanks for your honesty. I'll take three sets. I happen to like this type, and in my area, it seems to sell.

I'm sure you have third-party methods that work for you. Keep telling those stories, but be sure they are true, and your customers will buy now.

Buy now,
Wes

We Salute These New Members!

ADAMS, L.J.—Missouri
BARTLETT, Harold M.—Wisconsin
BROOKS, Michael H.—North Carolina
CAMPBELL, Robert E.—Texas
DOWLING, Stephen J.—Ohio
DUNN, Robert W.—West Virginia
ELLENBECKER, Dale N.—Wisconsin
FLEGE, Don—North Carolina
FOGLE, Donald E.—Wisconsin
FREINIK, Gerhard W.—Wisconsin
FUGINA, Edward G.—Wisconsin
GALE, Douglas L.—Michigan
GRAEF, William J., O.D.—Wisconsin
GROSCHUPF, Rainer H.—Wisconsin
HATHAWAY, Arnold G.—Wisconsin
HEGSTROM, David R.—Wisconsin
HEGSTROM, James A.—Wisconsin
INLOW, Richard W.—Wisconsin
IRELAND, Steven M.—Indiana
ISHII, Hanroku—Wisconsin
JOHNS, William J.—Wisconsin
JUSTILIANO, Vito L.—Wisconsin
KOEHN, J.M.—Wisconsin
KRAIL, Donald A.—Wisconsin
KUCKUK, John A.—Wisconsin
LAMBERT, Ronny C.—Delaware
LEEMAN, Kenneth D.—Wisconsin
MALONEY, William J.—Wisconsin
MISKOWSKI, Robert E.—Wisconsin
MORGAN, Robert W.—Wisconsin
NERIS, Johnny—Puerto Rico
NIED, Daniel A.—New Jersey
ORVA, Paul W.—Florida
PATTERSON, Gaylon—Arizona
PETERSON, Elmo O.—Wisconsin
PETERSON, Ronald N.—Wisconsin
POPP, J.J.—Michigan
ROBBINS, Jack R.—Wisconsin
SENZ, Walter R.—Wisconsin
STAFFORD, Phil—Pennsylvania
SUSSMAN, Hy—Georgia
THOMAS, Joseph—Wisconsin
VALERANO, Luis F. Matos—Puerto Rico
VANDER ZANDEN, Robert—Wisconsin
VON ARX, Kenneth J.—Texas
WIEDERHOLD, Anton J.—Wisconsin
WIESE, Robert L.—Wisconsin
ZYKAN, Frederick Thomas—Missouri

(Continued from page 12)

freedom were already correct and no bending were needed, but many times someone has gone in and bent the banking pins unnecessarily. These then need to be straightened in order to correct the corner freedom. To bend or straighten the banking pins, a round-faced hollow staking tool punch that fits the pin closely can be used, or a tool can be made from a piece of clock bushing wire or brass rod. Figure 7 shows the banking pins being bent. If the pins need to be bent only slightly, the punch can be used as in View "a." If much bending is needed, the pin should be bent as in View "b" in order to keep the pins parallel with each other. To make this type of bend, first bend the pin at its base. Then move the punch farther up on the pin and make the second bend. This type of bend can only be done on long slender-type pins. Some pins are easier to bend at their bases because they have been turned down smaller near the base.

After the corner freedom has been established, then the guard pin freedom is checked and adjusted if necessary. To check the guard pin freedom, the balance wheel is turned with the finger until the guard pin is well outside the crescent; then the needle is used to move the fork back and forth to check the freedom of the guard pin against the edge of the safety roller. See Figure 8, View "a." This freedom is the motion of the fork between the banking pin and the guard pin against the edge of the safety roller. The guard pin freedom should be about half the corner freedom. In no case should the guard pin freedom be equal to or more than the corner freedom. Once the guard pin freedom has been checked on one side of the line

(Continued on page 53)

"CLOCK CHATTER" © 1981

By Otto Benesh, CMC

THE PULLEY

The pulley is one of the four fundamental simple machines—the lever, the wheel and axle, and the inclined plane being the others. The pulley may be described as a disc, movable on an axis, with a groove cut around its circumference. The disc is called a sheave and is normally placed in a hollow mass of wood, metal, or plastic called a block. The block for most clock pulleys is a bent piece of metal referred to as the bridle.

There are two types of pulleys used in clockwork: the fixed and the movable. The fixed pulley has no increased mechanical efficiency and is primarily used to change directions. An example would be the pulley on the top of woodenworks clock cases which changes the direction of the cable from up to down. This provides for a longer drop of the cable in the case, utilizing the total height of the case for the drop, thereby allowing maximum running time. The weight required is the same as that required for a straight drop.

The movable pulley provides an even greater drop in a short space; however, the way it is arranged in a clock case causes it to have a negative efficiency. A straight drop requiring a weight of one pound will require two pounds with a pulley moving at the bottom of two lines. The arrangement in a Grandfather (long case) clock is an example of this. Pulleys using three lines will require three times the weight, so the rule is to multiply the single line weight by the number of lines to arrive at the required weight.

Having established a little background on these machines, let us pass on to some actual examples.

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 1 shows four examples. Proceeding from left to right, the first one is from a lantern clock. This type is usually a straight drop and is found in most of the clocks using rope cords. It is easily identified by the spikes in the bottom of the groove. It is another example of the fixed pulley. When you find one of these pulleys with a series of cut-out portions at the bottom, it is almost certain that the pulley is for a chain rather than a rope. Do not confuse this chain with the ladder type. This is the chain that has its links at ninety degrees from each other.

The next example is from a clock once again using a rope cord. It is a movable pulley and is found in many thirty-hour long case clocks.

Continuing on, we come to the most popular of the pulleys—the one for eight-day long case clocks. This is again the movable type and, as you may imagine, is quite old. Notice the decorative rings that ornament the sheave.

The last pulley is a movable one of Austrian origin and is used in the wall regulators that are so popular. The block or bridle has been engraved to enhance its looks. Notice the pattern used for crossing out the sheave.

Figure 2 shows some modern replacements for pulleys. As you can see, the only one that is a close match is the third from the left. Unfortunately, it is a pulley made in England in limited quantities. It is also quite expensive compared with the others.

The pulley on the far right is what is available for replacement for wall regulators, banjos, etc.

One of the most frequent problems with the fixed pulleys used in lantern clocks (as shown in Figure 3) is that the spikes in the center become dull and require sharpening and eventually replacement. This is not a difficult job. After removing the "C" ring wire and the rivets in the sheave, the pulley may be separated into the parts shown in Figure 4. Actually, it is not necessary to remove the spring shown at the right. This spring has a step in it which engages the spokes of the wheel and acts as a ratchet.

Figure 5 shows the center hub with the spikes. It is general practice when replacing spikes to drill new holes half-way between the worn ones and insert the new rods in this position. Once they are in, it is easy to point the new rods by filing. Then the old spikes are cut and filed flat with the hub. Obviously, the third time this is necessary, you either drill out the flattened

Figure 7

Figure 8

Figure 9

Figure 10

Figure 11

Figure 12

Figure 13

Figure 14

Figure 15

Figure 16

old ones or the last set. The choice is yours. Very seldom do we encounter two sets of flattened spikes. Restoration would require drilling out the worn ones so that there would be only one set of spikes noticeable.

The pulleys in Figure 6 are examples from repair work that has come through the shop for restoration. It is difficult to conjecture the reason for this type of work. The spindle on the pulley on the left is a bent nail, and the support for the weight is a piece of twisted cable. If you look closely, you may see the remnant of the old bridle. The bail has been cut off and the hub drilled through.

The example on the right had the bridle left in the hole in the sheave. It was taken out for photographing. The bridle had been cut as shown, probably so that a replacement with a screw axle could be used. This allows replacement without untying the cable at the seat board. How lazy can one get! It is anyone's guess as to how the center got chewed up. Termites?

Another pulley is shown in Figure 7, and as you can see, it has a large center hole. This pulley had been discarded and probably replaced by a new one. Actually, there was no reason to replace this pulley. The action of the axle on this perfectly round hole was quite satisfactory, and too often pulleys are replaced without regard for the action.

If you consider that the revolution of the sheave on its axle is very slow, the only thing that will disturb smooth operation is lack of roundness in either the sheave hole or the bridle axle. Far too often, good pulleys are replaced simply

because the hole is deemed too large. I was made a gift of a large number of pulleys that had been replaced and the majority need not have been. As they were old ones, I was overjoyed to receive them.

We are going to use the pulley shown in Figure 7 as an example of how to repair a pulley, even though this particular one doesn't need it.

The first thing to do is to separate the bridle from the sheave. The axles in the bridles are usually rivets and can be punched out. It is easier to punch the rivet out if you file the rivet down close to the bridle. Then with a twist drill, as shown in Figure 8, cut a cone shape in the end of the rivet. This need be no deeper than the start of the straight portion of the drill shank.

Figure 9 shows the rivet being punched through. The cone drilled allows the riveted-over portion to fold inward and prevents tearing the bridle.

Figure 10 shows the pulley separated into its component parts and ready for repair.

The next step is to fit a plug in the oversize hole. Figure 11 shows the sheave with a plug fitted. The plug may be soldered or riveted in for security.

When the plug has been affixed, the next step is to drill a hole for a new axle. See Figure 12. The old one may be used as a gauge for size. The operation is shown being done on a lathe with the sheave held in a bezel chuck; however, it may be done just as well with a hand drill.

The last step is to put it together and rivet the new axle tightly. Then the pulley should look like the one shown in Figure 13.

Another job that can be performed easily is the *(Continued on page 53)*

Basic Gemology for the Repair Shop

THE ROCK QUARRY

By Fred S. Burckhardt

Random Thoughts

Why does a customer argue that her mechanical watch kept perfect time for two weeks without a crown, and now, since the crown has been put on, it doesn't run right?

Why are some members willing to do all the work without getting the credit, but others want all the credit without doing the work?

Why is the Guild meeting with the smallest attendance the one when elections are held?

Why do those who are always blowing their own horns end up without an audience?

Why do customers leave watches in a drawer for several years and then want them put in good condition the week before Christmas?

Why is everybody an expert on jewelry except those who are in the business?

What ever happened to all the LED manufacturers who said that watchmakers were on their way out?

Why is it that the one who complains the most, does the least?

Why does the grass always look greener on the other side?

Why does an item go out of style shortly after you borrow money to stock it?

Why can't owners learn to set their digital quartz timepieces?

Why does a customer say, "There's no rush," and then call every day?

Why does a member accept an office, and then lose interest, causing every other member to suffer?

Why are there those who always have an answer–right or wrong?

Why do people call and ask, "How much is a one-carat diamond worth?"

Why do the busiest watchmakers attend every bench course, yet others never have the time to spare?

Why do people ask, "Who is this?" when you answer the phone?

Why are some always digging yet others never find a shovel to fit their hands?

Why is it that the number one complaint of watch repair customers isn't how much it cost or how long it took, but that the thing still doesn't run right after being repaired?

Why, in the telephone book, do jewelers have to be sandwiched between janitors and junk; watchmakers between waste disposal and water beds; clock repair between psychiatric clinics and clothes line, and gemologists between garbage and geneologists? The last I can understand because customers are always remarking about my ancestors. Clock repair is self-explanatory–clocks will drive you nuts, and the clothes line would be an easy way out.

Now that I have vented my hostility for the year, we'll get down to some serious business. I had a nice visit the other day with two of my favorite people, the Doone twins–Lorna and Briga. They were good watchmakers and both were also musically inclined. Lorna wrote a composition which became famous and Briga wrote the score for a stage show which became a big hit on Broadway. I can't recall the name of the show.

We talked about the old days when we had worked together in a trade shop. We used to get three dollars per watch. Of course, that included a mainspring and crystal. If the customer complained about the price, we threw in a dial refinishing job. We never did make much money, but we had a lot of friends. It's a shame the place didn't stay in the business. I told them how things have progressed for me. With the advent of the new cleaning machines and miracle solutions, a person can now turn out ten times the amount of work we used to turn out. Things got so good, I was able to reduce my price to two-fifty a watch. Now I'm able to work harder for less money. Isn't it marvelous what the free enterprise system can do? HT

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Retail Jeweler ☐ Student ☐ Other _____

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Name of Organization or school _____

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New Clock Q & A Book Soon To Be Available

After more than five years of preparation, AWI's newest book is ready for the printer. The long-awaited *Questions & Answers of and for the Clockmaking Profession* (Clock Q & A book) will soon be rolling off the press. We expect to begin delivery of these books before the first of April. The authors, Joseph G. Baier, PhD, CMW, James L. Tigner, CMC, and Marvin E. Whitney, CMW, CMC, are recognized as being among the leading contemporary horologists in the field.

This book is the most significant work on clock repair to be published from an original manuscript since Ward Goodrich wrote and published *The Modern Clock* in 1903. The authors have taken a direct approach in their efforts to include as much information about clocks as possible within the covers of a single book. They have used the same format as was used in AWI's popular *Questions & Answers of and for the Watchmaking Profession* which was published in 1970. This original Q & A book has been widely used by students and schools of horology and is about to go into its third printing. The new clock Q & A book will be a companion to the earlier text.

The first section of *Questions and Answers of and for the Clockmaking Profession* features almost every question that has ever been asked about clock repair. The questions are answered by the authors in a clear, easy-to-understand way, so that even the most inexperienced will find it a valuable tool The questions and answers are grouped in the following manner:

Basic Types of Clocks: Atmos, Carriage, Cuckoo, 400-day, Grand Sonniere, Sun Dial, Swing Clocks, Music Box
The Wood Movement
The Pendulum
Escapements: Recoil, Dead-beat, Floating
Trains: General Features, Gearing
Power Sources: Mainsprings
Strike Trains
Repivoting, Rebushing
Lathe work, Tools
Disassembly, Cleaning, Lubrication
Metals in Clockmaking
Theory, Mathematics, Electricity
Striking Mechanisms
Definitions

The second section of the book complements the first as it covers in detail "how-to" articles on practical clock repairing, escapements, heat treating of metals, and diagrams of the basic strike mechanisms used in clocks. The articles found in the supplemental second section include:

General Repairs:
- Replacing Broken Barrel Teeth
- Repivoting
- Hole Closing & Bushing
- Recapping a Center Wheel Arbor
- Restoring the Threaded Click

Striking Mechanisms:
- Rack & Snail
- Count Wheel
- Cuckoo
- Wooden Clock

Escapements:
- Adjusting the Brocot Escapement
- Adjusting the Recoil Escapement
- The Graham Dead-beat Escapement
- A Gravity Escapement
- Keebler Lux Clock Escapement
- The Oscillating or Floating Balance Escapement

Heat Treating Carbon Steel
Useful Reference Charts
Bibliography

The book contains 224 large, 8½ x 11 in. pages and includes many original drawings and photographs. The book will be available in soft cover which will keep the price in a range easily afforded by students and beginners as well as professionals. The cost of the book is $10.95 (post paid) from the American Watchmakers Institute Press. It will be available from your favorite book dealers as well. Those wishing early delivery of the book can place their orders now by sending a check for $10.95, made out to AWI Press, for each copy you want to order. Advance book orders should be mailed to: Clock Q-A Book, AWI Press, 3700 Harrison Avenue, Cincinnati, Ohio 45211. We expect to make delivery before April 1, 1981.

AWI Bench Courses / 1980

Programs		Instructors
A	Basic Electricity & Use of Meters	Jeager
B	Citizen LCD Alarm	Carpenter
C (a)	Citizen LCD Multi-Alarm	Broughton
C (b)	ESA/ETA Quartz Analog	Broughton
D (a)	Seiko 4300 Ladies' Quartz Analog	Smith
D (b)	Seiko LCD Chronograph/Alarm	Smith
D (c)	Seiko 0903A Men's Quartz Analog	Smith
E	Intro. to Solid State Watch Repair	Nelson
F (a)	Bulova Quartz Analog (SMQ)	Opp
F (b)	ESA LCD Chronograph	Opp
G	ESA Digital/Analog	Biederman
H	Clock Restoration	Benesh

FEBRUARY, 1981

8	A	Toledo, OH	Jaeger
21,22	H	Denver, CO	Benesh

MARCH, 1981

7-12		Los Angeles, CA	Residence Course
14	A	Kansas City, MO	Jaeger
22	C (b)	Chillicothe, OH	Broughton
28,29	H	Chicago (Rockford) IL	Benesh

APRIL, 1981

5	G	South Carolina	Biederman
5	A	Philadelphia, PA	Jaeger
25,26	H	Dallas, TX	Benesh

MAY, 1981

17	D (b)	Zanesville, OH	Smith
17	E	Kansas City, MO	Nelson
23,24	H	Los Angeles, CA	Benesh

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NAME: _____

ADDRESS: _____

CITY, STATE, ZIP: _____

Glossary of Problems

Last November, we discussed boredom, budget, and communication in our glossary of factors concerning the "average" affiliate chapter. Continuing through the alphabet, we arrive at the letter D.

Dedication Self-sacrificing devotion.

All chapters owe much of their success to those dedicated members who are willing to sacrifice their time and talents to their organization because they see the need to improve conditions in our profession. It is very important that you, as a member, value these dedicated people, support and assist them, and honor them at the appropriate time. Even the most dedicated will lose enthusiasm if their efforts are not appreciated. Also, become dedicated yourself. It's easy. Just believe in the goals of your chapter, roll up your sleeves, and go to work.

Fund (verb) To make provision of resources for discharging the interest or principal.

The wise chapter does not depend on dues money alone to finance its programs. Worthwhile programs can be funded in many other ways without incurring heavy financial burdens on the members. One such way is to hold periodic swap-meets or flea markets, with your guild receiving part or all of the receipts. The Allegheny Watchmakers Guild of the Watchmakers Association of Pennsylvania funds its annual picnic by holding an auction of donated articles at the picnic. These articles include watchmakers tools and materials, but other items as well. Someone's white elephant is someone else's treasure, and often these articles provide spirited bidding and entertainment.

Some chapters sell used watch batteries. This is fine, as long as they do not neglect the AWI ELM Trust and Scholarship fund, which is largely funded by donations of used watch batteries. I am sure there are many other means of funding projects, but I think it is important to have a policy that dues money be used only for those expenses and activities that benefit the entire membership. Banquets, conventions, and workshops should be self-supporting, with the costs born by those attending. The exception to this would be official meetings where the work of the officers benefits the entire membership. It is very important that you, the member, be concerned about how your chapter handles its finances. It may mean the difference between solvency and bankruptcy.

Robert F. Bishop

Guild An association of people with kindred pursuits or common interests or aims.

As of now, there are over 40 Affiliate Chapters, representing over thirty states and Ontario, Canada. This indicates that there are many areas not now serviced by watchmakers' organizations. While AWI has a New Guilds Liaison Committee with Fred Burckhardt as Chairman, we as affiliate chapters and as individual members of AWI have the opportunity to aid in the formation of new guilds in these areas not now serviced.

If you, the individual AWI member, live in an area where there is no local watchmakers' organization, and you recognize the need for one (I cannot see any reason why such a guild would not be needed), you have the opportunity to aid in the formation of such a guild. Convince a few of your fellow craftsmen that a local organization is to *their* advantage: that this is the only way that AWI's slide-tape and other technical programs can be made available to them; that sharing knowledge and experience with each other will make them better watchmakers. Next, contact AWI or Fred S. Burckhardt, 3620 Watonga Street, Fort Worth, Texas 76107, and prompt assistance will be forthcoming.

New guilds are not just needed in virgin territory; many affiliate chapters serve such a large area that the vital personal contact is almost nonexistent. One solution to this problem is to reconstruct your chapter to a local guild system. This may require extensive revision of your constitution, but the effort will be worth it. The constitution of the Watchmakers Association of Pennsylvania states that a guild may be formed with as few as five WAOP members. The Florida State Watchmakers Association has eight guilds. Some affiliate chapters serve only the immediate area of a large city, such as the Horological Society of New York, the Cincinnati Watchmakers Guild, etc. If you, the member of an affiliate chapter, believe that a local guild would benefit watchmakers in your area, get involved; let your officers know your wishes, and offer to help.

A final note: The 1981 Affiliate Chapter Meeting in June will be upon us before we know it. It is time now to plan your recommendations to the Board of Directors and select your delegates. Last year's was a productive meeting, but let's make this one even better!

TIMES

"All chapters owe much of their success to those dedicated members who are willing to sacrifice their time and talents to their organization because they see the need to improve conditions in our profession."

...from all around the ASSOCIATION..

NEW YORK

On December 1, 1980, at the Sheraton Centre, New York, Mr. Lou Zanoni, President of Zantech Inc., addressed the Horological Society of New York.

With the aid of slides, Lou Zanoni described the whole range of solid state service operations, consisting of training courses, service facilities, replacement parts, assortments, tools, equipment and testing devices.

The talk was filled with practical suggestions for the watch repairer. For example, with a technical check list that was distributed to each member of the HSNY, the repairer could analyze a timepiece and determine whether the source of trouble was in the power section, oscillator, display, etc.

A lengthy, in-depth analysis of case buttons was also presented. Since these important trouble spots are often overlooked, this section contained many unusual and interesting bench tips. A lively question and answer period closed the evening.

Lou Zanoni, President of Zantech, addresses the Horological Society of New York.

ILLINOIS

The November meeting of the Central Illinois Watchmakers Association featured Dr. D. Paul Miller who spoke about "The Amish–A People of Preservation." Dr. Miller presented a view of a way of life from the past which continues to survive today.

Three new Board members were elected at this meeting; their names will appear in a later issue of *Horological Times*. Leaving the Board will be Earl Lipp, Ben Smith, and Del Hancock. The Board's duties include selection of officers of the Central Illinois Watchmakers Association.

NEW JERSEY

Elections for the 1981 officers were held at the last regular 1980 meeting of the Watchmakers Association of New Jersey. The officers are Joseph Barbieri, president; Henry Kalmus, vice-president; Joseph L. Cerullo, secretary; and Alex Kast, treasurer.

There will be many new programs in 1981, such as a presentation by the Branson Cleaning Equipment Company (manufacturer of ultrasonic equipment) and a speech by Mr. Charles Terwilliger on the 400-day clock.

Fellowship Award honors Don DeWolfe (left) for many years of service to the New Jersey Watchmakers Association. Past President Emil Chessari (center) and President Joseph Barbieri congratulate him.

OHIO

The Quarterly Board Meeting of the Watchmakers Association of Ohio was held January 25, 1981 at the Marriott Inn, Columbus, Ohio. Members were invited to attend, especially the Saturday night Hospitality Room.

Members are reminded to send in their 1981 dues. Blue Cross members are reminded to consider filing for their major medical benefits.

The OWA Credit Union Board of Directors has declared a 6% dividend on all share accounts over $50.00 for 1980. This is a favorable report, and there is money on hand to loan all OWA members.

Members of the Watchmakers Association of Ohio would like to extend their deepest sympathy to the family of Mr. Albert R. Dail of Loveland, Ohio. Albert had been a member of WAO since 1960.

MISSOURI

The Kansas City Watchmakers Guild held a meeting recently in Kansas City, Missouri.

Newly elected board members for 1981 are Carlos Garcia, Jack Ryne, and Paul McCleenan. The guild extends their congratulations to these three fine guild members.

Tentative dates for AWI Bench Courses were announced. A meter reading course is scheduled for March 22, 1981, and another bench course on solid state watches is scheduled for May 16, 1981. Definite times, dates, and locations for these two bench courses will be announced later.

The meeting ended with an AWI slide show entitled "Bench Tips No. 2" by Joe Crooks. Members found this presentation both entertaining and informative.

In the Spotlight© 1981
by Orville R. Hagans

Orville R. Hagans, CMC, CMW, FAWI, FBHI

Krazy Clocks:

THE GUINNESS CRAZY CLOCK

Actually, the clock presented here is a replica of the original which was created for the famous brewers, Arthur Guinness, Son & Co., Ltd. It was introduced by them at the Festival of Britain Pleasure Garden at Battersea in May, 1951. Since then, literally millions of smiling spectators from all over the world have seen this clock make its highly original quarter-hourly reports of Guinness Time.

It is said that no clock of comparable complexity has been made for at least 300 years. Certainly no such intricate device for provoking your laughter has ever been created, for this clock makes use of the most advanced electrical and mechanical engineering knowledge. Its operation must be tended "round the clock" by a skilled technician.

The overall height from the base of the clock to the top of the tower is 25 feet; its total weight when fully assembled is one and three-quarter tons. The clock contains four synchronous clocks within itself. It is powered by nine motors, and there are more than 100,000 moving parts.

Every fifteen minutes, the show goes on. Just before the quarter hour, the rays of the sun start revolving. Note the smiling face on that sun; folks who know Guinness Stout have seen that face before.

The zoo keeper appears under an umbrella, ringing a bell. Does he get a response from his animals? Yes indeed! Look at the ostrich. He's craning even harder than the audience to see the show. Three toucans appear and busily point out the words "Guinness Time" on the trunk of a tree.

In the small tower appears the Mad Hatter–fishing–from a clock? Ridiculous! Or is it? He's already caught a whopper. Or is it? No, it seems his fish caught a fish caught a fish. The end results are mighty discouraging.

Now follow the trapeze at the top of the clock. It's whirling fit to give even these six acrobats a workout.

The music is rising. The clock is striking. It's time for the actors to return to their pipes, towers, and trees. These harried characters need some rest, for there's another show in just eleven minutes.

The biggest, funniest traveling clock in the world.

THE KEEPER: This famous foil constantly loses his Guinness Stout to the animals he watches, but—dauntless fellow—he appears four times each hour, hopefully ringing his bell to announce that it's Guinness Time.

THE OSTRICH: Poor bird! It takes a long time for anything he consumes to reach its goal. If you watch him fifteen minutes from now you'll see that that lump in his throat has made very little progress. What could it be?

THE MAD HATTER: What better place to find such a person (if not in "Alice in Wonderland") than on a Crazy Clock? Still, thanks to Guinness, he gets a bite on his line every fifteen minutes—and how many sane (or honest) fishermen can say that?

THE TOUCANS: The amazing and amusing antics of these colorful Guinness animals delight all who watch them signal Guinness Time from their tree in a house. (There's a switch!)

Wisconsinites Take Notice!

The horology training program at the Milwaukee Area Technical College is considered to be one of the most diversified in the country. The program accepts up to sixteen students and, in two years (four semesters), takes them through basic theory and construction of pocket and wrist watches, repair and regulation of the most complex timepieces, jewelry repair techniques, and microelectronics.

Instructor Gerald Jaeger has been with MATC for ten years, and in that time, has developed courses to keep pace with electronic watch technology. Before he could develop such courses, however, he had to adapt to the new technology and learn the necessary skills and concepts himself. His efforts in this direction have been thorough and successful; Gerald is well known to AWI members as the instructor of the Basic Electricity and Use of Meters bench course. He is also presently serving on the AWI Board of Directors.

Horology students at MATC are in class from 7:55 a.m. to 2:20 p.m. each day, learning the trade through "hands-on" experiences. The watches, clocks, and jewelry on which the students work are supplied by a customer service operation. As a part of their training, the students take customer orders and provide estimates as well as perform the necessary repairs. The cost of the training totals about $1,600 for tuition, tools, and books.

George Schlehr

The placement of graduates is generally no problem, because these students have the skills needed by business and industry. Nearly all of the horology graduates become watchmakers in jewelry stores and trade shops. Occasionally, someone takes an assembly job in a manufacturing plant. Many eventually realize their dreams to start their own businesses.

The watchmaking program dates back to the 1920's when it was offered in the Evening School. Jaeger's predecessors included Warren TeRonde, an instructor for 33 years. Edwin Schattschneider, another long-time instructor, may have been around when the watchmaking courses were established. A fourth instructor, Howard Adams, joined the staff after World War II ended to help handle the influx of returning veterans.

TeRonde, who was one of Schattschneider's students, relates an interesting tale. As TeRonde recalls, Schattschneider originally taught in the school's machine shop even though he had a watchmaking background. However, when the school's director needed a teacher to conduct a watchmaking class for physically disabled persons, Schattschneider had the necessary background and got the job.

Because so few horology schools exist in the Midwest, about half of the students in the MATC program are from areas outside the district served by the college. Horology is one of 185 vocational and technical training programs at MATC, which has a national and international reputation dating back to its founding in 1912. Each year, over 70,000 persons take courses part-time or full-time, and this enrollment makes MATC one of the largest educational institutions in the world.

Hats off to an outstanding

MATC horology student Michael Hannagan turns down a new pivot that has been set in a clock wheel arbor.

MATC horology instructor Gerald Jaeger advises student Sarah Jacobucci as she tests a quartz crystal in an LCD module. The tester was built by students.

horology school and its illustrious instructor, Gerry Jaeger!

We note, with mixed feelings of disappointment and best wishes, the retirement of Thomas J. Staarup, horology instructor at Southwest State Technical College in Mobile, Alabama. From now on, Tom will be ticking at a different frequency. It is a credit to him that his replacement will be Perry L. Griffith, CW, one of his graduates of 1973. Good fishin', Tom!

CLOCK CHATTER

(Continued from page 43)

making of a new bridle. A piece of iron, steel, or brass of suitable thickness is cut to the shape shown in Figure 14 using a piercing saw. The center section is rounded with a file as shown in Figure 15.

After finishing and polishing, a hole is drilled and if desired, the piece may be blued. Then upon bending the bridle to shape and riveting the axle, the piece is finished. This will allow you to match any peculiar design that may be found in the remaining pulley of a pair.

Some may have difficulty in revolving a hand vise of the type shown in Figure 15. The type known as a Lowell pattern may be easier to use. It is shown in Figure 16.

The time required to do any of this work is minimal. For those who intend to do restoration, it is essential to be able to repair pulleys.

TECHNICALLY WATCHES

(Continued from page 39)

of centers, the balance should be turned until the guard pin is out of the crescent on the other side of the line of centers. See Figure 8, View "b." Now, with the needle, move the fork back and forth to check the guard pin freedom. The guard pin freedom should be equal on both sides of the line of centers. When the guard pin freedom is not sufficient, the pin needs to be shortened by burnishing with a small steel burnisher. This is shown being done in Figure 9, View A.

If there is too much guard pin freedom, then the guard pin needs to be stretched or replaced. If the guard pin is slightly too short, then stretching would be the recommended procedure. To stretch a guard pin, the following method is used: take a small flat solid staking tool stump and grind the end down on two sides so the sides will be parallel to each other and so the end of the stump will be thin enough to go through the fork slot. Place this stump in the staking tool. Turn the fork upside down on the stump with the end of the stump going through the fork slot so the guard pin is resting on the top of the stump. Use a small flat-faced solid punch to stretch the guard pin. Tap the punch very lightly with a brass hammer. This operation is shown in Figure 9, View B. After the guard pin has been stretched, it will need to be burnished to the proper length. Note: For watchmakers who do not want to make a special stump for stretching guard pins, Bergeon and Co. distributes a tool for stretching guard pins. The number of this tool is 1008. It can be purchased from your local watch material distributor.

If the guard pin is broken and needs to be replaced, then the following procedure is used: first, remove the old guard pin by filing its end flush with the back side of the block that it goes through. Then take a small sewing needle that has had its very tip removed on an Arkansas stone. Place the needle in a pin vise and use the needle to push the old pin out while the block on the fork is supported on the bench anvil over a groove in the edge of the bench anvil or in the V-notch of the anvil. See Figure 10, View A.

After the old pin has been removed, then a small tapered hairspring pin is used for the new guard pin. Place the hairspring pin into a balance screw holder or a small pin vise; then insert the pin in the hole of the block on the fork as in Figure 10, View B. A slight twisting motion is needed to secure the pin in its hole. After the pin is tight, it

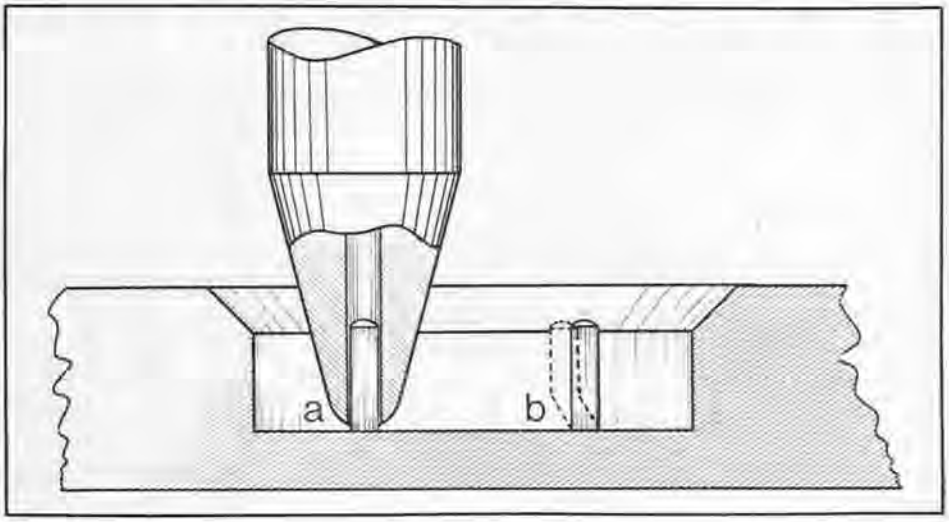


Figure 7

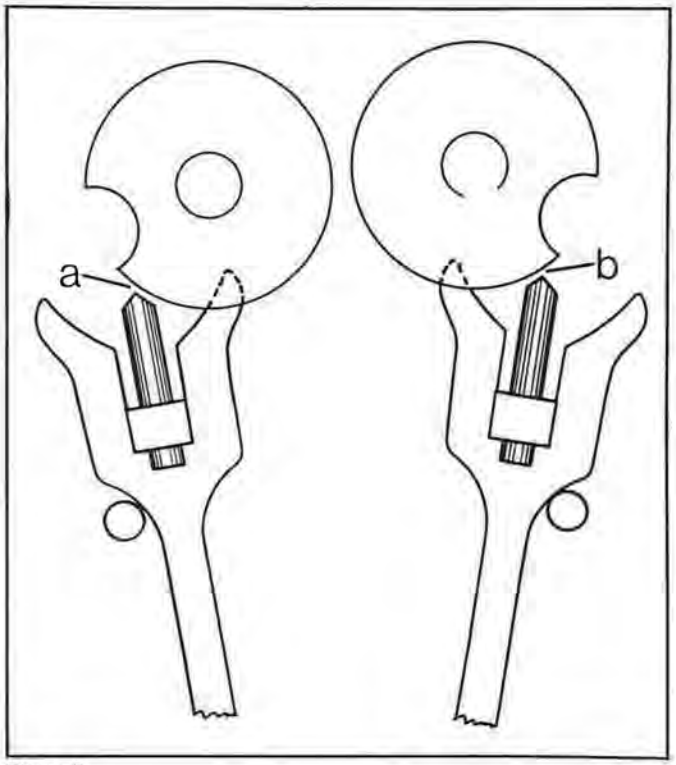


Figure 8

is cut off with the cutting tweezer close to the block on the unneeded end. Then the pin is cut off on the end that will form the guard pin. The dotted lines show where the pin is to be cut. If the guard pin is cut as shown by the dotted

TAX

QUESTIONS AND ANSWERS BY COMPREHENSIVE ACCOUNTING CORP.

Comprehensive Accounting Corporation of Aurora, Illinois, provides a monthly bookkeeping, accounting, and tax service to over 19,000 business clients through its nationside network of franchised accountants.

QUESTION: Do you know why your return may be selected for audit?

ANSWER: The Internal Revenue Service will select less than two million individual income tax returns per year for audit of the more than seventy million returns filed. Certain individual taxpayers may be subject to audit in each and every year while other taxpayers are rarely audited.

There are various reasons why your return may be selected for audit.

The vast majority of returns are selected for audit under a program known as Discriminate Function System (D.F.S.) which has been developed and computerized by the IRS. Under this system, the computer checks your return and gives it a score based upon its audit potential for increased tax liability. Certain variables on the return are weighted to arrive at the D.F.S. score; the higher the score, the greater the return audit potential.

Income tax returns that have a high D.F.S. score are then screened by classifiers who reveiw the entire return to determine if an audit is warranted. The classifier will also select those items that should be audited and then transmit the return for audit to the district office.

It may be assumed that a large variance from the average deductions claimed by taxpayers at your same level of adjusted gross income

TALK

make audit of your return more likely. The IRS has published statistics on the average itemized deductions for the year 1976 based upon adjusted gross income. For example, returns with adjusted gross income of between $25,000 and $30,000 had average deductions as follows: Taxes $2,262; interest $1,977; contributions $644; and medical expenses $442. For returns with adjusted gross income between $30,000 and $50,000, the average deductions were as follows: Taxes $3,050; interest $2,366; contributions $939; and medical expenses $523.

The amount of your adjusted gross income can also affect the likelihood of being audited. In excess of 11% of the individual income tax returns with an adjusted gross income of over $50,000 were audited, according to the last statistics published by the IRS; of individual income tax returns having an adjusted gross income of less than $50,000, only a little over 2% were audited.

An unusually large item of income or a deduction which is extraordinary in nature may also increase the likelihood of your return being audited. Furthermore, failing to report all items of income received may increase the likelihood of audit. Computers utilized by the IRS now have been programmed to match documents received on magnetic tape, such as W2 Forms and 1099's received from payers of interest and dividends which are compared to the income reported on your return.

An audit by the IRS does not mean that you are suspected of cheating, or under-reporting your tax liability, but its purpose is to test and determine the accuracy of the information contained on your return. TIMES

lines, it will already have somewhat the correct shape at its end and will need very little shaping with the burnisher. The correct shape for the end of the guard pin is a 90° angle. Note: In Figure 10, View B, the guard pin is shown being inserted from the end of the fork. Some companies inserted the pins from the front end and others inserted the pins from the back side of the block. The reason the pin is being shown inserted from the end of the fork is that the guard pin will be larger at its end which will give more margin of safety to the guard pin freedom. Sometimes if the pin is too slender at its end, it will enter the crescent of the safety roller too soon and will not provide the necessary safety action.

After the correct corner freedom and guard pin freedom has been established, the next step is to set the pallet stones for the proper drop lock and slide. The correct amount of drop lock is 1/6 the width of the pallet stone on high-grade watches and 1/5 the width of the stone on lower-grade watches. The reason that the high-grade watches can be set up closer than the lower-grade watches is because the escape wheels are made and assembled to their pinions with more precision, and the pivots usually fit more closely in their jewels.

The correct amount of slide is usually considered to be about 1/2 of the correct drop lock. Slide can sometimes be made less on a high-grade watch that has a good true escape wheel where the teeth are all the same length. When the escape wheel teeth are not all the same length, the amount of drop lock would need to be more to prevent the short teeth from locking on the impulse faces of the pallet stones. On the other hand, the slide would need to be increased in order to keep the long teeth from hanging up on the let-off corners of the pallet stones. When the drop lock and slide

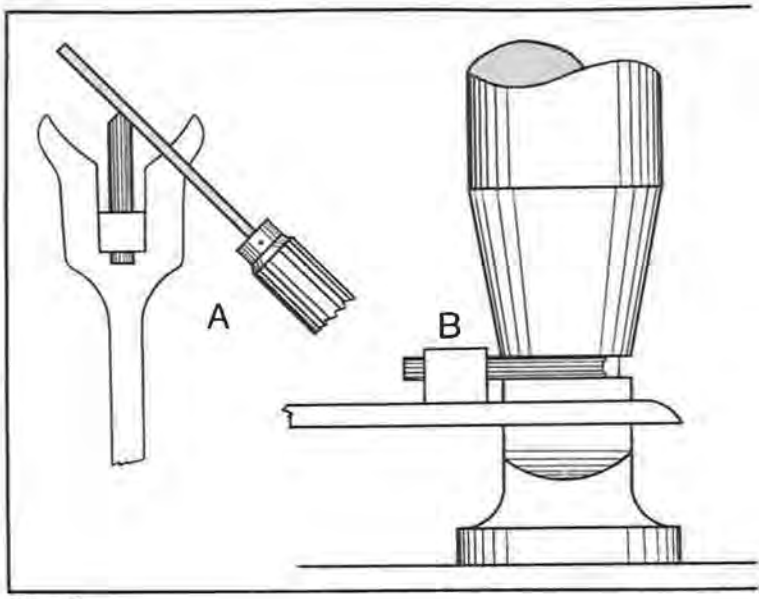


Figure 9

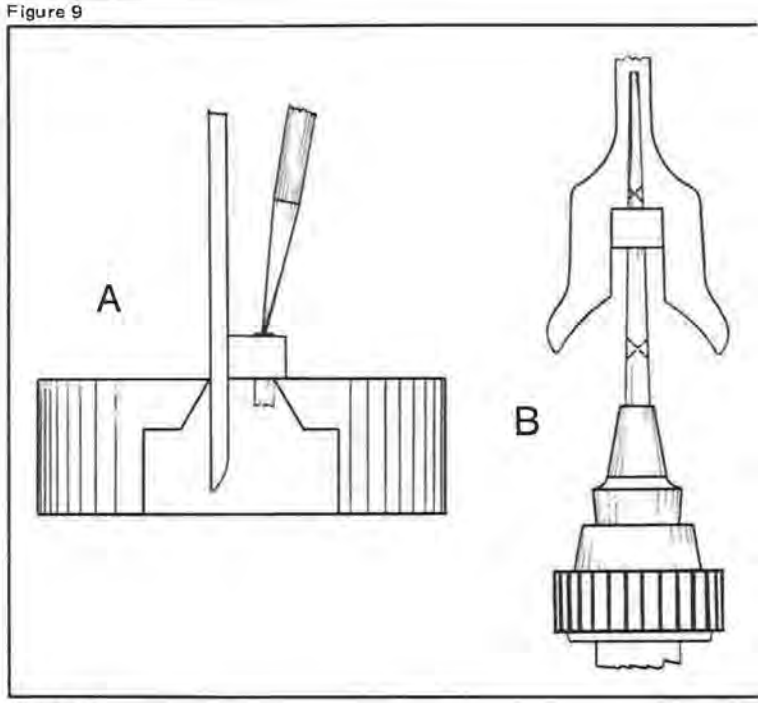


Figure 10

both have to be increased in this manner to compensate for an escape wheel that has irregular length teeth, the total lock will be so much that there will be too much resistance to

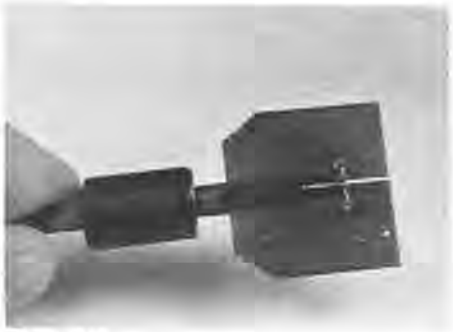


Figure 11

unlocking. This condition will cause the balance to take poor motion.

To move the pallet stones, a pallet warmer and an alcohol lamp are needed. Place the pallet fork upside down on the pallet warmer as shown in Figure 11. Then the pallet warmer is heated over the alcohol flame to warm the shellac enough that the pallet stones can be shifted. Caution: When heating the pallet warmer, only allow the outside edge of the warmer into the alcohol flame; otherwise, the pallet fork and its arbor could be damaged. Heat the warmer just enough to soften the shellac so the stones can be shifted. Sometimes only one of the stones needs moving. In that case, just heat one side of the warmer containing that stone. DO NOT use the tweezers to move the pallet stones. To push a stone in, use a piece of sharpened pegwood; to move a stone out, use a small needle that has been sharpened very carefully and very thin like a screwdriver blade. Use this in the back of the slot behind the stone. A slight twisting motion can be used to move the stone out. Note: Sometimes the shellac has deteriorated and doesn't melt as it should. In this case, the pallet stones should be removed from the pallet fork. Then the pallet stones and pallet fork should be soaked and cleaned in denatured alcohol, and the stones re-cemented with fresh shellac. When replacing the stones in their slots, keep in mind that the stone with the greatest angle is the L-stone and that it is replaced in the slot of the longest pallet arm. The impulse faces of both stones should face toward the oncoming escape wheel teeth.

For the effect of moving the pallet stones, please refer to the January, 1981 "Techanically Watches" column. From the stone moving information given in the January article, certain rules can be established:

1. Drop lock is changed when one or both stones are moved.
   a. When one or both stones are moved out, drop lock is increased on both stones.
   b. When one or both stones are moved in, drop lock is decreased on both stones.
2. Total lock is changed on the stone moved only.
   a. When a stone is moved out, total lock is increased on that stone.
   b. When a stone is moved in, total lock is decreased on that stone.
3. Slide is changed only on the stone opposite to the one moved.
   a. Moving the R-stone changes the slide on the L-stone and vice versa.
   b. Moving a stone out decreases the slide on the opposite stone.
   c. Moving a stone in increases the slide on the opposite stone.
4. Drop is changed on both stones when one stone is moved.
   a. Drop is increased on a stone when it is moved out and decreased on the opposite stone.
   b. Drop is decreased on a stone that is moved in and increased on the opposite stone.
5. Draw is changed *only* on the stone opposite to the one moved.
   a. Moving the R-stone out increases the draw on the L-stone.
   b. Pushing the R-stone in gets the opposite results.
   c. Moving the L-stone out decreases the draw on the R-stone.
   d. Moving the L-stone in gets the opposite results.
6. Impulse is changed *only* on the stone moved.
   a. Moving the R-stone out increases

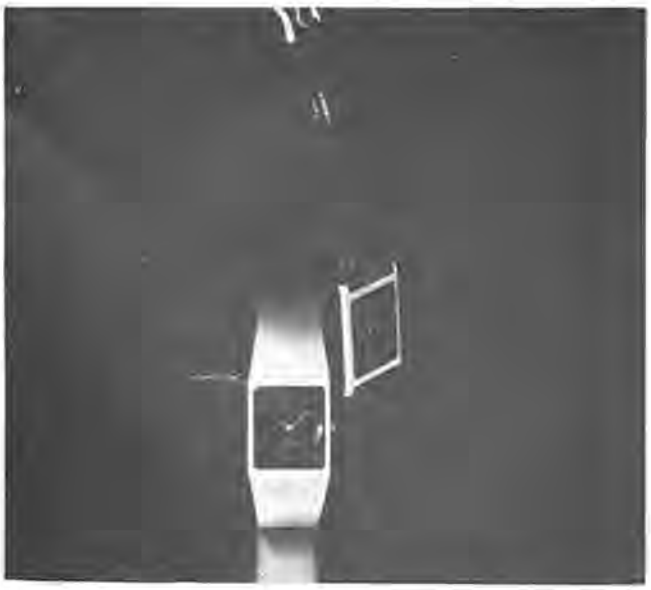
NEW MONACO LINE FROM LONGINES-WITTNAUER

The Longines-Wittnauer Watch Company is introducing a new, moderately priced line of ultra-slim Longines with the bold styling of the most expensive thin gold watches.

In making the annoucement, John L. Davis, President of the Longines-Wittnauer Watch Co., said, "We are delighted to introduce the Monaco line since these quartz timepieces combine the thinnest high styling with the look of gold."

The first watch in the new Monaco line is known as the Mirage. it is available with a gold-look bracelet at $495 and in a strap model at $425. The Mirage is available with a black enamel dial with Roman numerals as well as with a gilt dial. The gilt brushed finish of the dial matches the case and bracelet. Mirage, which has a hardened mineral crystal, is also dust and moisture resistant.

"Our marketing plan is to offer the young rising executive and working person the opportunity to own the status watch, which up to now was only in the price range of the very rich," said Mr. Davis.



NEW PRODUCTS FOR PEARL AND GOLD CUSTOMERS

Swest, Inc. has announced the development of Touche O' Gold, a breakthrough in solving the problem of "gold smudge." This unique product provides a barrier to the blackening of the skin caused by karat gold and silver experienced by some people. Applied like a facial or hand cream, Touche O' Gold is not sticky or uncomfortable to wear and has no unpleasant odor. It effectively combats the blackening of the skin by gold or silver jewelry and enables people to wear jewelry who may have formerly refused to wear it because of this problem.

Touche O' Gold is priced for quantity buyers to use as a resale item or as a promotional item. Along with an order for Touche O' Gold, purchasers will receive, upon request, a pamphlet on the causes of gold smudge.

Also being introduced is Rey Pearl Cleaner, formulated specifically for cleaning pearls and other soft stones such as turquoise. Such stones can be harmed by many jewelry cleaners which may be caustic. Rey Pearl Cleaner contains no such caustic element yet restores the original brilliance and luster of the stones.

For more information on these new products, request a free brochure from Swest, Inc., 10803 Composite Drive, Dallas, Texas,

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the impulse on that stone only.

b. Moving the L-stone out decreases the impulse on that stone *only*.
c. Opposite moves create opposite results.

After the proper drop lock and slide have been established, certain checks should be made to ensure that the escapement will operate safely. Check the escapement to make sure the escape wheel teeth still remain locked safely on the locking faces of both pallet stones when the corner freedom is being checked. The teeth must also remain safely locked when the guard pin freedom is checked. If the teeth unlock onto the impulse face of the stones when these freedoms are checked, the escapement will not be safe. If the teeth accidentally unlock when the corner freedom is being checked, then the roller jewel needs to be shifted in its hole away from the balance staff and toward the fork, or the roller table can be changed for one with a greater roller jewel radius. Increasing the drop lock very slightly will prevent the teeth from accidentally unlocking onto the impulse faces of the pallet stones.

When the guard pin freedom is checked and the escape wheel teeth accidentally unlock onto the impulse faces, then the guard pin is too short. Any time the escape wheel teeth accidentally unlock, the watch is likely to stop.

Another check is to make sure the drop is equal and safe but held to a minimum. The toes of the teeth must not touch the let-off corners of the stones during unlocking.

When setting the stones, if it is impossible to get a safe drop lock and still have sufficient slide, this is an indication that the fork is too short or the roller jewel is too close to the balance staff. It is possible that this can be corrected if the roller jewel can be shifted away from the balance staff which would require the banking pins to be opened slightly, giving more angular motion to the pallet fork which would allow for more drop lock and slide. If this does not correct the situation, then the roller table could be replaced with one that has the roller jewel farther from center, or the fork replaced with one that is longer.

When setting the stones and there is too much slide when the correct amount of drop lock is achieved, this is a good indication that the fork is too long or that the roller jewel is too far from the balance staff. This condition may be corrected if the roller jewel can be shifted in its hole toward the balance staff and the banking pins closed enough to reduce the slide to the correct amount.

Next month the BANK TO DROP METHOD of setting up the escapement will be discussed. HT

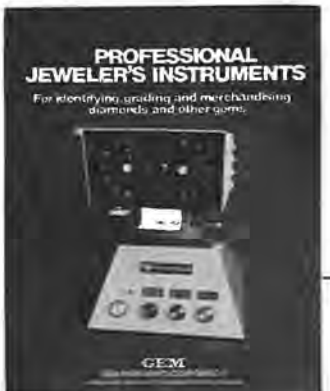
75220 or 1725 Victory Boulevard, Glendale, California, 91201.

NEW INSTRUMENTS CATALOG FROM GEM INSTRUMENTS

A new 24-page instruments catalog is now available from Gem Instruments Corporation, wholly owned subsidiary of Gemological Institute of America. This fully illustrated brochure features a complete selection of professional jewelers' instruments and accessories, all of which are availalbe from a single source. Developed to merchandise, examine, and grade gemstones, these instruments help jewelers add a profitable new edge to their business by using these unique sales tools in making diamond and colored stone presentations.

The brochure highlights the exciting new ColorMaster which is ideal for color grading, appraising, matching, selling, and merchandising colored gemstones according to the manufacturer. This new instrument allows the jeweler to communicate the color appearance and shapes of colored gemstones in clear, concise notations. ColorMaster images can be accurately recaptured at any time!

For more information and a copy of the new GEM Instruments Catalog, write Gem Instrument Corporation, P.O. Box 2147, Santa Monica, CA 90406.



TWO NEW MINI-QUARTZ ALARMS FROM PICCO

Two new mini-quartz alarms with recessed dial lights, offering the quality, convenience and performance that Picco is known for, have been added to its collection of smartly styled clocks. Available with brown case and brushed champagne dial (model 090B)

or black case and matching dial (model 090K), both rectangular-shaped models have gilt metallic front panels and diamond-cut bezel openings.

Measuring 3-3/8 in. x 2-1/2 in. x 1-3/8 in., other features of these two new clocks are luminous arabic numerals and hour dots. Both feature quality movements, accurate to within 10 seconds per month, keeping accurate time for two full years with a single AA alkaline battery. An alarm tone provides a pleasant chirping sound. In addition, a black compact travel case is included for easy portability. The suggested retail price is $34.99. For more information, contact PICCO at 540 W. 58th Street, New York, NY 10019.

"ESTATE PLANNING AND WILL WRITING GUIDE"

Every business owner should own this book. The cornerstone of any estate planning is a will, and this book is a manual for writing a will—and understanding the one your lawyer writes. It is very readable, written in plain language, and logically organized. It includes specific requirements for every state and should be required reading. It contains 182 pages, 8½ x 11½ in., hardbound, and is available from the Citizen's Law Library Inc., P.O. Box 1745, Leesburgh, VA 22075. The price is $14.95.

NEW LINE OF VIGOR ECONOMY JEWELERS SAW BLADES

B. Jadow and Sons of New York are pleased to announce the availability of a new line of Vigor Economy Jewelers Saw Blades. For the economy-minded watchmaker, jeweler, hobbyist, model maker, or anyone involved in industries requiring fine precision cutting, these new blades will be most welcome. The quality of these blades has been tested by experienced mechanics over a long period of time and found to be highly acceptable.

Complete variety of sizes is available. A new metal display, featuring these saw blades, will shortly appear at all wholesale supply houses.

The price for these saw blades is $.69 a dozen. A unique feature of this line is that each dozen saw blades is individually packaged in its own envelope to protect and preserve the quality.

In order to introduce this new line, B. Jadow and Sons invites all interested parties to send a self-addressed stamped envelope to B. Jadow and Sons, Inc., 53 West 23rd St. New York, NY 10010, and receive one dozen saw blades FREE OF CHARGE.

The Vigor line of Economy Jewelers Saw Blades is sold through all wholesale distributors of jeweler's and lapidary supplies.

"LIGHT & MOTION" JEWELRY SHOWCASE FROM JACOBY-BENDER

Jacoby-Bender, Inc., one of the country's leading manufacturers of men's and women's jewelry and fine watch attachments, now offers a new and unique watch and jewelry merchandising display.

The ID-172 "Light and Motion" display measures only 20½ in. square by 5½ ft. tali and takes less than 2 square feet of floor space. Nine clear plexiglass shelves can hold a minimum of 72 pieces of assorted jewelry, all packaged. Two overhead lights plus two vertical lights brilliantly light the interior and all the jewelry "floats" within the display with no corner obstructions. A clear, see-through rear door is framed in steel with a full-length hinge because, unlike all other vertical displays, J-B's "Light and Motion" has a 3-way lock and key.

Jacoby-Bender offers free personalization of each display with the jeweler's store name in gold letters across the top panel. For further information and a free 40-page color catalog, contact Jacoby-Bender, Inc., 62-10 Northern Boulevard, Woodside, NY 11377.

BULOVA PLANS 1981 COURSES

Leo Helmprecht, manager of Bulova's Field Training Services (standing), has announced an updated program that will teach quartz watch service to at least 2,000 watchmakers in 1981. Certified Quartz Technician diplomas will be issued to all those who complete the one-day course satisfactorily. Watchmakers who are interested should contact the local Bulova sales representative. Helmprecht stresses that knowledge gained on Bulova calibers helps watchmakers to work on all quartz calibers.

Henry Frystak (seated, left) and Calvin Sustachek (seated, right), field instructors, are shown here at a recent conference during which a schedule of seminars was planned.

SCHOLARSHIP FROM VARTA BATTERIES

Varta Batteries has set up a scholarship fund of $1,000 for a student interested in pursuing a full-time career in the field of horology.

In a letter to Horological Society of New York's President Howard Levy, Varta Batteries, Inc. President Arthur M. Muti explained the fund:

"Education is the foundation for growth, and we therefore support your organization and the entire Horological Society," Mr. Muti wrote. "We are providing a $1,000 scholarship to be made available from Varta through The Horological Society of New York."

"When your organization selects a worthy individual, we will present the check to you so you may award it to this person."

Students studying for full-time careers in the field of horology who are seeking financial aid should contact Mr. Howard Levy, President of the HSNY.

TOUGHER REGULATIONS FOR BANK GIVEAWAYS

"We made some important gains that will give jewelers a better competitive edge with bank giveaways."

These words by JA Chairman Michael D. Roman were in reaction to the recent announcement of the tighter federal regulations which will now be applied to the nation's financial institutions in regard to bank giveaways, starting January 1, 1981. Over the course of the last decade, Jewelers of America (JA) has been in the forefront of business groups urging federal banking agencies and Congress to examine the rampant abuses involved in bank giveaways and sale of merchandise.

While the new rules still permit banks to continue to offer depositors a premium at the time of opening a new account or adding to an existing account, a dollar limitation on the permissible cost of each premium has been set at $10 for deposits of less than $5,000, and $20 for deposits of $5,000 or more. The dollar limitation must be determined by including the premium's cost plus all other charges, such as shipping, warehousing, handling and packaging. The new rules do not permit averaging the costs of various items of merchandise offered in a premium program. However, the expenses of developing, advertising, or promoting a premium program are not included in determining the cost of a premium.

Also, banks may not give more than two premiums per account during a 12-month period, which is measured from the time a depositor receives the first premium. These and other changes caused JA Chairman, Michael D. Roman, to comment:

"I would have preferred the adoption of a rule to ban bank giveaways entirely, but the compromise worked out by the Deregulation Committee is going to make it a lot more difficult now for banks to circumvent the premium rules. I believe that the abuses that were well documented will be greatly reduced and banks will be less likely to use premium promotions in the future."

SWEST'S 18th ANNUAL JEWELRY CASTING WORKSHOP

Plans have been completed for the 1981 Jewelry Casting Workshop to be presented by Swest, Inc. The Dallas-based firm has hosted up to 500 people from all over the U.S. as well as foreign countries every year for the past 17 years. The annual event is a two-day series of lectures and demonstrations held in Dallas, Texas which features many well-known experts in the industry using the latest equipment and techniques.

"Our 18th workshop will be held on Saturday and Sunday, March 14 and 15, 1981," said Earl R. Weaver, president of Swest, Inc., "and this year we are again pleased to have as our co-host El Centro College, of the Dallas Community College District. They are providing their excellent facilities in the heart of downtown Dallas for the workshop."

The workshop, which opens at 8:00 a.m., Saturday, and continues through 2:00 p.m. Sunday, will provide broad fundamentals as well as in-depth discussions of proven methods and techniques covering jewelry casting and related processes. The continous

sessions format enables the beginner, advanced, or industrial caster to schedule his time in the areas of his greatest interest. Special seminars will be provided for those interested in production casting. Registration will be on a first-come first-served basis.

The workshop registration fee of $50.00 per person covers admission to all sessions, a procedures outline workbook for taking notes, transportation between the workshop and the Swest Offices and lunch on Saturday. The registration form contains information on hotel accommodations, college credit, and further details on the workshop sessions.

For complete details and registration form, contact Workshop Chairperson, Swest, Inc., 10803 Composite Drive, Dallas, Texas 75220; Phone (214) 350-4011.

CITIZEN NAMES TANAKA DIRECTOR OF TECHNICAL SALES AND SERVICE

The Citizen Watch Company of America, Inc. has announced the appointment of Hidenori Tanaka as director of the Technical Sales and Service Department.

He will be responsible for the technical education program for Citizen's sales staff and for servicing and repairs training of watchmakers in Citizen's service centers throughout the United States.

Mr. Tanaka has worked for the Technical Sales and Service Department in Europe, the Middle East, and Australia. He holds a university degree in French literature and has a technical high school degree in mechanical engineering.

Citizen now has ten service centers: Los Angeles, New York, Dallas, Detroit, Seattle, Atlanta, Minnesota, Puerto Rico, Chicago, and Honolulu. Citizen features a 10-day turnaround policy to repair and return all watches under warranty within 10 days of receipt.

"Citizen believes in service," said Setsuo Kasahara, president of Citizen Watch. "While research tells us repairs are needed in less than 1% of items sold, our goal, nevertheless, is to provide customers the fastest possible servicing on any Citizen product."

Citizen also sponsors a series of bench course seminars. Mr. Tanaka will be responsible for training watchmakers in the field to repair quartz watches through hands-on instruction.

Mr. H. Tanaka (left) new director of the Technical Sales and Service Department, is in charge of servicing and repairs training for Citizen Watch Company.

No more tricky time zone calculations for Far East travelers. "World clock," presented to the new Hotel Century Hyatt in downtown Tokyo by the Citizen Watch Co., Ltd., helps keep visitors to Tokyo "oriented" by showing the time in 30 major international cities. A similar clock was presented by Citizen to the Tokyo Keio Plaza Hotel.

CITIZEN "WORLD CLOCKS" SPEAK INTERNATIONAL TIME

You're an American in Tokyo on business and it's 3:48 p.m. If you call the office, will you get your boss or the night watchman? If you call your husband or wife, will you talk to the wonderful person you married or an incoherent voice awakened in the middle of the night?

"Visitors at two downtown Tokyo hostelries—The Hotel Century Hyatt and the Tokyo Keio Plaza Hotel—no longer need worry about such tricky time zone calculations," says Setsuo Kasahara, president of Citizen Watch Company of America. "Both hotels feature their own unique 'world clock' presented by our parent, Citizen Watch Co., Ltd. of Tokyo."

Shaped like a map of the world, each clock is a configuration of 17 timepieces giving the time in 30 major cities, including Buenos Aires, Anchorage, Abu Dhabi, and Glasgow. All 17 clocks are controlled by a single advanced oscillating quartz crystal master clock newly developed by Citizen. Each digital readout has "a.m." and "p.m." displayed by LEDs, and the time in hours and minutes displayed in luminescent orange plasma. The Hyatt clock also has digital date readouts on either side of the international date line.

The abstract map presented to the new Hotel Century Hyatt is made of 957 inlaid pieces of cherry wood. Situated on the second floor wall of the luxury hotel's main lobby, the entire map measures four meters long and 2.2 meters high. The world clock in the new South Building of the Tokyo Keio Plaza Hotel is fashioned in embossed hairline brass, overlaid with 120 blue-threaded cords of silk and hemp. It measures 3.5 meters across and 2 meters high.

Citizen Watch Co., Ltd. is the Tokyo-based parent company of Citizen Watch Company of America, Inc. Citizen anticipates worldwide production for 1980 to have topped 22 million watches.

PARIS JR. COLLEGE GEMOLOGY GRADUATES

Twenty-one students representing seven states and four foreign countries recently graduated in the seventh class of Paris Junior College's professional gemology program, announced Paul Clayton, chairman of the Division of Horology and Jewelry Technology at PJC. In addition to students from Texas, the class included individuals from Massachusetts, Colorado, Missouri, Mississippi, Arkansas, and Louisiana, as well as from Japan, Finland, Taiwan, and Canada. TIMES

Classified Ads

Regulations and Rates

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Horological Times, P.O. Box 11011, Cincinnati, OH 45211. (513) 661-3838

Tradesman

CLOCK WHEEL AND PINION CUTTING Fast Service–Write for free brochure and price list. Fendleys, 2535 Himes St., Irving, TX 75060.

WATCH REPIVOTING, WHEEL and PINION CUTTING expertly done by **EUROPEAN WATCHMAKER** with diploma from **GLASHUTTE** $15.00 and up. Specializing in **REPEATERS, CHRONOMETERS, TURBILLONS, KARRUSELS,** watches with **PERPETUAL CALENDAR, UNUSUAL ESCAPEMENTS,** etc. I can make any part for any watch; it is just a matter of economics. Send **SASE** for **FREE** price list. **FREE** estimate given on your watch. **PHILIP PONIZ (NAWCC, AWI, MBHI),** 1207 Scrub Oak Circle, Boulder CO 80303. 303-494-9666.

WHEELS, Pinions, barrels or whatever, repaired or made new. Repivot arbors. Parts made to order. Send sample for free estimate. No watch parts. Ken Leeseberg, Ken-Way Inc., 19 W 672 Army Trail, P.O. Box 219, Addison, Illinois 60101.

ELECTRONIC WATCH REPAIR SPECIALIST Digital (LED & LCD) and Analog. Tuxedo Electric-Quartz Watch Repair Div., P.O. Box 561, Tuxedo, NY 10987. (914) 351-2282.

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

Pearl and Bead Restringing. All types. Fast service. Jean A. Gruenig, P.O. Box 12007, Columbus, Ohio 43212.

Clock repair material and tools. Manufacture of clock springs, dials, escape wheels, verge kits, weights, all types of brass and steel stock and custom made parts. Catalog postpaid $2.00; Tani Engineering, Box 338, Atwater, Ohio 44201. (216) 947-2268.

WATCH REPAIR FOR THE TRADE: QUARTZ (LCD, STEP MOTOR), ACCUTRON, AND MECHANICAL. Careful work & thorough-going repairs plus ultrasonic cleaning and electronic diagnosis. The Watch-Repair Shop, C. K. Goshman. 1219 Mound St., Madison, WI 53715. 1-608-255-3247.

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

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.

Watchmaker–34 years experience, excellent work–fast service. Price list on request–Call 1-517-688-4311 anytime or write to Charles "Chick" Kerby, 988 Terraceview Court, Somerset Center, Michigan 49282.

Watch Dial Refinishing, Crystal Fitting & Watch Repair. 48-hour Service–Finest Quality. Quantity works welcome. Send your work to: Kirk Dial & Crystal Co., 625 -4th & Pike Bldg., Seattle, WA 98101.

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

HERSCHEDE FACTORY REPAIR SERVICE. Call or write for details: Earl E. Furnas, Service Director, P.O. Box 825, Starkville, MS 39759. Toll Free: 1-800-647-1835. Visa and MasterCard accepted.

Help Wanted

Watchmaker with minimum of 5 years experience in clock & watch repairing. Must have knowledge of all major electronic & mechanical watches. Send resume to Hahn Jewelers, 913 Main St., Antioch, Illinois 60002.

Watchmaker wanted for very active jewelry store in north central Montana–Recent graduate O.K.–We do watch repair, clock repair, jewelry repair and manufacturing–You can become a part of it all. Phone: 406-265-7522.

WATCHMAKERS: We are looking for a fine watchmaker who is knowledgeable in electronic watch repairing. Salary would be $21,000 per year. Our trade shop offers a wide range of benefits. Pleasant working conditions. Contact Mr. J. Pollak, Pollak Watch Service, Inc., 2132 E. 9th St., Cleveland, Ohio 44115, or call 1-216-241-4413.

Wanted To Buy

STERLING FLATWARE 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, GA 30345. (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. W. F. N. Enterprises, Inc., HT, 2300 Henderson Mill Rd., NE, Suite 318, Atlanta, GA 30345.

IMMEDIATE CASH PAID for Gold, Silver, Platinum, and 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.

GOLD FILLED and ROLLED GOLD PLATE RGP $3.50/t.o.; 1/10 10k $16/t.o.; 12k G.F. $8.75/t.o.; 14k G.F. $14.75/t.o.; 25 year watch case $17/t.o. Prices based on $600 gold. Send for schedule. CASH or CHECK. Ship to AVON METAL SERVICE, LTD., P.O. Box 17484, Milwaukee, WI 53217. Phone: (414) 351-0933.

For Sale

'A' QUALITY SWISS SPRING BARS. WRITE FOR FREE SAMPLES. P.O. Box 774, GREENVILLE, MS 38701.

American pocket watches, movements, cases, material and tools for sale. Write for list. Want to buy watchmakers tools, American pocket watches, related items. Dashto Horological Services, 5349 Basilica Circles, Virginia Beach, VA 23464. (804) 420-2631.

For Sale. Small watch repair shop. Excellent income, low rent, good lease. Superb tropical weather plus sun, sea, sand. $7,500. Retiring 1981. Stuart's Watch Repair, 11 Back St., St. Thomas, VI 00801.

U.S. HEADQUARTERS FOR ALL SCHATZ PARTS. PARTS FOR THE NEW 400-DAY ELECTRONICS. ALSO FOR KUNDO ELECTRONIC. GREENHILL CLOCK SERVICE, 4895 COCONINO WAY, SAN DIEGO, CA 92117.

Metal Cutting Lathes, Bench Mills, Drillpresses, Unimats (accessories also), Maximats, Sherline, Machinex, the new 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, 2100 Selma Road, Springfield, Ohio 45505. Phone (513) 322-8562.

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. $200.00. Write EOG, P.O. Box 11011, Cincinnati, Ohio 45211.

Retired watchmaker offering Boley Lathe with 28 wire chucks, 8 ring chucks, bezel chuck, 3 jaw plastic chuck, tail stock–motor with mount, cement chuck, carbide chuck, 2 balance holding chucks, misc. items. Price $850.00. C&E Marshall staking set with 14 reamers complete except for extra-small punches, pulleys for drilling on lathe with belt. This is triangle-shape swing arm type, Price $350.00. Both items prepaid U.P.S., M.O. or C.C. only. Rich Barnsdale, 2719 Missouri Ave., South Gate, CA 90280.

For Sale–Timing Machines, Watchmaster Timers, Vibrograf 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 Ohio 45157. Or phone (513) 553-2113. Territory: Southern Indiana, Kentucky, Michigan, Ohio, Tennessee, and West Virginia.

Bergeon waterproof tester No. 5555. Brand new-never used–$150.00. M. Teitch, 34 Bell Lane, Tappan, NY 10983. Phone: (914) 359-8140.

Small profitable jewelry store for sale in northern Montana–45 minutes from Glacier National Park–Excellent opportunity for watchmaker–Absentee owner will sell, very reasonable. Phone: 406-265-7522.

Miscellaneous

Digital Watch Service Training. Zantech, Inc. offers training and instruments for servicing all types of digital watches. Course includes diagnosis of watch malfunctions and repair methods, including techniques in wire bond repairs using silver epoxy. Louis A. Zanoni, Zantech, Inc., 77 Shady Lane, Trenton, NJ 08619. (609) 586-5088.

QUARTZ BATTERY CLOCK MOVEMENTS: Regular or Mini: $7.95 each, 3 for $22.65, 6 for $42.90. Hands included. $2.00 handling. CALDAK TIME, Box 3181, Camarillo, California 93010.

Dates to Remember

FEBRUARY

1-4—SJTA Atlanta Show; Hyatt Regency, Atlanta, GA

1-4—Memphis Gift & Jewelry Show; Memphis Cook Convention Center, Memphis, TN

1-5—International Spring Fair; National Exhibition Centre, Birmingham, England

7-15—Tucson 1981 Spring Gem and Jewelry Show; Marriott Hotel, Tucson, AZ

8—Diamond Council of America Executive Meeting; Suite of Executive Director, Hilton Hotel, New York, NY

8-11—JA Spring International Jewelry Trade Show and Convention; Sheraton Center & N.Y. Hilton, New York, NY

8-11—New Orleans Gift & Jewelry Show; Rivergate Convention Hall, New Orleans, LA

8-11—Baltimore Gift Show; Convention Center, Baltimore, MD

12-15—Tucson Gem & Mineral Society's Tucson Gem & Mineral Show; Tucson Community Center, Tucson, AZ

13-17—The Independent Jewelers Organization Spring 1981 Seminar/Buying Group; New Orleans Marriott, New Orleans, LA

14-17—INHORGENTA 81 International Trade Fair; Munich, West Germany

22-27—Dallas Spring Gift, Jewelry & Housewares show: Dallas Market Hall & Anatole Hotel, Dallas, TX

22-24—Wisconsin Gift Show; Milwaukee Convention Center, Milwaukee, WI

28-March 2—Illinois Retail Jewelers Association Annual Meeting; Holiday Inn East, Springfield, IL

28-March 2—Spring Pacific Jewelry Show; Hyatt Regency, San Francisco, CA

MARCH

1-3—MJ&SA Expo/East; Sheraton Centre, New York, NY

15-18—Minneapolis Gift & Jewelry Show; New Hyatt Regency, Minneapolis, MN

21-22—Michigan Jewelers Association Annual Convention and Show; Hyatt Regency, Dearborn, MI

22-25—MJ&SA Expo/Providence; Providence Civic Center, Providence, RI

22-25—Philadelphia Gift & Jewelry Show; Holiday Inn, City Line, Philadelphia, PA

22-26—Annual Exhibition of Fine Jewellery & Sterling Silver; Goldsmiths Hall, London, England

24-29—Watch Material & Jewelry Distributors of America Inc. Annual Convention; The LaCosta, Carlsbad, CA

27-29—Antique & International Jewelry Bazaar; National Guard Armory, St. Petersburg, FL

BENCH TIPS

(Continued from page 22)

I've always heard that two heads are better than one. Now doesn't that go to show you what can happen when two great heads get together, talking technical matters?

Speaking of Mr. Fried, I have to share a good one that he pulled on me. I sent him some pictures and information about an unusual clock and deliberately left out the self-addressed, stamped return envelope just so I could hear him scream.

Well, I didn't hear a word! He just waited three or four months and then sent me a large, heavy envelope full of what I had sent him along with other odds and ends and three pages of innocent, double-talking chatter. This envelope arrived adorned with a 15-cent stamp and no return address; I had the privilege of paying lots of postage!

Send your tips to: Jingle Joe, 265 North Main Street, Mooresville, NC 28115.

Advertisers' Index

The best way for you to become a Seiko expert is to get all the facts from the Seiko experts.

With the Seiko Mechanical or Quartz Technical Library.

A Seiko Technical Library has it all. Everything you need to know about repairing Seiko watches. One library for Seiko Quartz watches. One for Seiko Mechanical watches. Comprehensive, designed to put all the facts at your fingertips in a time-saving, easy-to-use format.

Mechanical Technical Library

Includes a watch parts catalogue and a technical guide book for current mechanical calibers, in addition to the current casing and interchangeability publications. $25.00.

Quartz Technical Library

Consists of a representative sampling of five analog and five digital technical guides and corresponding parts lists, in addition to the current casing catalogue. $31.50.

Seiko has a nationwide network of authorized material distributors who are fully stocked with quality Seiko parts. Which means you'll have no difficulty getting the parts you need—when you need them—to repair any model we sell.

To get your complete Seiko Technical Library, just send in your check or money order for $25.00 for the Mechanical, $31.50 for the Quartz.

SEIKO

Seiko Time Corporation
Material Sales Department, 555 W. 57th St.,
New York, N.Y. 10019

Citizen unwraps a quartz timer that does it all for under $1200.*

You could spend around $3000 for a digital display multi-function rate measuring instrument.

But it isn't necessary.

The Citizen CQT-101 can measure not only quartz watches (analog and digital) but also tuning fork and balance wheel watches with all the accuracy you need.

Its measuring range is from 0.01 second a day to ±399 seconds per day.

To monitor various types of watches and clocks, you simply change the microphone.

The CQT-101 is the only quartz timing instrument you'll ever need.

And even when it's not helping you build your service business, its attractive, professional look makes it in an effective in-store promotional display.

Pay $2000 or $3000 for a timer? Ridiculous. Now that Citizen's CQT-101 is here.

Place your order with your material house or directly to Citizen Watch Company. For more information, write: Citizen Watch Co. of America, Inc., Service Headquarters, 12140 W. Olympic Blvd., Los Angeles, CA 90064. Tel.: (213) 826-6541.

CITIZEN

We sell **with** you, not through you.

*Suggested retail. Price does not include shipping and microphone for mechanical watches. Sales tax additional in California.