HOROLOGICAL TIMES™

AMERICAN WATCHMAKERS-CLOCKMAKERS INSTITUTE
NOVEMBER 2010

ISSUE highlights

This Month's Focus: *Technical Insights*

Horological Time Bases

Developing Your Skill Set Can Impact the Bottom Line

Challenging Situations: Remaking a Mainspring

L&R Tempo 400 Watch Cleaning Machine Start Switch

Dip Oiler Use and Preparation

AWCI Online Referral Directory Generates Leads

New Equipment

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Cover: © iStockphotos.com/Seraficus

a message from the executive director

BY JAMES E. LUBIC, CMW21

The AWCI-ELM Charitable Trust needs your support. Again this year when you receive your dues renewal you'll see you're being asked for a $25.00 donation to the ELM Trust. When the ELM Trust receives a donation, not only does the Trust benefit, so does AWCI who is working on your behalf.

Educating the public about watches and clocks, watchmakers and clockmakers is the main mission of the ELM Trust. This educating of the public also benefits you as a member of AWCI. Through the efforts of the ELM Trust the public learns more about how unique you are as a professional. They learn about the need for qualified watchmakers and clockmakers. Additionally, consumers learn our trade is not the proverbial *Dying Trade* or *Lost Art*, but it's alive and prospering, and there is a real need for more people to get the proper education/training in order to enter our profession and become successful.

The ELM Trust thanks you for your past and future support. This year's donors, as always, will be recognized in the *Horological Times* for their generosity.

In this month's issue you will see the listing of all the AWCI committees. Each committee has specific goals and objectives. If you have suggestions you would like to pass on to any of the committees please feel free to do so. You can make your suggestion by calling AWCI toll free at 866-367-2924, or by fax at 513-367-1414. Or, you can send an e-mail to info@awci.

Thank you to all who volunteer to work on a committee or two. You are a very important part of AWCI and we all look forward to your valuable input.

Finally, when placing orders with our advertisers please be sure to thank them for supporting AWCI and the *Horological Times*. Speaking of our magazine, I would like to thank President Butterworth for allowing our new Marketing Director and *Horological Times* Editor, Amy Dunn, to introduce herself to the AWCI membership by filling what is traditionally the AWCI President's space.

Welcome Amy! We are happy to have you as a new member of the AWCI team.

AWCI new members

California
George Kuc-Arcadia, CA *

Colorado
Richard F. Powers-Denver, CO *

Iowa
Kim A. Miller-Janesville, IA

Massachusetts
Donald Uliano-Sharon, MA *

Michigan
Vin Sou Pin, CC-Roseville, MI *

Minnesota
Joshua Culp-Saint Paul, MN
Colin Simmons-Lakeland, MN

Nebraska
Charles Hill-Plattsmouth, NE

North Carolina
Ernest Amodeo-Raleigh, NC
Steve Hurst-Raleigh, NC *

Ohio
Thomas M. Kovatch-Uniontown, OH
Susanna Woycitzky-North Olmstead, OH *

Pennsylvania
Luke Kelley-Petersburg, PA
Jason Woods-Lititz, PA

Texas
Ben Wang-Houston, TX

Virginia
Robin Gutierrez-Merrifield, VA *

Washington
Jaime Mora-Seattle, WA

*AWCI welcomes back these individuals who have chosen to reinstate their membership.

a message from the marketing director

BY AMY DUNN

Amy Dunn, Marketing Director and Editor, *Horological Times*

First, I would like to thank the Board, the many members I've met, and the AWCI staff for being so welcoming and helpful in my first months as Marketing Director and editor of the magazine. There are many facets to this new position, but the main focus is to build recognition and create a demand for services for the Institute, its members and the industry. "A challenge, you say?" "Yes, and an exciting one!"

These first few months have been dedicated to one of our main communications tools, *Horological Times.* In the future, you'll see more news and business–building and articles, along with the technical reviews you've all grown to appreciate. Watchmakers and clockmakers are a unique and vital niche market, and my goal is also to promote our strengths through the magazine and attract additional readers, advertisers and industry participation.

My challenge in 2011 will be to enhance the website. The goal is to make it more user–friendly and develop it into an outreach tool. Why? Consumers of your products and services are scouring the internet looking for resources. We want to make it easy for the public to find the Institute and consequently, you, our members. One way we can accomplish this is by adding a consumer information section to the website. The second—and one of the most important ways the website can serve your business—is by improving the Referral Directory which gives consumers ready access to your services. It's vital that you participate in the Referral Directory. This tool enables us to connect you with numerous active business leads you might not receive otherwise. From the level of activity on the website and calls to our office, we know the business is out there—the Referral Directory can connect you with this business to grow your bottom line.

I'll have many other marketing projects on my plate as we look toward the future. To promote the industry and build AWCI membership, I'll also be placing articles in the press, posting on our Facebook page, and employing a variety of public relations tools to create awareness and demand for watchmaker-clockmaker services. Already, I have received many valuable suggestions and insights from members, so don't hesitate to share your ideas—I honestly value your input. You'll find it's easy to reach me at: 866-367-2924, ext. 307 –or– adunn@awci.com

I look forward to meeting many more AWCI members in the future!

A BUSY FALL FOR MINNESOTA CLOCKMAKERS GUILD

The members of the Minnesota Clockmakers Guild had active, informative meetings in September and October this year. In September, Richard Zielike explained the different electric clock movements available. Elroy Anderson covered one Seth Thomas electric clock movement while Susan Wood showed and described two other Seth Thomas electric movements.

The October meeting was a demonstration and discussion of metal heat-treating using various sized forges, thermo-cycling and forging. Examples of Paul's knife-making were also part of the show and tell.

MCG holds meetings every month and some of their upcoming topics include:

- Making a clock case from old piano wood by Al Wenzel
- Hands-on hairspring manipulation by Doug Thompson
- A bushing techniques discussion

The following is a reprint from the October, 2010 issue of *WatchTime*, America's leading magazine for those interested in fine wristwatches. The magazine is published bi–monthly by the Ebner Publishing Group of Germany and is available by subscription, online or in newsstands.

LAST minute

By Joe Thompson

How to Find a Good, Local, Certified Watchmaker

OK. You've had that fine mechanical for five years now. Maybe more. You know it needs to be serviced. You're a smart cookie. You realize there's oil in the movement that reduces friction and keeps that little mechanical engine purring just right. But, just as with your car, after a while somebody qualified needs to get under the dial, check the movement and change the oil. Your question is, who?

You might want to call AWCI. The American Watchmakers-Clockmakers Institute is, as its Web site says, "the premier international organization dedicated to preserving and promoting the highest standards of workmanship in the horological crafts." Headquartered just outside of Cincinnati, the group has 2,400 members all over the country. Most, 60 percent, are bench watchmakers; the other 40 percent are clockmakers. Servicing and repairing watches are what these guys (and some gals, too) do for a living. One of the most important things AWCI does is set standards for the profession and certify its members. It holds continuing education courses designed to prepare watchmakers for an exam it administers called the AWCI CW21 exam.

Recently I got to hang out with the AWCI gang. They held their 50th Anniversary Convention in August in the Cincinnati area. They invited me to give the keynote speech at the convention and I spent three great days with the group. These folks love watches. One of the bummest of bum raps is that watchmakers are dull. *Au contraire*, they have an inside-out fascination with and appreciation for the wristwatch and I enjoyed listening to them. There's a price one pays for a career in watch repair in today's wireless world. Watch repairer is not a "prestige" profession. They don't make a fortune. The watch parts they need to ply their trade are often hard to get. But these guys are mavericks — rugged individualists and gifted mechanics, who are hopeless romantics about horology. They willingly pay the price for their labor of love.

Among the things I learned at the AWCI convention was what it takes to earn AWCI's CW21 Certification. The exam is brutal. It has five parts and goes on for four days. There is a written portion. On its Web site (www.awci.com), AWCI posts 10 sample questions. Among them: "What is meant by 'dynamic poising' of a balance? How is this accomplished?" And "Lubrication is critical to the proper functioning of a watch. Discuss four ways the watchmaker can control the needless spreading of lubricants throughout a watch." After the written section come four sections having to do with the use of a watchmakers' lathe and servicing modern Swiss wristwatch movements, both quartz and mechanical. One watchmaker told me he had never suffered from headaches in his life until the weeks leading up to the CW21 exam. The headaches lasted for weeks after it, even though he passed and got his certificate.

AWCI'S WATCH REPAIR TEST FOR CW21 CERTIFICATION GOES ON FOR A GRUELING FOUR DAYS.

There is a bundle of interesting information on the Web site about the AWCI 21st Century Certification for Watchmakers. One of my favorite parts is the three-page list of tools required for the exam, including eight types of tweezers and eight different lubricants. (AWCI supplies the lubricants for the test. But it's BYOE if you want to use epilame, also known as fix-o-drop.)

Watchmakers who pass the test earn the right to use the CW21 designation after their names. (It also greatly increases their chances of making Rolex's list of repairers authorized to receive parts for repairing Rolex watches, which is a huge deal.) To get the CMW21 title (Certified Master Watchmaker), a watchmaker must pass another written test, be able to produce mechanical movement components that conform to Swiss factory tolerances, and undertake other projects determined by the AWCI Board of Examiners. Which brings me back to your watch that needs servicing or repair. You might want to consider using the services of an AWCI member. There are two ways to find out if there is one in your area. One is to use the Referral Directory on the Web site, www.awci.com. If the search, which is done by city, does not find an AWCI member in your town, AWCI executive director Jim Lubic recommends you call AWCI's toll-free number, 1-866-367-2924, extension 301. AWCI welcomes inquiries and will help locate a certified member in your area.

One final thing: the organization actually goes back much farther than 50 years. AWCI was created in 1960 when two watchmaker associations merged into one national organization. But its roots go back nearly a century before that to the New Yorker Uhrmachers Verein, formed by German immigrant watchmakers in New York City in 1866. ○

LAWS GOVERNING MERCURY IN BATTERIES ARE CHANGING

RENATA LAUNCHES BATTERY LINE WITH 0% MERCURY

In response to more stringent environmentally protective heavy metal laws, Renata recently introduced its new line of 0% mercury, silver oxide watch batteries. New laws requiring this technology are currently scheduled for July 1, 2011 implementation in several states, covering new device sales as well as service and distribution. It is anticipated that additional states and markets around the world will follow.

Producing mercury-free watch batteries has been a major focus for Renata over the past several years. High volume distribution of this innovative new product has already begun via leading Swiss watch movement producers and watch brands. Although the changing laws in the US drove demand for a mercury-free product, Renata states its commitment to 0% mercury is 100% worldwide. According to Renata, "overall battery performance and leakproofness appear absolutely excellent."

For more information on these 0% mercury batteries contact your Renata battery distributor or Sy Kessler Sales, Inc., North American Headquarters for Renata (sales@sykessler.com, 800.527.0719).

BY JACK KURDZIONAK, CW21

ACCEPT YOUR LOSSES EARLY

The late Ralph Berger always advised his colleagues to accept business losses sooner rather than later with the admonition, "Your first loss is the small loss." He clearly understood that business losses could often grow in size and cost after they are recognized. Ralph was not a watchmaker or clockmaker per se, although he was an AWCI member for many years. Ralph was a successful engineer, executive, and entrepreneur from New England with a special affinity for horology as an avocation.

Investments, regardless of whether they involve time, money or both, always require careful monitoring by the person who makes the investment. Ralph's advice is pertinent to anyone investing time or money into any project; that includes those of us who are clockmakers or watchmakers. Consider the watchmaker or clockmaker who estimates a repair at $500, which includes $170 for material and $330 for three hours of labor. The client approves the repair at $500 and the repair is begun. Within 30 minutes of initiating the repair, it is discovered that the timepiece in question requires a custom-made part, which will cost an additional $270. That leaves only a $60 balance to cover three hours labor. What is one to do? Does one absorb the loss and get on with the project? Alternatively, do you notify the client of a cost overrun of $270 to get the timepiece back into running condition with the risk of the client refusing the extra charge? If Ralph could be asked for his advice, he probably would suggest changing the estimate to $770 and obtaining the client's acceptance of the amended estimate. Of course, the client could refuse the additional charge. That scenario would force a decision on the part of the watchmaker/clockmaker to absorb an initial small loss after only spending ½ hour of time, or absorb a large loss of $270 by completing the project at the original estimated cost. If one followed Ralph's advice, that first small loss would be absorbed and the unrepaired timepiece returned to the client. The remaining 2½ hours allotted for the repair would now be available to spend on another repair at the full hourly rate.

Many consider the thought of quitting a repair an admission of failure. Some may view this as an embarrassment leading to some introspective self-examination questions. What can I do to improve my estimating skills? Will I be viewed as incompetent if I do not complete a repair? Remember that quitting a project can damage one's ego, but going forward on a losing project will damage one's paycheck. At the end of the week, ego, regardless of how large, does not pay the bills. A large weekly paycheck will pay the bills. Business decisions need to be rational and unemotional. Delaying a decision, or not deciding at all, is a form of decision-making. For better or worse, you need to make decisions, and once made, you must carry out those decisions.

President Harry Truman provides a wonderful historical example of decisiveness. During his presidency he was called upon to make numerous critical decisions, many of which were widely criticized by his critics who considered him incompetent or worse. Someone once asked the president what he thought about the people who had a negative perception of him. He responded in his own homespun way by saying, "If you need a friend in Washington, get a dog." If you need a paycheck and you asked Ralph for advice, he would say, "Cut your losses, cut them early, and your dog will still think the world of you".

SELLITA WATCH MOVEMENTS

Several independent Swiss watch manufacturers are now using mechanical movements made by the Sellita Watch Company of Switzerland. Watchmakers viewing these movements for the first time can easily mistake them for ETA products, as they appear to be exactly like the more familiar ETA movements. However, do not be fooled, they are NOT ETA movements. They are marked SW200, SW200-1, SW220,-1 SW240-1, SW300, or SW500. The ETA trademark does not appear anywhere on these movements. The movements in the SW2XX series are very similar to the ETA 2824, 2834, 2836 series. The SW300 movements bear a close resemblance to the ETA 2890-based movements while the SW500 series is strikingly similar to the ETA 7750 series of

movements. Service and part reference documents are available to all on the Sellita website www.sellita.ch. Anyone familiar with the ETA analogs of these Sellita movements should have no difficulty servicing Sellita products. Some, but not all ETA movement parts are interchangeable with their analogous Sellita movements. Consult with your material dealer for advice. Many, but not all, ETA parts will properly fit Sellita movements. You will need to order genuine Sellita parts when an ETA part cannot be substituted.

You will definitely be seeing these movements in for service. Last year, Sellita produced its millionth movement, making it apparent that they are not just a limited focus, niche movement manufacturer. Download their tech sheets. Download their parts list. Call your material supplier when you need spare parts so you can obtain the correct parts and do a proper repair.

IT MUST BE TRUE, IT WAS ON THE INTERNET

We frequently receive a forwarded, mass distribution email from a friend. Such mass email may include funny stories, jokes, pictures, or even an item purported to be the truth about some topic. Most of the time, this writer just ignores them, but for some unknown reason I opened one of them, which presented the astonishing news that August 2010 has 5 Sundays, 5 Mondays and 5 Tuesdays all in one month. It went on to say this rare occurrence happens only once in 823 years. Sure enough a quick look at the August 2010 calendar did confirm that it did have five of each of those days. But is that unusual? Take a look at the calendar for any year and it will show every August with 31 days. With seven days in each week, every August has four complete weeks plus three more days so that the month always has three consecutive days occurring five times. This cycle repeats every few years and it will happen again in 2021 so no one has to wait 823 years.

Websites can be informative, educational, and sometimes even entertaining. This one was certainly entertaining if nothing else. Another friend thought he could be helpful by sharing a horological website www.mysmallbiz.com/watch-business/, he discovered. This enlightening website describes in detail how to get rich quick in the watch business. According to the website, all you need to begin is an interest in the watch business. With that initial level of dedication,

from the workshop

BY JACK KURDZIONAK, CW21

you can soon join the ranks of "Those in this business that enjoy making a good living from buying and selling high-end watches, making their profit by 'flipping' the products in much the same way as realtors flip houses." The website reminded the novice horologist to listen to J. D. Rockefeller's advice, " 'Buy low, sell high', and you can make a handsome profit selling antique watches, pocket watches and related items."

According to the website, the internet makes the watch business relatively easy and profitable. With a little knowledge, anyone can specialize in authenticating valuable watches and separating them from worthless counterfeits. To increase one's profits in the watch business, the website suggests. "Given that many of the more expensive watches are antiques, there is also a significant market for watch repair. By hiring an expert trained in repairing or restoring watches, you can guarantee a regular revenue stream even in times when the market is weak."

Finally, any spare time can be profitably spent by attending, "A number of major watch trade shows around the world where, with some haggling, you'll be able to pick up high-end watches at bargain prices which you can sell (sometimes even at the same show) for a handsome profit. Swap meets and flea markets are also worth exploring. With a little luck and a lot of perseverance you can find some real gems at a fraction of their market value which will set your watch business on an instant path to success."

After exploring the website, I wondered why, after forty years, I have not become independently wealthy in the watch business? Why do I still sit at the bench, hour after hour, repairing watches when there are so many other watchmakers willing to take on this task? Why have I never found a genuine Rolex watch being offered at a flea market for $5? All of the above statements found in a website or email must be true because they were on the Internet which leads me to remember what I learned in school so many years ago. "Do not believe everything you see or read." We all still need to think for ourselves. ♦

book review

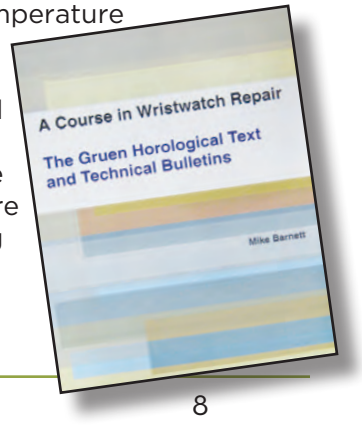
BY JORDAN FICKLIN, CMW21

A Course in Wristwatch Repair: The Gruen Horological Text and Technical Bulletins. Compiled by Mike Barnett, 105 pages, black and white illustrations.

The Gruen Horological Text was really a joy to read. As a young watchmaker who has been exposed mostly to modern repair techniques, I found it reassuring to know that fundamentals of watchmaking have not changed. That is, the concepts I was taught were also being taught in 1948. Unlike the WOSTEP textbook, *The Theory of Horology*, which is full of formulas and theory about how watches operate, the Gruen text is an instructional guide in servicing and repairing mechanical timepieces.

This text follows the order of instruction in a watchmaking course taught by the Gruen watch company at a school they operated on their campus. At the beginning it covers watchmaking tools, their use and preparation, along with the basics of micro-mechanics including filing, sawing and turning.

In the first 78 pages everything is covered from the critical basics like fitting the dial and hands and cleaning and oiling to the more advanced techniques like positional and temperature adjustment. The text is full of well-written descriptions, step-by-step procedures and accompanying illustrations. Obviously, hands-on practice and constructive feedback are also necessary when learning these techniques.



Additional topics covered include:

- Balance wheel staff replacement, truing, and poising
- Hairspring formation, manipulation, vibrating, poising, adjusting, and untangling
- Jewel replacement
- Mainspring handling
- Escapement theory and adjustment
- Gear train calculations as well as how to recognize and solve problems with depthing
- Balance staff and stem fabrication
- Isochronal Adjustment
- Tightening loose cannon pinions
- Fitting and adjustment of watch bands

In addition to the basic techniques critical to watch repair of all brands, the book includes technical bulletins from Gruen covering the specifics of several Gruen Autowind models for gents and ladies, calendar models and stem interchangeability.

For the beginner watchmaker this book serves as an excellent guide for topics that should be covered in their study of watchmaking. However, some caution should be exercised. While 95% of what is taught is still considered to be good watchmaking, some of the techniques would not be considered good watchmaking by modern standards. These techniques could be applied in the repair of vintage timepieces where parts are no longer available, but should not be used on modern production calibers for which parts can be readily obtained.

Young watchmakers with modern training will find this book serves to build confidence in the techniques taught in school, as well as to expose the watchmaker to other techniques that were perhaps not taught in school. In addition, the book covers some topics appropriate to older timepieces, but sometimes overlooked in modern training, like the replacement of bezel-type jewels and the turning of a new jewel setting.

For the experienced watchmaker, the book is a good review of the basic techniques and a resource for technical information specific to some Gruen calibers.

The Gruen Horological Text puts forth an excellent watchmaking course that, if followed by a diligent student who has access to an instructor or mentor to critique their work, could produce a well-qualified watchmaker.

L&R tempo 400 watch cleaning machine

Repair & Modification of the Start Switch

BY KAREL EBENSTREIT, CMW, CC21

1. Description of Problem and Parts:

L&R Tempo 400 watch cleaning machines came on the market some 30-40 years ago and were proven to be made very robust and have been doing an excellent job for decades. They are still working in many shops, but if they fail, spare parts and the shops that perform the repair are hard to find. The machine I have now has worked flawlessly for some 28 years, except for a start switch that has failed twice. The first time was about four years ago when the parts inside the switch broke lose, shorted and caused severe burning damage to the body of the switch. I managed to get the replacement switch from L&R, but it failed again in exactly four years. This time the switch was not making any contact inside. When I pressed the start switch, nothing was happening and there was no way to fix the inside of the start switch. An ohmmeter test confirmed the contacts were not doing their job. There are four yellow push button (PB) switches on the front of this machine. Three of them are simple ON/OFF switches, but the start switch is a double switch, a combination of "normally open (NO)" and "normally closed (NC)" contacts that must operate at the same time. All push buttons are illuminated inside by a small light bulb. These are separately fed and rarely fail, but bulbs are still available.

The L&R shop in Kearney, New Jersey no longer supports this machine and parts are no longer available. In the U.S., this service has been passed on to the shop in San Rafael, California called Electronics Instruments Service (Contact: Richard, 415-479-8960). In Canada, similar help for this equipment and ultrasonic work is available from Crystal Electronics in Newmarket, Ontario (905-953-9129).

When I talked with both of them I found they would be able to repair the start switch, but not with original parts. Additionally, they would need to search for the replacement to do the job at a cost of at least $400 plus shipping. Considering the cost of shipping this heavy machine, the risk of equipment damage during shipping, and the time lost being without the machine, I decided to find replacement parts myself. I thought this would not be too difficult, and it should work far better with new, more robust parts, if done correctly.

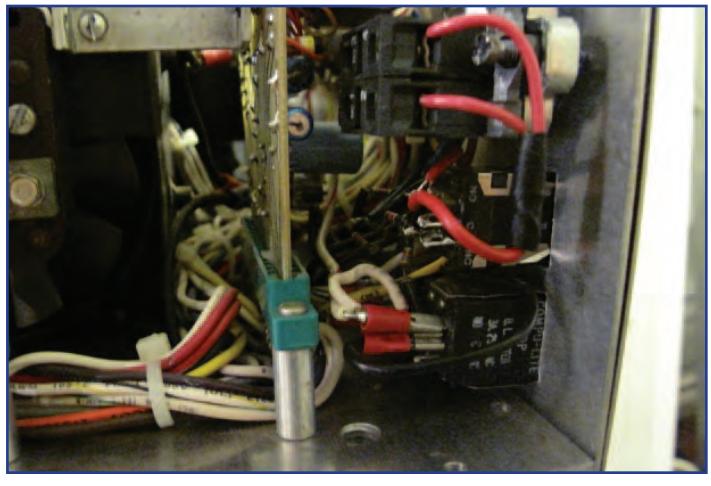


Figure 1

I was lucky to find the replacement switch parts. Although they were a bit larger than the original, they still fit nicely and feel great to the touch. The complete switch consisted of four parts: the push button, main body, plus two contact blocks (one NO, the other NC contacts). The main body has three insert locations for a maximum of three contact blocks. Since I used only two, I chose the locations that best fit my case to ensure they were away from the transformer on the printed circuit board inside the machine (Figure 1).

The assembly of these parts can be done simply by clicking them together or unclicking them apart. To get the push button out, pull on the L-shaped lever at the corner of the switch. To unclick the NO or NC contact block, pull on the metal part on the top of the body at the center on the opposite side of the setting screw. These parts are very robust mechanically and should last much longer than the rest of the machine. I obtained new parts from a regular electrical distribution parts supplier (Grey Bruce Electric Supply Inc., Owen Sound, Ontario,

L&R tempo 400 watch cleaning machine

Repair & Modification of the Start Switch

BY KAREL EBENSTREIT, CMW, CC21

www.GreyBruceElectric.com, 519-376-4120).
The parts are made by Telemecanique/Schneider Electric and I am sure they can generally be obtained from many suppliers in U.S. or Canada dealing with this make. The parts are:
Part #: ZB4BA2 (35373) - for the push button
Part #: ZB4BZ102 (37018) - for main body with NC contact block included
Part #: ZBE101 (35563) - for NO contact block

The total cost of all parts was under CAD $50. The parts are shown in (Figure 2). From left to right they are: The new push button, main body and one of the contact blocks (NO).

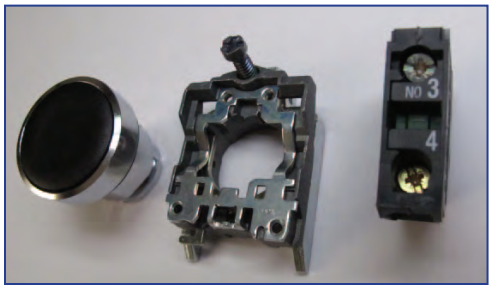


Figure 2

If you find a similar double pole switch, make sure it consists of one normally open (NO) and one normally closed (NC) contact that will operate at the same time as the push button is pressed or released. The contact blocks I used are rated at 240 VAC voltage and 3-amp current.

2. Installation and Repair Procedure:

To replace the start switch, the front panel of the cleaning machine must be flipped forward to get to the back of the PB switches, allowing you to make a hole for the new start switch and to rewire it. The best way to get to the inside of the front panel is to remove the main cleaning machine cover first. This cover is held by several screws located at the bottom of the machine in an extremely bad location. To get to these screws easily, I placed the machine on the top of my grandfather clock working stand, which is about four feet high from the floor with a 10"x10" square top platform. This allowed access from the bottom while holding the heavy machine at a reasonable height to work on. Some similar arrangement might provide the same result. I disconnected two cables on the top at the back plastic one by pulling up, starting with the black one first by twisting counterclockwise then pulling up. Next, I detached all the screws at the back of the black cover and removed it.

Then I loosened the bottom screws of the main cover spreading apart the cover and lifting upwards to remove it. With this cover off, I removed four screws at the front bottom and flipped open the front panel. I placed another support under this panel to enable me to work on it. Next I disconnected all wires from the start switch and removed it completely for better access. This work may be done with the old switch left in the position if you work carefully.

To make a hole for the new start switch I marked it exactly 30 mm from the center of the old start switch on the center line with it. I drilled a number of holes around the smaller circle, then for the final

L&R tempo 400 watch cleaning machine

Repair & Modification of the Start Switch

BY KAREL EBENSTREIT, CMW, CC21

hole I cut the rough circle with a jeweller's saw. I finished the 23 mm diameter hole for the new switch by filing the rough edges with a half round file. The front panel was made of aluminum, so it was easy to work with (Figure 3).

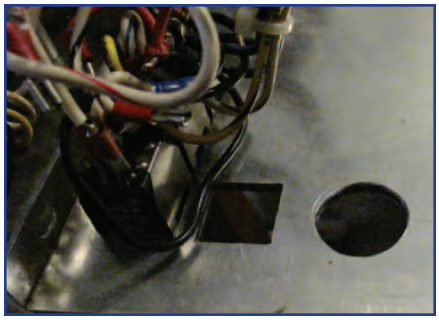
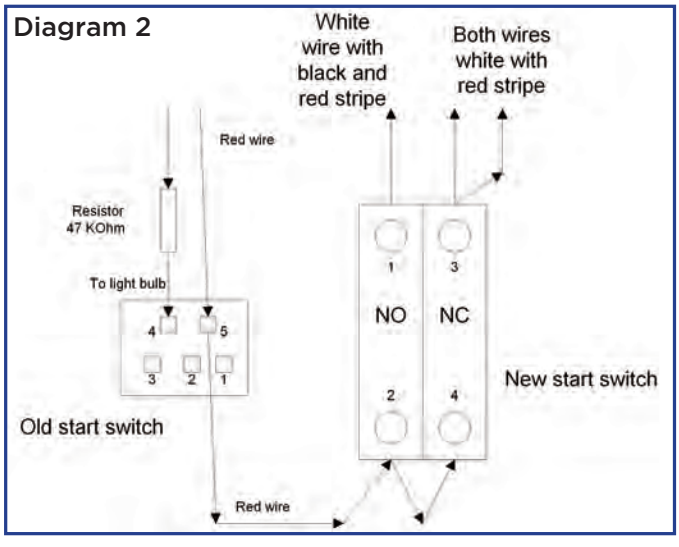


Figure 3

I reinstalled the old start switch. Because the light bulb section of the old switch was still working, I kept it wired. It still illuminates when the machine is started, the same as before the modification. It is a neon bulb fed via a 47 kOhm resistor. Then I installed a new push button body, with an NO contact block at the bottom of the body and an NC contact block at the center to ensure it clears the transformer at the back when the panel is reinstalled. I clicked in the push button through the front and tightened the screw holding PB body in place.

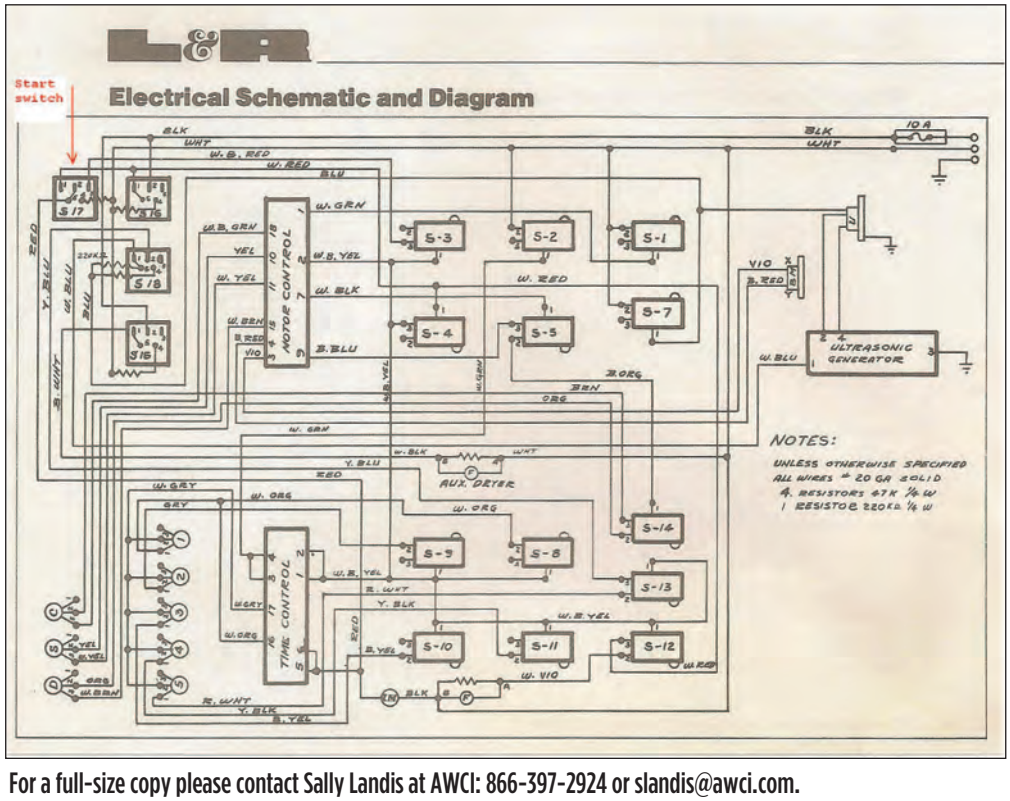
Rewiring was fairly simple. See Diagram 1 for the old original L&R electrical schematic diagram, and Diagram 2 for the wiring revision.

Diagram 2



I rewired the contact blocks per Diagram 2 or as shown in Figure 4. The wires on #1, #2 and #3 of the old switch were simply plugged into it. Unplug them, cut the ends off and use the barred wires for connection to the new contact blocks. The "red" wire from #2 or #5 of the old switch plugs into #2 of the new contact block, and the jumper is then installed between #2 and #4 of the new contact blocks. The wire from the old #3 (white with black and red stripes) was moved to #1 of the new switch, and two wires from # 1 (white with red stripes) of the old switch

Diagram 1



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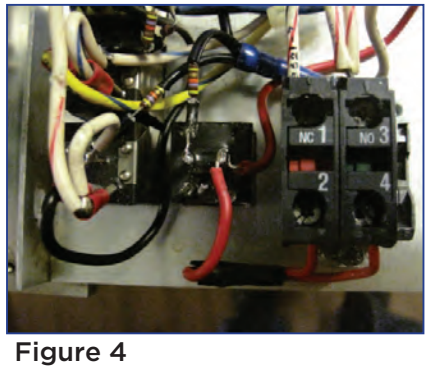

Figure 4

L&R tempo 400 watch cleaning machine

Repair & Modification of the Start Switch

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were placed in position #3 of the new contact block. Wires were held in the contact blocks by the screws, which made for an easy connection. See Figure 4 for the final connection and proper color coding of wires. I then reinstalled all parts in the reverse order and ended up with the push button as shown on Figure 5 just above the still illuminable old start switch.

3. A Few Words of Caution:

This machine has 13 micro switches inside to provide the automation of the cleaning process. Some of these micro switches are located near the area that may get hot when running, therefore you may find pieces of asbestos inside your machine to prevent overheating of the micro switches. You should not disturb this arrangement because breathing asbestos particles is hazardous.

The work described above should only be done by a person who is confident with this type of work. If you are unsure, have it done by someone who is trained. The procedure described above will assist whomever performs the work, permitting a faster repair at a lower cost. ♦

Figure 5

dip oilers

BY JORDAN FICKLIN, CMW21

The topic of oilers, their use and preparation is one I have been thinking about since I learned about Bergeon's new "Ergonomic" oilers while attending the 2008 AWCI Convention. I guess I was intrigued by an oiler that costs 8 times as much to purchase as any other on the market. Admittedly, I purchased several and I like them. The purpose of this article is not to sell Bergeon's $25 oilers, nor is it to tell you how to prepare your oilers, because I know there are many correct methods. Instead, I would like to demonstrate how I prepare and use my oilers and the thinking behind my methods.

When cleaning and servicing a watch, one of the most important things is to place the correct amount of oil precisely on the points that need lubrication. Without the proper tool this would be an impossible task. There are three main kinds of oilers: Dip Oilers, Glass Fountain Oilers and Automatic Oilers.

I don't know any watchmakers who still use fountain oilers, but you can still purchase them so there must still be a few users. Fountain oilers use the principles of capillary action to draw a small amount of oil from the tube (like a fountain pen). I personally have never used one. Dip oilers (or oil pikes) are the most common oilers. The tip of the oiler is dipped into are servoir of oil or grease and a single drop forms on the end. This drop is then placed precisely on the pivot or friction point. Automatic oilers have a reservoir like the fountain oiler, but they also feature a retractable point which is pulled back into the reservoir and then released with a single drop of oil on the tip. The automatic oiler can be adjusted to produce a specific sized drop of oil with fairly good consistency. The Bergeon 1A oiler pictured is used for oiling assembled cap jewels. This makes the process of oiling cap jewels much easier than using a simple dip oiler. There is also another version for oiling train jewels.

My focus in this article will be on dip oilers. Overall, there are as many ways to prepare oiler tips as there are watchmakers. There are also many factors that come into play, and for different applications you may wish to have the drop form in different manners. Determining factors include:

- **Size of tip:** Affects what size of drop will form at tip of oiler
- **Surface treatment:** Determines how the oil attaches itself to oiler
- **Shape of oil tip:** Affects where on the oiler the drop of oil forms
- **Method by which oiler is introduced and removed from oil cup:** Influences how much oil forms on end

As a standard disclaimer: When servicing a timepiece, the oilers and oils need to be kept clean at all times, no matter what kind of oiler you use or how you prepare it.

The size and shape of the oiler is probably the most important factor in determining the usefulness of an oiler, and in my opinion, it's the one aspect most manufacturers seem to ignore. I was taught in school that the tips of oilers would have to be modified in order to get good results. I know other watchmakers who were taught the same thing, but they modify their oilers in a different manner. The one exception I have found is the new ergonomic oiler from Bergeon. It seems to work correctly right out of the package.

When you order a new dip oiler from your local supplier there are three different styles which may arrive. Each style has its advantages. Some oilers

dip oilers

BY JORDAN FICKLIN, CMW21

have a bulbous tip (Fig. 1) while others have a flattened spade tip (Fig. 2). The ergonomic oiler from Bergeon has a flattened spade tip with a groove carved in the tip about 2/3 up on the spade shape. (Fig. 3) This groove is designed to keep the oil at the tip and prevent it from creeping up and off the tip of the oiler. Each style is available in different sizes for applying different quantities of oil. I always start with the smallest size (usually black) because I can always add more oil, while taking it away means cleaning the whole watch again.

Figure 1

Figure 2

Figure 3

I have oilers which I have prepared in different manners for different functions. When applying oil to the escapement, it is best for the drop of oil to form on the side of the tip because the oiler will approach the stones in a manner roughly parallel to the surface of the stone, or to the escape wheel. When applying oil to a long pivot, like a fourth wheel or third wheel with driver, ideally the oil drop will form at the tip of the oiler so as not to wick off the oiler when it nears the long pivot. I have found it advantageous for the oil to be at the tip of the oiler in most situations. The ergonomic oiler allows a drop of oil to form on each side of the oiler, but the groove ensures this drop stays near the tip of the oiler.

To form an oiler, which maintains a drop of oil on the very tip, I start with a bulbous oiler. I dress the oiler by removing the rounded tip leaving a flat face (Figs. 4 & 5). I run the tip of the oiler against an Arkansas stone holding the oiler at about a 70° angle relative to the stone. When the oiler is introduced into the oil cup and removed, the resulting drop of oil forms on the flat face completing the bulbous shape of the oiler (Fig. 6). This drop of oil can be placed very precisely into an oil cup or into any corner in the watch (Fig. 7). As long as there is room to approach a flat surface at an angle, the oil can also be applied to flat surfaces like pallet stones or areas of sliding friction.

Figure 4

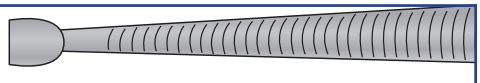


Figure 5

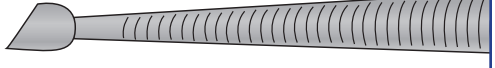


Figure 6

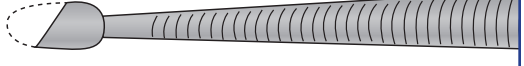
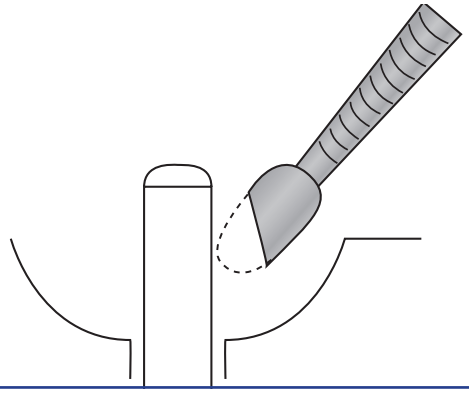


Figure 7



A spade tip oiler naturally forms a drop of oil at the sides of the tip, but to ensure the drop stays near the tip there are several different methods which work. You could try each or a combination of all of them. I like to mimic the design of the ergonomic oiler (Fig. 3) by carving a groove in the spade tip. To carve this groove I use a single edge razor blade and slide it across the tip, as though it were a saw. This forms enough of a groove to prevent the oil from creeping. Other ways to prevent oil from creeping up the tip include polishing the tip or applying epilame.

dip oilers

BY JORDAN FICKLIN, CMW21

Sometimes it's necessary to apply a very small drop of oil. The black or red oilers readily available just aren't small enough for these needs. To prepare an oiler that can apply a very small amount of oil, take a spade tip oiler to an Arkansas stone and reduce the size of the tip until it is about 30% of the original size, approximately 0.50x mm long by 0.15 mm wide. When the tip is slightly larger than the desired size, it should be polished with a cotton wheel (Figs. 8-10).

Even when your oiler has a properly prepared tip, controlling the quantity of oil depends on the manner in which you introduce the oiler to the oil cup and how you withdraw it. If you have prepared an oiler with a groove in it, or if you use the Bergeon ergonomic oiler, you want to be sure not to insert the oiler past the groove into the oil. Completely submerging the oiler tip into the oil defeats the stop mechanism built into these oilers. The best way to prevent inserting your oil too deep is to only have a very small amount of oiler in your oil cups. (You throw most of it away when you change out your oil every week anyway.) In the most basic form, the faster you withdraw the oiler from the oil, the smaller the droplet to form on the tip. When I want a smaller amount of oil I tend to drag the tip out of the oil across the dry portion of the oil well. This removes excess oil leaving a small, controlled drop.

When you need the ultra-small drop, which is necessary for lubricating the locking surface on Omega's co-axial escapement or ball bearings on an oscillating weight, you should introduce the prepared small oiler to the oil while observing with magnification. As the oiler gets very close to the oil, the oil will almost appear to come up to meet the oiler. At this point withdraw the oiler and you will be left with an extremely small drop on the oiler which can then be transferred exactly where you need it, probably using a binocular microscope.

BUYING NOTES: It can sometimes be confusing locating just the oiler you want when ordering.

This guide may help:

- Bergeon Oiler No. 5423 - a plastic handled-oiler with a bulbous tip; the oiler comes with a brass cap and 2 extra oiler tips stored inside.
- Bergeon Oiler No. 30102 is a plastic-handled oiler with flat spade tip.
- Bergeon Oiler 7013 is the new ergonomic oiler (Fig. 11).
- A-F Oiler numbers 350 - 353 are metal-handled oilers with a bulbous tip. ♦

Figure 11

challenging situations, part 2 remaking a mainspring

BY DALE LADUE, CMW21

Working on watches and clocks when parts are unavailable can be challenging. If you do not perceive something as a problem, it ceases to be a problem. When this customer's beloved digital watch needed a cell, they mentioned one of the push buttons did not function. A closer look determined the tab on the contact spring had broken away.

I briefly tried to find the contact spring through a few material suppliers but to no avail. I decided to repair the spring as a matter of expediency. The repair had to be able to withstand the pressure that occurs when the button is pushed. Additionally, the spring tension needed to be retained. I did not want to apply heat, which may have altered the temper. Therefore, soft soldering a piece onto the spring was not an option. I decided to rivet a section of alloy mainspring in place of the broken piece.

A piece of wooden dowel was turned to fit in the lathe tailstock and used as a pad to support the contact spring while drilling. A stubby spade drill was formed from a broken 1/8" shank carbide twist drill. Figure 1 depicts the drill in the headstock and the contact spring supported by the dowel in the tailstock.

Figure 1. Sturdy stubby carbide drill was fashioned out of broken 1/8" shank carbide twist drill.

Two holes were drilled in the contact spring. The first hole was drilled as shown in Figure 2, and the second hole was drilled as shown in Figure 3. A section of alloy watch mainspring of approximately the same width as the contact spring was chosen. The alloy spring was lined up with the contact spring and marked for drilling as shown in Figure 4. The corresponding first hole was drilled in the alloy spring in the same manner as the holes were drilled in the contact spring. The first hole in the contact spring and the drilled hole in the alloy spring were lined up. A piece of brass wire was

Figure 2. Wooden dowel turned to fit into lathe tailstock and used as drilling pad. The first hole drilled.

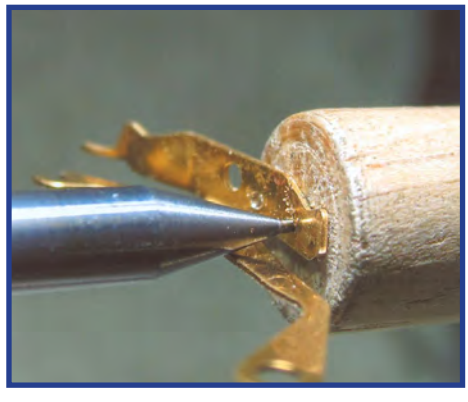


Figure 3. Second hole drilled.

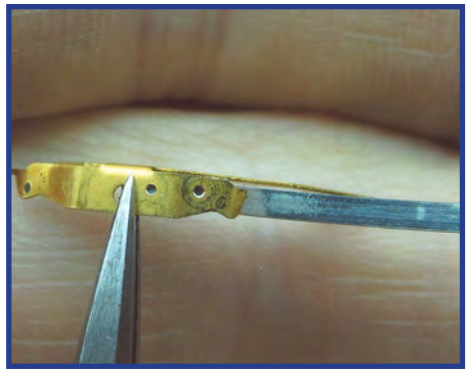


Figure 4. Watch alloy mainspring aligned and marked for drilling first hole.

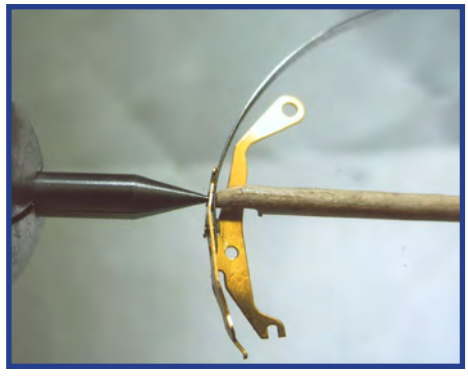


Figure 5. After riveting mainspring and contact spring together at first hole, another hole drilled in mainspring using other hole in contact spring as a guide.

BY DALE LADUE, CMW21

inserted and riveted in place. Once the first rivet was firmly attached, a second hole was drilled in the alloy spring using the second hole in the contact spring as a guide. A smaller dowel was used as a drill pad in order to reach around the 90-degree bend of the movement support section of the contact spring. Figures 5 and 6 show the setup and drilling. A piece of brass wire was inserted and riveted in place holding the new piece firmly.

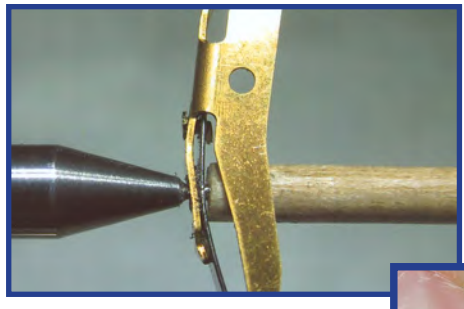


Figure 6. Smaller dowel used as drilling pad.

As shown in various Figures, there was a hole centrally located in the contact spring. A divider was used to measure the distance from the center hole to the tip of the remaining contact. The divider was turned 180 degrees and a mark was scribed at the proper length on the new alloy spring (Figure 7). The new contact was cut or ground to the scribed length and shaped to make proper contact with the movement contact terminal (Figure 8).

Figure 7. After second hole drilled, springs again riveted. Divider used to scribe proper length on mainspring.

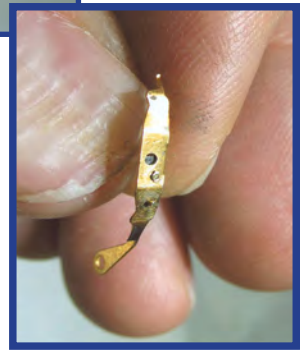


Figure 8. After cutting to length, new spring shaped.

BY DALE LADUE

Figure 9. Spring tip polished on ceramic slip.

Figure 10. View of repaired contact spring installed.

Finger cots are always used for final assembly and servicing. Repair techniques are typically performed without finger cots. Fingerprints are used as a reference for scale. Some pieces are assembled for photographing a procedure's final result prior to complete servicing (cleaning and oiling).

I used a piece of translucent tape to hold the contact spring against my finger as the new tip was contoured and polished (Figure 9). The repaired contact spring was installed and worked flawlessly as shown in Figure 10. ♦

Dale LaDue is a second generation watchmaker-clockmaker who has been a contributing author to *HT* for many years. A graduate of the Gem City School of Horology, he has been in business in the Rochester, NY area for nearly 30 years. Dale's work covers the gamut of "challenging situations" which are often the topics of his articles. Dale is also the current president of the New York State Watchmakers Association.

horological time bases

BY JEAN-FELIX PEROTTO, CSEM, NEUCHÂTEL, SWITZERLAND

Introduction

Since the dawn of humanity, mankind has used the Earth's natural rotation cycles, on its axis and around the Sun, to rhythm his daily activities. The invention of the sundial in the 3rd century BC enabled the diurnal fraction of the day to be segmented into finer divisions. Then, in the 13th century, rudimentary pendulum clocks activated by weights appeared. Featuring neither dials nor hands, they simply rang the hours. In 1658, the Dutch mathematician Huygens constructed the first real clock. It had a pendulum, was equipped with a dial, possessed a single hour hand, and its accuracy was approximately one hour per day. But the adventure had finally begun.

First used for maritime navigation, then later to regulate human activities, to synchronize trains and more recently for the Internet network and the GPS satellite navigation system to function, it became necessary to invent timekeeping instruments of increasing stability. At the heart of every clock and watch is stored a fundamental element, *the time base.* The present article retraces a brief history of this time base.

What is a time base?

Fundamentally, a *time base* is a device which produces a frequency that is as *stable* as possible. A timekeeper—clock or watch—is therefore nothing other than a time base associated with a counter and a device to display the state of this counter.

An oscillator is invariably found at the heart of a time base; however, not all oscillators are necessarily suitable. To be stable, the oscillator must be based on a *resonator*; that is to say, a physical device possessing a natural oscillating frequency or *resonance frequency*, and presenting a *high quality* factor. The *accuracy* of the time base is obtained by adjusting the natural frequency of the resonator or by modifying its environment, for example the counter.

The resonator is a passive element. It only becomes an oscillator and constitutes a time base when associated with a driving system. Time base stability largely depends on the resonator and ultimately, the clock or the watch it equips. However, at this point, it might be useful to briefly recall a few notions relative to resonators.

A bit of physics to help us understand

A resonator, more specifically *harmonic*, is a device whose state is defined by a second-order linear differential equation with constant coefficients:

$$\ddot{x} + 2\vartheta\dot{x} + \omega_0^2 x = 0 \quad (1)$$

where ϑ represents the dissipative losses and w_0 the natural pulsation of the resonator, or *resonance frequency.* When the losses are weak, the solution of this equation is a sinusoidal function of time weighted by an exponential damping term:

$$x(t) = x_0 e^{-\vartheta t} \sin(\omega_0 t + \varphi_0) \quad (2)$$

Therefore, a harmonic resonator of non-zero initial conditions produces damped sinusoidal frequency oscillations. $f_0 = \frac{\omega_0}{2\pi}$ However, as can be observed in a resonator with a chronometric vocation, the damping factor plays a key role.

The fundamental parameter qualifying any resonator is its quality factor or Q-factor. It is a dimensionless number that can be interpreted in two different ways despite being very closely linked. Firstly, Q can be considered as the ratio between the internal energy W of the resonator and the dissipated energy $\triangle W$, due to the Joule-loss during an oscillation cycle:

$$Q = 2\pi \frac{W}{\Delta W} \quad (3)$$

Consequently, a resonator with a high quality factor requires less energy to drive than an identical resonator with a low quality factor. Another slightly more abstract interpretation of the Q-factor,

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but equally important to understand, states that the stability of a resonator is proportional to its quality factor:

$$Q = \frac{\omega_0}{\Delta\omega} \approx \frac{\omega_0}{2\vartheta} \quad (4)$$

In this equation, the term $\triangle W$ (known as bandwidth of the resonance) represents the amplitude of fluctuations that may affect the resonator's oscillation frequency, under the invariably perturbing effect of the driving device or even the natural noise of the resonator.

Factors not taken into account here include frequency fluctuations due to external causes such as temperature, pressure, etc., that affect in a first approximation only the frequency. Therefore, considering its negligible natural noise, a free resonator oscillates at a perfectly defined frequency of w_0, but ultimately comes to a stop. Inversely, a driven resonator certainly oscillates indefinitely but at an imperfectly defined frequency, comprised between $\omega_0 - \frac{1}{2}\Delta\omega$ and $\omega_0 + \frac{1}{2}\Delta\omega$.

Consequently, time base stability is directly linked to the resonator's quality factor: the higher it is, the less sensitive the resonator is to its drive mechanism. This remains so for all resonators, no matter their type—mechanical, electrical, electro-mechanical, optical or even atomic. Indeed, resonator improvement remains a constant quest, begun several centuries ago, persistently working towards the attainment of higher and higher quality factors.

The pendulum – a venerable ancestor

Until 1930, the all-category time base champion was undeniably the Shortt pendulum clock [1]. One meter high, it was thermo-compensated and thermo-regulated. Oscillating under vacuum with a period of 2 seconds, it was periodically driven by tiny electrical impulses coming from a less stable

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slave pendulum, itself synchronized with the master pendulum. The transmission of time to users was electrically ensured by the slave pendulum.

Shortt's pendulum equipped chronometry observatories the world over and transmitted the most accurate time in its day. Its stability, around 0.3 seconds per year, was such that for the first time in history it became possible to measure the fluctuations of the Earth's annual rotation speed on its axis. Using the relation (4), the quality factor of this pendulum clock can be estimated at several tens of millions, indeed far superior to that of quartz resonators housed in our electronic watches.

The pendulum clock, as an horological time base, displayed two major defects: its resistance to miniaturization, and the difficulty of transportation due to its sensitivity to vibration and dependence on its geographical positioning (the Earth is not a sphere and it rotates). Therefore, from 1930 the chronometric pendulum clock was replaced by more stable versions and relegated to the ranks of decorative clocks.

Torsion pendulums and balance-springs

The 19th century saw the introduction of clocks with a time base constituted by a torsion pendulum. This type of resonator no longer relied upon the Earth's gravity but used a rotating heavy weight attached to a torsion wire. The Q-factor of such resonators was excellent, although inferior to that of Shortt's pendulum clock, as the energy dissipation in the torsion wire cannot be entirely cancelled.

In 1928, the Frenchman Jean-Léon Reutter built the first model of the torsion pendulum, the Atmos Clock, on the basis of his patent. Still manufactured today, this mythical clock has the particularity of drawing its energy source from infinitesimal temperature and atmospheric pressure variations. Such a performance, totally ecological before its day, is made possible according to the relation (3), on

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account of a good quality factor and the very low frequency of its resonator, approximately 0.05 Hz.

Well before that, in 1675, Huygens described a resonator composed of a rotating weight associated with a spiral spring. The essential advantage of this resonator over the traditional pendulum was that it could function in any position and be miniaturized at will; two indispensible requirements for the conception of portable timekeepers such as the pocket-watch and, later, the wristwatch.

Functioning within the 2.5 to 5 Hz range and presenting a quality factor of 100 to 500, today, the balance spring resonator spiral has attained a very honorable chronometric standard. Recently, silicon manufacturing techniques stemming from microelectronics technology have enabled the development of an "all-silicon" balance spring resonator with further improved performance levels [2]. It is also important to mention that it is via the balance spring in the 1950s that electricity made its judicious entry into the world of wristwatches [3]. Indeed, the first electrically- powered watches possessed a balance dotted with a minuscule magnet passing through the axis of a flat coil. At each balance oscillation, an electrical contact enabled the battery to send a current through the coil thereby creating, for a brief instant, the driving of the balance. Additionally, for the first time, a battery replaced the traditional spring as an energy source.

1st revolution: the watch without a balance

At the beginning of the 20th century, watchmakers knew that watch-accuracy improvements could only be achieved by increasing the resonator's frequency and quality factor. Thus, in 1966, at the expense of solid technical effort, the manufacturer Girard-Perregaux was able to push the frequency of the balance to 36,000 Ah (oscillations per hour, the official frequency unit for watchmakers), that is to say 5 Hz, while traditionally it oscillated at around 20,000 Ah. Boosting the frequency to higher levels implied purely and simply abandoning the sprung balance to the benefit of other things still to be invented. However, it was impossible to mechanically or even electrically drive any oscillating resonator, whatever its type, beyond a dozen hertz. It was only with the invention of the transistor by three American scientists, Bardeen, Brattain and Schockley, in 1947 that the situation changed, permitting watchmaking to take off and master high frequencies.

Tuning fork integrated in the Bulova Accutron

All the resonators mentioned here up to now possessed *located constants*, that is to say whose frequency is defined by a mass *m* (or inertia *I*) and a perfectly located spring *k*. Attaining increasingly high frequencies meant shifting to resonators with *distributed constants*. The frequency of this resonator type depends, in this case, on the material density, its Young's modulus E, its shape and geometrical dimensions. The best known resonator in this category is the *tuning fork*, particularly appreciated by musicians for its precision of tone and purity. Thus, with a good tuning fork, a transistor, a magnet and a coil, it is easy (in theory at least) to create an excellent time base. Born from this idea, the *Accutron* watch saw the light of day in 1960 in the USA, invented by Max Hetzel, a Swiss watchmaker working at Bulova. Later, in Switzerland, jointly at Ebauches SA and the CEH (Centre Electronique Horloger), appeared the *Mosaba*, the balance-less watch [4].

1950-1970, the crazy inventive years

Figure 1 is a schematic representation of the tuning fork time-base such as it equipped the first electronic watches of the 1960s. The steel tuning fork, with 25 mm arms, occupied the full watch diameter; it oscillated in flexion at 300 Hz. At the extremity of each fork was a tiny magnet surrounded by an equally small coil. The tuning fork was electromagnetically driven by a very weak electrical current passing through the coils and controlled by a revolutionary component: the transistor. The tuning fork was mechanically coupled to a small toothed wheel via the intermediary of a ratchet. This 3mm diameter wheel had 300 teeth; at each tuning fork oscillation, the wheel was pushed one tooth forward

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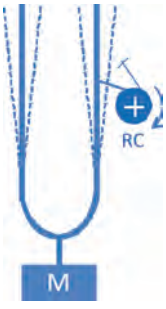

Figure 1: Tuning fork in flexion and its ratchet

and via a gear reduction train drove the watch hands.

The perfect symmetry of the tuning fork virtually canceled any reaction of the support (M), an indispensible factor in preventing the watch from turning itself into a vibrator. Despite the delicacy of its implementation, the use of the tuning fork was an excellent idea and, as can be noted, totally ahead of its time. Nonetheless, the tuning fork presented three major disadvantages:

1. Driving the hands was carried out by using a small amount of energy from the tuning fork, which in this case fulfilled a dual role, acting both as a resonator and a motor. However, taking energy from a resonator, according to equation (3), produced a totally undesirable effect, diminishing its quality factor. But with only a single transistor, how was it possible to achieve a better result? 2. The second inconvenience of the flexion tuning fork time base was its positional dependence. Due to the earth's gravitational pull, a tuning fork pointing upwards (as in Figure 1) vibrates at a slightly lower frequency than when pointing downwards. 3.The third inconvenience of the tuning fork/ratchet system was its poor resistance to shock. Any slight lateral knock on the watch case could interrupt (and from time- to-time even speed up to several seconds) the rotation of the ratchet wheel! Added to this was the unpleasant and continuous whistling sound emitted by the tuning fork, which also contributed to a diminished quality factor. The latter was however situated between 1000 and 3000; that is to say, clearly higher than the sprung balance resonator.

Motivated by the conceptual opportunity offered by the tuning fork/transistor combination, a frantic creative urge pushed engineers to find the horological Grail; an acoustic resonator without positional error and resistant to shock.

All shapes and vibrator modes were envisaged, discussed and tested. Even the sphere, with its flawless symmetry, became a candidate, but unfortunately a point of attachment and suitable drive system were never found!

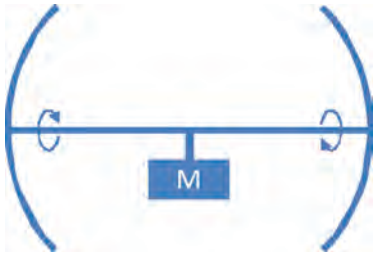

Figure 2: Tuning fork under torsion

At the CEH, two projects among the most successful emanating from this effort were the Alpha caliber, an extension tuning-fork, and, at the very beginning of the 1970s, the Gamma caliber using a torsion tuning fork as represented in Figure 2. This steel tuning fork was composed of a torsion bar (horizontal line on the diagram) fixed at its center by a foot that was a part of the watch frame (M). The arm occupied the full diameter of the timepiece and was terminated at each extremity by a rotating weight representing the resonator's inertial component. These two weights oscillated in opposing phase, cancelling the net moment applied to the watch. Resonator driving and the capture of its movement were similar to those of the Hertzel tuning fork. Although the position error had this time nearly been canceled, the disadvantages 1 and 3 still largely existed. In view of the emerging quartz watch, the Gamma caliber was abandoned in 1971 and all R&D activities in the acoustic resonator domain were interrupted.

Parallel to these research efforts, a study group at the CEH investigated the possibility of using a radioactive isotope as a time base. Therefore, this no longer had anything to do with a resonator. By counting the disintegrations of a radioactive element one could, it seemed, develop a *statistical clock*. However this clock presented such poor stability in the short to medium term, that this project was also rejected.

During these wildly innovative years, a balance clock that was radio-synchronized by the Prangins emitter near Geneva was also invented at the CEH. Baptized the *Pendulette Prangins*, this clock was powered by a 1.5V battery and consisted of an electrically driven balance spring time base and a radio sensor that picked up the seconds and double minute beeps of Prangins, emitted on 75 kHz waves. Every minute, the balance phase (adjusted to oscillate slightly too fast) was mechanically corrected from 0° or 180°, so as to maintain an average frequency identical to the Prangins reference. This undoubtedly was the first radio-synchronized clock

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in history—a preview of the radio-synchronized watches [6] to come.

Finally, a non-mechanical resonator was the object of several studies at the CEH and around the world. Well known by electronics engineers, it was based on an *LC circuit*. The resonance frequency of such circuits is $f_0 = \frac{1}{2\pi\sqrt{LC}}$ with a quality factor, $Q = \frac{1}{R}\sqrt{\frac{L}{C}}$ where R is the circuit's inevitable electrical resistance. Despite using the best L and C components possible, only a very modest quality factor is obtained, barely surpassing 100. Thus, the LC resonator as a watchmaking time base was also abandoned.

Beta 21 quartz schematic and device

2nd revolution: quartz technology

In 1921, while Shortt was perfecting his famous pendulum in England, just over the ocean, on the other side of the Atlantic, a mini-revolution was underway. Walter Cady, a physics professor at Wesleyan University had just succeeded in making the first quartz oscillator function.

The quartz crystal, the most abundant crystalline form of SiO^2, is a true gift of Nature. Not only does it possess excellent mechanical and chemical stability, but also piezoelectric properties: electrical charges appear on the crystal's surface under the effect of a mechanical constraint and reciprocally. This property facilitates the coupling of the resonator to its electronic driving system. No more coils and magnets, just simple electrodes deposited on the surface of the crystal sufficed. Quartz, of course, remains a mechanical resonator but now driven electrically and not electromagnetically. Furthermore, an appropriately cut quartz crystal presents good frequency stability under temperature variations; an essential quality for a watchmaking time base. However, the real advantage of quartz over its steel predecessors is its Q factor, that expresses itself in hundreds of thousands even millions for superior performance quartz.

Shortly before 1930, the first quartz clock was constructed in the USA. Based on electronic tubes, its volume and electrical consumption was such that it was virtually impossible for anyone to imagine that one day it could be worn on a wrist.

Yet, at the end of the 1930s, quartz clocks had already replaced the Shortt pendulum in observatories. However, quartz really took off in industry during World War II and was used to equip radios and radars of the American army.

The arrival of the transistor enabled an initial and significant volume and consumption reduction of quartz clocks. Thus, around 1955, battery-powered quartz marine clocks made their appearance with a close to one-liter volume. But the invention of the integrated circuit in 1958 by Jack Kilby working at Texas Instruments made it possible only ten years later, and closely tailed by the Japanese, to develop at the CEH the first ever quartz wristwatch, commercialized under the name Beta 21 [5].

The Beta 21's resonator consisted of a 23 mm quartz bar oscillating in flexion at 2^{13} = 8192 Hz around two vibration nodes. The bar was suspended in a vacuum capsule by 4 wires also acting as electrical connectors for the driving circuit (Figure 3).

Figure 3: Model of Beta 21 quartz

There was no longer any question of using the quartz's mechanical movement to drive the hands. An electrical signal of the same frequency as the quartz was picked up in the driving circuit to control an electronic frequency division chain. Consequently, the resonator's quality factor remained unaltered. In the Beta 21 watch model, this division chain, constituted of approximately fifty transistors

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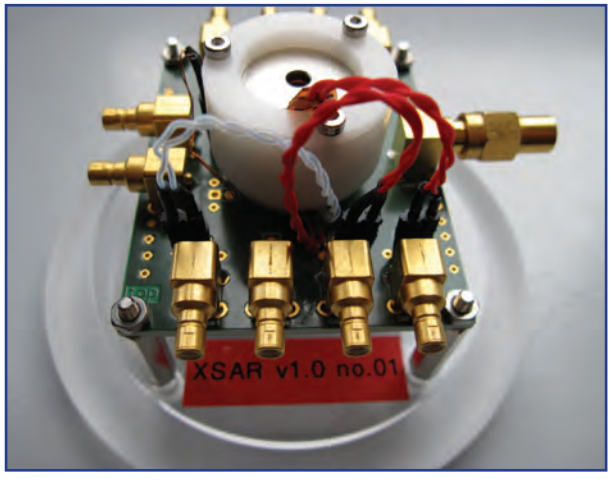
integrated on the same silicon chip, produced a signal at 256 Hz, capable of driving a minute vibrating motor. The latter activated a ratchet, then a gear train, as in the Accutron, but this time with quartz precision and a much improved resistance to shock. The choice of a 256 Hz motor was dictated by the weak number of transistors it was possible to integrate on a single silicon chip in 1967. In watch circuits today, it is easy to divide quartz frequency up to 1 Hz to control a Lavet type stepper motor, for example.

Current electronic watches all use a tuning-fork shaped quartz resonator, oscillating at 2^{15} = 32768 Hz (Figure 4). The quality factor of such a resonator can reach 300,000, and the electrical power necessary to drive it is reduced to a few nanowatts only. Such resonators have a negligible position error thanks to their great rigidity and weak tuning fork weight.

Figure 4:
Quartz 32 kHz tuning fork

The only weakness of the 32 kHz quartz tuning fork is its thermic sensitivity (around 0.04 ppm/°C). When worn, this represents an annual error rate of one to two minutes. Other higher frequency vibration modes (around 2 MHz), associated with other quartz crystallographic cuts, made it possible to develop resonators that were clearly less temperature sensitive. However, their more elevated electrical consumption negatively affected the autonomy of the watch. From 1970 onwards, the CEH undertook diverse studies to find solutions to this complicated thermic problem. One such research project consisted of using two quartz; an initial 32 kHz low consumption quartz, synchronized by a second 2 MHz high-precision one, periodically activated for a brief instant. After that, other original frequency thermo-correction techniques were developed at the CEH, then at CSEM, supported by its watchmaking partners. It is currently possible to predict that the stability of a timepiece equipped with a quartz 32 kHz tuning fork, in association with the most sophisticated thermo-correction techniques, will soon be close to 10^7 that is to say, 3 seconds per year.

The quartz watch has just celebrated its 40th anniversary. With resonators occupying an incredibly miniaturized volume of 1.4 mm3 [7] and stability rates grazing one second per year, the quartz watchmaking time base is a brilliantly successful industrial concept.



Prototype of the first CSEM miniature atomic clock. Further size reduction and integration are ongoing.

3rd revolution: the atomic watch?

Progressing beyond quartz stability implies turning to frequencies that are no longer defined by macroscopic properties of matter (density, Young's modulus, etc.) but by certain fundamental and immutable atomic properties.

We have known for almost a century that atom electrons possess perfectly definable energy levels and that the transition of one electron between two separate levels by an energy $\triangle E$ is accompanied by the emission or the absorption of an electromagnetic radiation of frequency $f=\triangle E/h$, where the denoted h is the Planck constant. These frequencies are generally situated in the infrared domain or worse, so inaccessible to electronic circuits. However, certain atoms possess so-called *hyperfine* levels separated by miniscule energy differences like the associated wave found in the hyperfrequency domain, and therefore perfectly accessible to current electronics. Hence, the rubidium 87 atom has two hyperfine levels whose transition frequency

BY JEAN-FELIX PEROTTO, CSEM, NEUCHÂTEL, SWITZERLAND

is 6.8346826128 GHz with a 0.5 Hz bandwidth still corresponding to, according to relation (4), a quality factor of 10 billion! This particular rubidium 87 characteristic enables the development of a frequency standard, called a *rubidium clock*, presenting a better than 10^{10} middle-term stability corresponding to less than one second in 300 years! Other atomic time bases based on a cesium jet, such as atomic fountain clocks, attain ultimate stability rates of around 10^{16}, corresponding to the measurement of the age of the universe to the nearest second! The miniaturization of such clocks to wristwatch format remains understandably unrealistic.

However, in the same way as the huge quartz clocks of the 1930s were reduced to a liter in the 50s, to finally comfortably fit in a refined ladies' watch, perhaps the rubidium clock will follow in the same footsteps. Today, several laboratories such as CSEM and IMT-EPFL are working on rubidium time bases, whose volume is already expressed in cm3 fractions. In these "clocks", a laser modulated to a half of the frequency of the hyperfine transition replaces the costly microwave source. Nevertheless, the consumption rate of these mini-atomic time bases still remains excessive: a hundred milliwatts, for the most part used to heat the rubidium cell to 80°C (metal maintained in vapor phase) and to regulate the system's temperature to a thousandth of a Kelvin. Other similar research projects using cesium atoms may lead to even more compact and less energy-hungry time bases [8]. However, it is to be noted that the long-term stability (one year) of a miniature atomic rubidium clock will only be slightly superior to that of the best quartz standards.

The ultra-mini atomic time base domain represents an immense opportunity in terms of innovation. Even if "atomic watches" are unlikely to be seen on ladies' wrists in the near future, our enhanced precision GPS receivers and faster and more reliable computer networks will benefit directly, as well as a vast array of instruments, technical equipment and applications for which extreme time base stability is a determining requirement.

Conclusion

In seven centuries of technical evolution, time bases have gone from an accuracy rate of one hour per day to approximately one second per year. Their volume has been miniaturized from 1 m^3 to 1 mm^3 and functioning power requirements have plummeted from 100 milliwatts to 10 nanowatts. These three fundamental and evolving gains alone already cover 18 orders of magnitude, making horological time bases one of the most improved and astonishing products of the industrial adventure.

If you would like more information on this article you can contact the author at: jean-felix.perotto@csem.ch ♦

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2009, #61

questions & answers

BY DAVID CHRISTIANSON, CMW21, FAWI

QUESTION:
Enclosed is a picture of a pocket watch which I would like information on. I would appreciate any help you could give.

Ron Melocoton
Dunnellon, FL

ANSWER:
Your watch has an interesting story behind it. It has Turkish numerals on the dial so it was made specifically for the Turkish market. The half-plate movement is Swiss made. From the style of the movement and the case bow, your watch dates near the end of the 19th century.

The dial is signed: "Systeme Roskopf." The story of the Roskopf watch is a fascinating story about Georges Frederic Roskopf (1815-1889) and his lifelong struggle to produce a simple but accurate watch for the working lower middle-class. He was an idealist who wanted to eliminate all unnecessary ornamentation and unnecessary work on the outside of the case and on the movement, develop a quality non-precious metal case, and apply these savings to make a quality internal mechanism. He wanted to use materials that were of the highest quality and pay his workers amply in order to maintain a high standard of workmanship.

He succeeded with his "proletarian watch" in 1865-1867. He used a three wheel train that drove the hands directly from the main wheel. By eliminating the center wheel he could put in a larger mainspring barrel that extended beyond the center of the watch and was large enough to use Adrian Philippe's patented free mainspring that would provide a greater than normal motive power to the train. His watches were stem wound with pin-set hands. He used a tangential pin lever escapement on a removable platform for ease of manufacture and adjustment, and with a bendable pallet fork tail of his own design for ready adjustment, also. When Georges died in 1889 a number of firms claimed to be his "true successor" but only his son's firm of Wille Freres and their associate Charles Leon Schmid actually succeeded him. At this time Switzerland did not have a patenting system so there were a number of imitators of his now popular design. Through the years the Roskopf name became synonymous with the pin lever escapement even though Roskopf did not invent it, Louis Perron (1779-1836) did. Roskopf modified the escapement for ease of manufacture and adjustment and he patented it in Switzerland's neighboring countries.

In the beginning the imitation Roskopf watches, for the most part, were faithful to the original Roskopf design and the imitators often proudly put the Roskopf name on the dial, capitalizing on the Roskopf name and reputation. By the time your watch was made, most of the Roskopf imitators, including Roskopf's son, were using a normal five-wheel train ebauche (rough movement) with what had become the "Roskopf system" of a quality watch with the Roskopf pin lever escapement design.

QUESTION:
If you answer questions on watches, the attached are photos of a watch I found at a watch auction. What is it? Thanks in advance for any information you have.

Paul M. Hurst

ANSWER:
I think what you have is one of the better made Swiss imitations of American watches of the late 19th century.

Swiss made imitations of American watches (called Swiss fakes) appeared during the Civil War and were distributed through the early 1900s by domestic importers in an attempt to compete with the success of the machine-made American watches. They flooded the American market with low grade copies of the American watch marked with American sounding place names and/or makers.

questions & answers

BY DAVID CHRISTIANSON, CMW21, FAWI

In March of 1871 the U.S. Congress passed a law that required imported watch movements to have their country of origin engraved on them. The Swiss tried to get around this by engraving "Swiss" in highly engraved areas that made it very difficult to read the actual origin of the watch.

The early Swiss fakes were mainly 18/size, full plate models, key wind and key set with Roman numerals on the dial and made to fit American made cases. They often had crude lettering and very light gilding, almost silver in color. The dials usually didn't have a name on them and the movements didn't use the words "Patent (pat.) Pinion" or have the individual patent holder's name on them that was common with American made movements They had two dial feet instead of the usual three on American models and they were made of crudely finished components. They used solid balances, some with timing screws, as opposed to the American-cut balances. The balance bridges typically had "fat" balance cap jewels in large blued steel settings that were held in place with three screws instead of the two that American manufacturers used. Usually there were scribe marks on the dial side of the front (bottom) plate made by a depthing tool to locate the pivot holes. These scribe marks are not normally found on the mass-produced American watch movements. Most of these Swiss fakes have slow trains (14,000 beats per hour), a beat that was found on only the earliest of the American-made movements. The ends of the pillar posts on American movements were machined flush with the outside of the front plate but the Swiss imitations were left rough. The Swiss watches usually had larger balance cocks than the American movements that they were imitating.

In spite of the 1871 "county of origin law, Swiss imitations without a country of origin mark continued to be imported into North America. By 1885 Swiss imitations were of better quality and resembled the popular American watches more closely. Henry B. Fried remarked in one of his articles that "this writer has a number of the early imitations, two of which are marked 'Massasoit Watch Company, Boston, Mass' and look just like early William Ellery watches. Having parts that can interchange with the originals, they would fool many experts."

Most of these better quality fakes were engraved in old English style lettering and carried impressive names. The serial numbers seem to be consistently in seven digits. Numbers engraved on the underside of the back plate do not always agree with those visible on the barrel bridge. These better quality imitations had smaller cap jewels, two cap jewel screws, shorter balance cocks, and three dial feet allowing for the use of American dials. They often used a February 1883 patent date, many with obvious Swiss patents or trademarks. They were usually stem wind and pin set.

In spite of their better over-all quality and design, the traditional light gilding of the plates, scribe marks on the front of the lower plate, the slow train, and other distinctly Swiss features continued to reveal their Swiss origin to those familiar enough with these watches.

The 1898 Dingley Law placed more stringent restrictions of imported goods and as a consequence the Swiss imitations of American watches disappeared from the American market between 1900 and 1910.

I can find no listing of the name on the movement, A.J. Pratt of New York, as a watchmaker on any of the extensive world-wide lists of watchmakers nor did an internet search turn up anything for Pratt or for the name of E.F. Bossert on the dial.

I would suspect that A J Pratt of New York is a fictitious name, although E F Bossert was probably a jewelry and/or watch distributor (wholesaler).

Send your Questions to *Horological Times*
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IS YOUR POLISHING "UP TO SPEED?" PART 1 OF 2 BY JOHN W. SAFRANEK, MS, EDITOR-IN-CHIEF

INTRODUCTION

The following are highlights of the Chronometer Club Seminar held on August 4th, 2010 preceding the AWCI 50th Annual Convention and Educational Symposium in Cincinnati, Ohio.

Topic: Case & Bracelet Refinishing
Instructor: Mark Jones, Senior Technical Instructor for Rolex, USA
Attendance: 55 Registered Chronometer Club Members

Due to the number of participants and the location, the instructional delivery of this seminar was theory and demonstration utilizing close-camera and extremely high-quality projection equipment. Everyone had an excellent view of the techniques being demonstrated.

The agenda for seminar included the following topics:

I. Metals
II. History of Metals and Polishing
III. Work Space Organization, Inspection, Identification and Piece Preparation
IV. Bracelet & Case Refinishing (per Rolex procedures)

Mark Jones, Senior Technical Instructor for Rolex USA reviews the seminar agenda for our appreciative Chronometer Club audience. The 10th Anniversary seminar was one of the most well-attended in the Club's history with 55 members participating.

Part one of this article will cover agenda items I – III of the seminar, and will provide an overview of the seminar topic highlights. Mr. Mark Jones delivered an extremely thorough presentation, packed with information and tips on the topic. I hope you enjoy the following highlights of the information he shared with our club.

METALS

- Mr. Jones provided a detailed overview of the metals utilized in Rolex watches, including a video and a brief explanation of the evolution and unique properties of the proprietary 904L, which is, by all accounts, the best stainless steel in the world. "At Rolex we treat steel as if it were a precious metal."
- Mr. Jones also discussed the importance of Rolex's 'Everose' which is a rose gold that has been stabilized in production to retain its original rose luster. The unique nature of Rolex's white and yellow gold was explained. "Our white gold stays white since we do not use one par ticular type of metal, and our yellow gold is blended so as not to produce allergies." "Rolex does all of its own gold alloying which keeps the process safe and preserves our trade secrets," Jones concluded.

HISTORY

- The history of polishing was explained in a unique way by Mr. Jones, who began with jocular, Socratic questioning and some very witty and humorous references regarding the use of the term 'bling.'
- Mankind's desire for weapons and bright, shiny things seems to have set the stage for the development of not only metallurgy, but also the inherent desire to make these metal objects both attractive to the eye, and able to capture and reflect light in curiously novel ways.
- Many former, famous scientists were mentioned including Salvino D'Armate (inventor of the first eye glasses), Leonardo da Vinci (introduced the idea of an orbital system for polishing and designed the first machine for polishing mirrors), Christian Huygens, (inventor of the pendulum clock, and builder of the first mirror polishing machine using da Vinci's drawings), Thomas Young (worked on disproving that light was particles and introduced wave theory), and Robert Hooke (worked with Young on wave theory and invented the anchor escapement) and James Clark Maxwell & Heinrich Rudolf Hertz (introduced the photoelectric effect and experimented with reflection and refraction).
- Finally, Albert Einstein's early work on time and motion was referenced along with the year 1905, known as the 'year of miracles.' This was also the year Rolex was born. (Coincidence? We think not!)

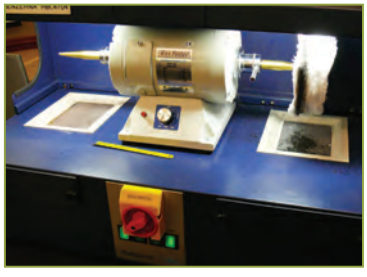
IS YOUR POLISHING "UP TO SPEED?" PART 1 OF 2 BY JOHN W. SAFRANEK, MS, EDITOR-IN-CHIEF

SHOP ORGANIZATION

- This section included numerous photos of both ideal and improper polishing work areas. These were actual photos of polishing rooms used by watchmakers and jewelers. Mark prefaced the photos viewed by Chronometer Club members, "The idea is not to be critical, but to give 'a view of the workspace.'"
- Mr. Jones continued, "We need to think of this as something that is part of our job, a very important part. This is what the customer sees. The outside. The polish and the finish. They judge us on that. When a watch comes back from Rolex, the customer looks at the outside."
- Mark further framed the importance of this aspect of the topic, "What is actually in the polishing room? What is the value of what you are polishing?"
- Health issues associated with not keeping clean and using inappropriate vacuum systems were stressed, followed by more photos of 'scary' set-ups which clearly showed a lack of health and sanitation, and a total lack of vacuum extraction of polishing residues. Mark stressed, "Proper eye and lung protection should always be worn, particularly if not using an enclosed-hood polishing machine with complete extraction/filtration."

Mark Jones demonstrates the proper use of personal protective equipment, essential to health and safety during polishing or refinishing.

- How should the ideal polishing room be set up? Clean and organized. Good workspace, closed and away from the watchmaking benches, which is essential for dust control. Good lighting overhead with bench lamps, as well as machine lights. Good ventilation in a negative flow room with a good dust collector. Tool organization boxes of pegs for compounds and wheels. Drawers which can close and/or cabinets for proper storage and to prevent 'cross contamination' of compounds, metal residues, etc.
- Mr. Jones discussed the necessity and importance of a variable speed motor for refinishing and polishing work.



The Ray Foster P90 'Dental Lathe' utilized by Rolex USA for polishing and refinishing tasks with specialized spindles, advertises 300-4000 rpms at 1/3 HP for the full range with quick-change chucks a big plus.

- The motor utilized in the seminar and discussed by Mr. Jones was a 'Ray Foster' variable motor, the 'PR90' which can be viewed on the manufacturer's website at http://www.fosterdental.com/pages/lathe.htm. The contact information for the manufacturer is: Ray Foster Dental Equipment, 5421 Commercial Drive, Huntington Beach, CA 92649 Phone 714/898-7795, Toll Free 800-654-4519, e-mail: sales@fosterdental.com

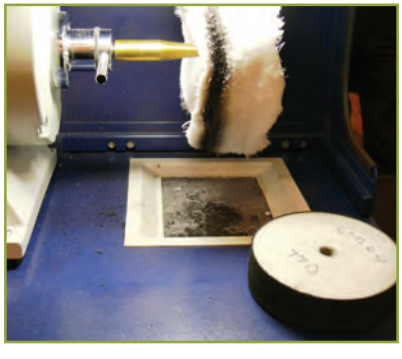
Specialized con-loc arbors utilized with Artifex wheels.

- One set of spindles for use with this machine were the SD 5000-R – Spindle W/Flange for Variable Speed (Right) and SD 5000-L – Spindle W/ Flange for Variable Speed (Left). Rolex has also made a specialized flange which you need. This can be ordered from them if you have the correct type of account.
- Variable speed was critical due to the compounds and the types of wheels which required lower rpms.

IS YOUR POLISHING "UP TO SPEED?" PART 1 OF 2 BY JOHN W. SAFRANEK, MS, EDITOR-IN-CHIEF

An alternative to the Ray Foster P90 is the Arbe Machine Mfg. PM504, boasting a ½ HP motor and full torque at any calibrated speed between its rated 0-3450 rpms (3600 rpm actual). This unit can be configured with dual 'Super Flow' fully-enclosed polishing hoods which is important for health and lung concerns. For Arbe Machine (www.arbemachine.com) contact the distributor: Jules Borel & Co. (www.julesborel.com 800.776.6858).

New cotton buffs must be properly prepared or 'combed' in order to produce the surface necessary for a high luster finish, and the frayed ends of cotton must be trimmed for an even profile on the wheel.



Buff and feels wheels on a machine dedicated to be used with Gray Menzerna. Note the proper loading or charging of the buff on only 1/3 - 1/2 of one side.

This is the author's custom-made Arbe stand-up polishing and filter system consisting of a cartridge filter polishing system with 100% airflow at 1100 CFM. It uses a 1 HP motor to accomplish this. The Arbe filters polishing dust and residues through a two-stage system, including a 1st stage cartridge down to 1/3 micron, and a 2nd stage HEPA exhaust filter boosting efficiency to 99.99%.
This system captures nearly all airborne allergens including dust and pollen. The air going into this polishing machine is actually CLEANER when it exits AFTER polishing! In the background is a crystal-clear view of Mt. Watzmann over Berchtesgaden in Bavaria, which serves as a reminder of why clean air is critical to good health!

- Wheels necessary for proper work included: Cotton 150 X 24 (very high thread count of fine linen with front-to-back and back-to-front binding is necessary); felt in 120 X 25 size; artifex (20-mm mount) in medium and soft (soft for curved backs of oyster bracelets and medium for hard cutting such as on bracelets that have heavy damage); a buffex wheel in a fine grade for satin blending of finishes (this grade also does not cut through the protection tape at the appropriate lower speeds); a cotton buff dedicated for polishing plexi-crystals.

- Compounds which were explained included: Menzerna White Polishing Compound (also a yellow which is close to the white on the website); the M paste developed for Rolex is a diamantine paste product, which is also used in combination with variable speed–it becomes more of a burnishing compound than a cutting

IS YOUR POLISHING "UP TO SPEED?" PART 1 OF 2 BY JOHN W. SAFRANEK, MS, EDITOR-IN-CHIEF

compound. Additional compounds include Menzerna Gray (ref. 4704), Finishing Pink and Crystal-Kleer.

Gray Menzerna as it appears after removal from carton and use to charge wheels.

- Mr. Jones explained, "Compounds come in two different forms, a dry and a waxy (paste). Originally Rolex used a higher wax content compound that adhered nicely to the wheels and gave a good finish. Recently they have switched to a drier compound that achieves a quicker high polish and makes it easier maintain the wheels. Compounds and oils are available to ORJs."
- Mark reminded us, "There's an old saying, 'what's good for Rolex is good for everybody.'"

Part two of this article will appear in subsequent issues of this publication.

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THE FEMININE SIDE OF HAUTLENCE HL^{C} IN CIRCULAR FORM

By offering a movement that has been developed and manufactured independently as part of its collection, this young manufacture is revealing the extent of its intention to transcend time. Since its inception, the HAUTLENCE brand, based in the heart of Neuchâtel, has set its sights on creating innovative watchmaking concepts and bringing them together with art, sometimes contemporary or classical. By playing on the repetition of circles—down to the arched sections reserved for reading the minutes—the round HL^{C} remodels its dial with the geometry that makes an allusion to the repetitive nature of infinity. Watch features include a thinner 41mm case and mother-of-pearl dials with four horns that are screwed to the outside of the case, enhancing the adjustment of the pivoting strap. This woman's watch retails between $50,000-$60,000, depending upon the customization of diamonds.

Hautlence states that a real watchmaking manufacture exists primarily through its capacity to continue producing calibers that differ from their predecessors. With its 3rd caliber, HAUTLENCE believes it has sealed its entry into the circle of brands that have chosen to inscribe their names in watchmaking history.

NEW PRODUCT RELEASE FROM SWISS LEGEND: MILITARE LIMITED EDITION

This new, rugged "military" design has definite appeal to a male target audience. The limited edition Swiss-made watch has an automatic chronograph caliber: ETA 7750 25 jewels. The chronograph is 60 second, 30 minute with 12-hour counters. It's constructed of stainless steel and black PVD plated with sapphire crystal. Other important features are the triple canteen covers, day and date luminous display, an oversized case and a VJ7750 movement. The Swiss Legend Militare Limited Edition retails for around $3,000.

HOROLOGICAL JOURNAL (HJ) NOW AVAILABLE TO U.S. SUBSCRIBERS

Starting October 2010, the British Horological Institute's monthly publication, *Horological Journal (HJ)* will be available to U.S. subscribers.

Believed to be the world's oldest continuously published technical journal, *HJ* has for many years been available exclusively to members of the British Horological Institute. Now, at just £44 a year, the new *HJ* Subscriber option is available to U.S. clock and watch professionals and enthusiasts.

To subscribe at the new rate, contact the BHI at +44 (0)1636 813795 with your credit card details, or go to www.bhi.co.uk and follow the "HJ Subscriber" link to our secure payment facility. For a preview copy of HJ go to www.bhi.co.uk and follow the links for *"Horological Journal"* and "Sample Copy."

This initiative gives clock and watch enthusiasts around the world an introduction to the BHI, including the services and products available to anyone who would like to become a member.

Do you have information regarding this month's requests? Do you need information about one of this month's responses? If so, send your information to ***Horological Times*** **Bulletin Board**, 701 Enterprise Dr., Harrison, OH 45030-1696. PH: 866-367-2924, ext. 307, Fax: 513-367-1414, e-mail: adunn@awci.com.

A TECHNICAL RESEARCH REQUEST:

From G. Price Russ "Olins Patent"

In a Dec. 09 article in *Horological Times*, Dale LaDue uses a chuck described as "Olin's Patent." I was able to locate this patent and wanted to share this information with the readership. It is United States patent 235283. It can be found by number on the Patent and Trademarks Office website: www.uspto.gov. As a result of a conversation with Mr. LaDue, I searched for the patent for another chuck marked "Scholer Pat. Jan. 21, 1896." Although I searched the entire list of patents issued on that date, I did not succeed in finding it. If you or any of readers know the number of this patent, I would very much appreciate getting this information.

RESPONSE:

Provided by AWCI Technical Staff

The Scholer U.S. Pat. No. 553,265, discloses a chuck for watch crowns, wherein the chuck has a conical center for the purpose of holding a variety of different sized crowns which are held by a cap.

a look at *Watch Around* magazine

The world knows Swiss watchmaking solely by the image it projects. But behind the gloss of beautiful watches and beautiful people, the white-coated watchmakers and the sparkling Alps, there's a far more fascinating and largely unreported reality.

Watch Around is a magazine for watch-lovers that believes horology, in general, and Swiss watchmaking, in particular, deserve more than a glossy image. Since it started in 2007, it has become the most respected watch publication in the industry itself and is winning an enthusiastic following among subscribers in Europe, Asia and North America.

Totally independent and run by qualified journalists, *Watch Around* can attract the best and most knowledgeable writers. We are thus able to cover objectively and intelligently the technique, culture and business of watches like no other publication in the field.

Destined for a global audience, *Watch Around* is alone among European watch magazines in covering such issues as developments in the US after the end of the Consensus Agreement, China's ambitions in watchmaking, the chronometry competitions, and the world of horology beyond the brands.

The publication goes deep beneath the dial on your wrist, through the mysteries of the movement and into the culture that has shaped horology. Switzerland's fourth biggest export industry is a fascinating interaction of engineers and entrepreneurs, craftsmen and middlemen in a strictly hierarchical organization that is little known in the outside world.

We feature the outstanding and sometimes crazy timepieces it produces and delve into their mechanisms. We talk to designers, dreamers, rogues and eccentrics. We tell you stories you've never heard. *Watch Around's* founder and editor-in-chief, Jean-Philippe Arm, was born in the heart of this watchmaking country, and more than anyone, he knows the people, the unspoken rules and the secret language of this close-knit world. After graduating from Neuchâtel University, he worked as a news journalist in the regional press. In 1990 he launched a watch magazine for a publishing group — the first of its kind in Switzerland. After 13 years as managing editor of *Montres Passion*, he decided to launch his own watch magazine of a much higher editorial quality, and *Watch Around* was born.

Interested in subscribing to *Watch Around*? All AWCI Members can benefit from a special rate of $30.00 for 6 issues. Payment via PayPal (us@watcharound.com) check (from U.S. Bank only) or U.S. Money Order to TWI, LLC 1760 Second Avenue Suite 7C New York, NY 10128. (This special offer is only valid for U.S. delivery.) AWCI Members receive a reduced rate of $30.00 for 6 issues of *Watch Around.*

TODAY'S TRANSITION FROM SCHOOL TO WORK LIFE FOR THE NEW WATCHMAKER

BY HERMAN MAYER

The following is a speech by Herman Mayer to recent graduates of the Lititz Watch Technicum. This well-known two-year program combines centuries-old watchmaking techniques with the latest diagnostic applications. As head (Principal) of the school, Mr. Mayer gives his insights on the fascinating and challenging aspects new watchmakers will face as they enter the professional community.

You have been knocking on the door of the professional watchmaking community for the last two years and today, this door formally opens to let you in. I want to welcome you on behalf of Rolex and of SAWTA, the Swiss American Watchmakers Training Alliance.

Watchmakers are typically a strange and eccentric group. I am sure you are aware of this already from your formative years here at the LWT. This is exactly the topic of my message today. "INAPPROPRIATE," the more conservative members of the audience are thinking now. "NECESSARY," I counter. Let me explain: The character of a collective is defined by its individual constituents. In our context, that means the state of the watchmaking profession is directly dependent on the actions and dispositions of its members.

"Why," you may ask, "does the state of the profession matter to me?" The answer is simple: It matters to you directly in the form of workplace quality, income and social status, to name a few examples. If you are a member of a profession that does not enjoy a solid reputation and status, you notice the resulting consequences instantaneously and directly. It determines your day-to-day existence. For example, it affects the size of your savings account, the size of your retirement account, the car you drive, the neighborhood in which you live, the school your children attend, and...the overall quality of life you can provide for you and your family.

Some of the effects are long term. For example, the quality of education you can make possible for your children will have an effect on their lives far in the future; you must not ignore your obvious obligations towards the next generation. We are all social beings and need to accept our responsibilities.

Our Western culture has a solid trend toward an egocentric attitude, and there may be nothing wrong with that. However, the recent history of our beloved profession demonstrates with endless examples how a lack of vision beyond the tip of the nose of our professional community... has compromised its status to the detriment of its individual members. For our work at the bench, a vision much beyond the tip of your nose is hardly necessary... and it's only when a watchmaker removes the loupe and steps away from the workbench that the big picture becomes apparent: The world does not revolve around us!

There is today a tremendous demand for qualified watchmaking professionals, which offers a unique opportunity. The timing is right for building a solid and rewarding career. However, you need to combine your watchmaking skills you acquired here with social competence, strategic thinking, authenticity, and performance orientation in order to qualify for this opportunity. Working on a watch movement is by far no longer enough—it's the overall package you have to offer as a professional that will make all the difference going forward.

Let me explain:

Social Competence

Until recently, members of the watchmaking community have typically shown serious deficits in this area, especially the older generation. They found nothing wrong with being tucked away in the basement or behind a curtain at a messy and disorganized bench avoiding contact with the outside world. This seems to have worked in the past, where the watch service culture was more utilitarian, but this clearly cannot support the high end watch culture of today. Today's watchmakers need, in addition to the technical skills, the ability and willingness to communicate with customers, brands, colleagues and actively live the watchmaking culture. Remember to take the loupe off and start a meaningful, positive dialogue with the members of your professional environment. The watchmaker of today needs to be compatible and in sync with the spirit of the high end watch culture.

Strategic Thinking

There have been serious shortcomings in this area, too. Strategic thinking needs foresight, and when you view the world through a loupe, you don't see very far. Here is a good example of the limited vision of the watchmaking community as a collective. In a time when the sales of new mechanical high-end timepieces was higher than ever, watchmakers, instead of getting ready for the challenge by furthering their education, decided to take legal action against the manufacturers to force them to freely sell components and tools. If they would have looked without the loupe at the situation, they would have realized that free access to parts and tools is useless when the necessary skills and knowledge are not present.

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BY HERMAN MAYER

This is just one of many examples. Let me add another from the other side—the watch brands. Over the past decade, the watch industry has enjoyed an exponential increase in sales volume of the mechanical high end segment of the market. It does not take a genius to figure out that the word "sales" is followed by the word "after-sales service." Still, many companies became aware of this fact when their turnaround times exceeded six months and the customers' complaints became so massive it threatened to become a deterrent for the continued sales of new products. Here too, those who were in the driver's seat did not take off their loupe. They enjoyed the close up view of skyrocketing sales numbers, but failed to see the simple truth: With every high end watch sold, they had the obligation to assure reliable after-sales service. Finally, some players in the industry woke up and took action: They began to get involved in primary and continued education to perpetuate our beloved profession, assuring the watches they built will run to their owner's satisfaction for decades to come.

Regarding strategic thinking, here's my advice to you: Remember to take the loupe off. Look at the situation. Look at your strengths, weaknesses and preferences. Be fully aware of what you have to offer, and be even more aware what you are still lacking. Then, look at the long term potential of each situation.

You should consider not only your personal growth, but the growth of your profession. It is for our common benefit that there be a healthy and strong watchmaking landscape in the United States. When watch owners find experienced professionals to fulfill their service needs, they will be more than willing to invest in their passion. For us watchmakers, this translates into a reliable and comfortable work/life experience.

Performance Orientation

As you know, you can put a 2824 together, a 955, and sometimes when you have a good day, a 7750. Take the loupe off and recognize you will enter a learning period that will last until the day when you put your tweezers down for the last time. Due to the extremely small scale of our work, we always work to our limits, the limits of perception, and the limits of dexterity. We are constantly pushing to expand this limit, to move it farther away, but we will never be able to get rid of it altogether. On the other side, there are always new products, features or tools entering the market, service procedures are improved, and you need to stay on top of these developments to keep your work efficient and in accordance with current standards and customer expectations.

This means continuous learning is key to your continued professional success. If you fail to actively pursue this, you will significantly limit your career. Forget the term "good enough." "Good enough" does not exist in our profession. Our world is perfection. Our customers worked intensely to establish a lifestyle that allowed the possession of expensive timepieces, and our customers are willing to pay a good amount of money for work well done.

To summarize my speech into a few simple statements:

- Your generation is entering the profession at a time more favorable than ever before in its 800-year-old history. Be aware of this and use this opportunity to actively redefine its identity.
- Make a difference and support the watchmaking profession to perpetuate this old and venerable trade. You will be rewarded with job satisfaction and a high quality standard of living.
- Make a difference and be ready to identify nearsighted thinking, irrational decision-making and bizarre behavior and resist it.
- Make a difference and actively maintain your status as a member of the professional community. Keep your obligations towards your social environment in mind with all your actions.
- Work hard, be authentic and remember that you embody the watchmaking profession wherever you are, whatever you do. ♦

How Developing Your Skill Set Impacts The Bottom LINE

USE AWCI STANDARDS AND PRACTICES TO KEEP YOUR SKILLS UP TO DATE

BY JERRY FAIER, CMC21

As I mentioned last month, I will be using my column for the next while to help you make better use of the Standards and Practices documents as you develop your skills, knowledge and dispositions at the bench. This should help you both improve your bench practice as well as help you prepare for certification or maintain your current certification. AWCI is on a journey to educate both our members and consumers, and I will share with you how I have used these documents to develop myself and improve my clientele.

Let's start with the topic of these articles: Your skill set. This is the cognitive-motor set that enables you to service a horological product. The question is, what do we do to these products and how do we know what the correct thing is to do? Your knowledge set is the cognitive information you have pored over and studied. How much do you need to know and what should you study? A disposition refers to the attitudes you apply to your customers, your work, your workshop and other professionals. It also includes your attitude towards further learning. What should my shop look like?

"What should my shop look like? What should I do to make it safe? Where can I go to find the answers? *The AWCI Standards and Practices* documents, of course!"

For the last 750 years our trade has been in a marked existence, it has largely been an oral tradition. That is to say, all we learned about the trade was usually transferred by the master telling the apprentice what he knew. (Back then, no women were allowed to practice the craft). If the master lacked any knowledge or his depth of knowledge was poor, the apprentice came off short in that area. If you take that apprentice and allow him to train another apprentice, you can see how some knowledge was quickly lost and dogma became the norm.

You didn't want someone to take your precious knowledge about adjusting escapements? Then lie or make up something that sounds plausible. It has been known for centuries that social pressure will stop even the brightest from asking solid scientific questions if they think everyone else knows what is going on. The point is, if we have no standard, then who is really a good or knowledgeable watch/clockmaker? How do we know when someone has achieved the needed skills, knowledge and dispositions? Simply, we set a standard by using a committee of known successful, competent and profitable people who share the same sets of skills, knowledge and dispositions and we put it down on paper. That's how both documents were developed. They were based on the competency of horology's best, and what they learned that made them most successful. Did everyone agree on all items? Not at all! Those common items that we shared were the ones we listed. So if you can perform all the items in the S&P's, then chances are, you will also be successful, knowledgeable and have good dispositions for yourself, your shop and your customers. Better yet, the customer has a reference that will tell them if they want quick or quality. In print, it's very clear—if you are really following the documents.

"I visited a family who came to my shop, asked 30 minutes worth of questions and was referred to the Clock S&P. Two weeks later, they asked for a house call. This is the customer I want!"

They care about who I am and what I will do to their product. There is no debate about my charges or the services I can perform for them. They are my best customer! They support me with their needs and I support them with my skills. That, in the lingo of sales, is a win-win situation—I might add, the best win-win situation because we all get what we want! Think it over. What are you after? Does every customer ask about this? Not yet, but that is what I was referring to about AWCI's journey towards consumer marketing. Why do you think the watch industry is interested in our certification program? It gives them a standard to reference and a match against their requirements. When they match, it's a win-win for them, as well. They get a bench person who won't destroy their products, and the consumer (who pays everyone's bill) can trust the company. In today's market, that's a huge connection! It's what drives the bottom line.

Let's start with one example from the Clock S&P. Look at the list of 26 items that lay out the needs of General Movement Servicing. In the olden days, the term overhaul seemed to be the jargon of the day. What did overhaul mean? Did it mean to drag across a gravel road until the product becomes totally useless? With the number of really messed up movements coming across my bench today, it really makes one wonder if that is the case. That's why

How Developing Your Skill Set Impacts The Bottom LINE

USE AWCI STANDARDS AND PRACTICES TO KEEP YOUR SKILLS UP TO DATE BY JERRY FAIER, CMC21

we set out using a different term. We are applying a known list of procedures (I often refer to these as bench regimes or bench routines) to be applied to any movement which requires a thorough breakdown, repair of damages/wear found and rebuilding back to as close to original quality as possible. What does this include? The 25 items or steps are summarized, but they represent the steps a professional bench person would go through with any movement to ensure the product was returned to its best service condition. Notice, it did not say just get it running and hope you die before the next worker has to suffer through your mistakes. In the coming months, I will address groups of these to show you how to use them as a training device. The 26th item is your disposition or how you treat your customer. All of us on the committee agree it is senseless to do all this work and expect that the customer knows how to care for the product once they leave the shop, unless we, as professionals, educate them. It's all part of our job!

As for the Watch S&P, it is organized a little differently. If you look under the Certified Watchmaker (CW21) you will see listings of the knowledge, skills and dispositions set out in sections. We use the word Proficiencies as a heading for the items watchmakers should be proficient at—just that simple. This section talks about work planning, tool selection, tool servicing and reading and interpreting technical data from the manufacturers. Seems simple enough, but if you visit as many shops as I have, you soon learn one of the first steps in increasing profitability is to have the bench worker organize themselves and get all their tools in order (sharpen their screwdrivers, clean their desks so they don't add to the sources of contamination, have the needed parts ordered in and ready for the service process) and their bench ready for the next job. This business of multi-tasking doing several jobs at once only means that your sources for problems from the above list begins to increase exponentially! That just slows you down and means you are less productive. Think just a moment. Remember, when all your tools were new and ready to go to work, how much faster the jobs seemed to go? What changed?

When we look at the next section, we are looking at dispositional behaviors. Do you have the right mind set to do the job? Are you thinking of the completed project before you start and how you will get there or are you thinking about your next activity? These types of distractions only cause your mind to stray from the task at hand and slow your job progress. Think about it.

The next several lists go on to enumerate the specifics of the first and second groups. Do you perform all these tasks every time you start a job? If you make it a habit, then the errors go down, interruptions don't cause havoc with your progress, the jobs seem to go smoother, which in the last analysis means more efficiency and more—yes—more money in your pocket.

Most of the information in these S&P's is the organizational behaviors that we all get sloppy with over time. This serves only to cost us at the bench. When we forget to flatten a wheel (straighten a pivot or tooth) because we just didn't see it, or replace a cracked jewel because our procedures excluded that extra step of reviewing each jewel rather than a quick glance at the entire plate, we get taxed against our work. Look at yourself and see what you do. If you are truly honest, I think you will see how many little details you leave out only to have to come back later to get that watch or clock set up correctly in the end.

In short, it seems like the S&P's are an example of Get Ready, Get Set, GO! The problem here is, it's such an abbreviated idea. The Get Ready may take a bit of doing. The Get Set is more than just sitting down at the bench, and the GO? Well, that can be a false start with lots of wasted time if you are not really ready and set to do the job. Think it over.

Next month we will tackle some individual items from these lists. My father used to read and re-read the same books over and over. When I asked him why he did that, he told me there wasn't a time when he re-read something that he didn't learn something either new or something he had forgotten. Could that help you at the bench and maybe make you an extra dollar or two today? ♦

To review AWCI Standards & Practices go to: www.awci.com. Look under SERVICES then use drop-downs for EDUCATION and CERTIFICATION. On this screen you can click on an S&P bullet under Certification.

Letters To The Editor

EXCERPTS FROM COMMENTS ON AWCI'S 50TH ANNIVERSARY CONVENTION BY ROBERT NELSON, CMW, CMEW, FAWI

I'm sorry I can't be with you at this historic 50th anniversary meeting. This occasion brings back many wonderful memories. Many are recorded in the official history, which I hope is still continued. I recall the first order of business when I became President in 1975 was to commission a history by Marvin Whitney who did an excellent job.

I recall how fortunate we were to have the privilege of personally knowing and working with such icons of the industry as Henry Fried, Orville Hagans, Marvin Whitney and many others. We had the opportunity to be involved with the development of the Institute under the guidance, leadership and inspiration of Milton Stevens.

We saw the nationwide influence of the educational aspect of the Institute develop and flourish through the traveling workshop program with the talents of Ewell Hartman, James Broughton and many others. More than two hundred of these workshops and seminars were presented throughout the U.S. and Canada.

We who entered the profession shortly after WWII saw many more changes in the industry than had been made in the previous 200 years. Among these were:

- Stainless steel screw back and indestructible waterproof cases
- Shock-proofing mechanisms such as Incabloc
- Unbreakable, set-proof and rustproof main springs
- Commercial cleaning solutions replacing various unhealthy solvents
- Automatic cleaning machines eliminating moving through solutions
- Ultrasonic cleaners reducing degreasing, peg wood and pithing
- Timing machines, replacing the timing rack and Sunday winding chores
- Instant demagnetizers replacing the coil pull-through type
- Unbreakable fancy shaped crystals
- Synthetic lubricants replacing fish-based oils
- Lubricants included in rinsing solutions eliminat ing oiling each bearing
- Sensitive 360-degree self-winding mechanisms
- Batteries replacing mainsprings
- Transistors replacing mechanical electric contacts
- Tuning forks replacing balance wheels
- Index wheels replacing escapements
- Quartz crystals replacing balance wheels and tuning forks
- Integrated circuits replacing gear trains
- The much ballyhooed but short lived no moving parts LED digital watch
- The still used LCD digital watches
- The popular stepping motor analog watches
- Watches under $10 better timekeepers than $100 railroad watches
- Absolute accuracy maintained by radio waves from the atomic clock
- Demise of American watch manufacturers
- The desire to wear expensive watches coming full circle

Excerpts from a letter by Avo Antabelian on AWCI course offerings

As an experienced watchmaker for over 20 years, taking three courses before taking the exam has made me truly appreciate that professional instruction is invaluable. After the first course, I realized how modern the watch industry has become, with a more creative and upgraded change.

The need to upgrade skills to the twenty-first century became very apparent. The courses have been an investment for present and future success, regardless of how many years of business. Learning to sacrifice and follow through by attending these most valuable lectures with hands-on operational watch work exercises would aid anyone.

Each class has its own value. You receive a completion acknowledgement certificate after the instructor, Mr. Tom Schomaker, finishes the course material and you attend the complete class component. The experience was valuable. [It included] the lecture by Mr. Schomaker, the detail support, the devotion to you as a class participant, and the desire to help you understand the subject matter at hand to the best of your ability.

Each course certificate has been posted in a frame... displayed for all customers to see and acknowledge. The extended time and sacrifice has made our quality of service easier and our business more successful.

AWCI has the backing and support of many major fine watch companies. Their output of knowledge will help with our participation in this industry, making these courses and testing more valuable, and at some point, required.

Highlights from an e-mail response by Michael McGuire on *The Watchmaker's Breakfast* in the September, 2010 issue

Oatmeal is a great nutritional breakfast. It gives you long energy with the proper fats. All our bodies need fat—our government suggests dietary intake of 30-35% of our total calories. Saturated fats, while vilified in the press, are necessary with high amounts of vitamin D and vitamin A.

Oatmeal preparation should be cut oats, as rolling creates heat and reduces the nutritional content. Soaking the oatmeal overnight in water and whey or lemon juice breaks down the phylaic acid, which blocks mineral absorption in our bodies (zinc?). Drain and add fresh water.

For sugars for oatmeal, the article is lacking our oldest and most natural sugar—honey. If you let the oatmeal cool a bit, the enzyme activity is very healthy. Add some raisins, too. As far as the suggestion that agave is healthful...it is very high in fructose and Saponin. For those liking brown sugar, there is rapadura sugar, which is a naturally made product from sugar cane by an older method.

For Omega 3, it is important to take vitamins A and D in the naturally occurring ratio. The best is old-fashioned cod liver oil. But please note that most of the cod liver oils are distilled and then synthetic vitamins are added.

So load it up with butter. Stay away from hydrogenated fats made in a chemical plant! And make it sweet with honey.

Excerpts from a Letter to the Editor by Larry Blanchard, CMW21, on AWCI's 50th Anniversary Convention

First, I say "praise" for the events of the 50th anniversary convention. The headquarters staff and the several officers, chairpersons, committee members and other volunteers did a great job putting it together and making it happen. The speakers, presenters and exhibitors did an excellent job.

In addition, the purpose of this writing is to share some thoughts from my early experiences in pursuit of the trade.

In retrospect, the American watch industry made major contributions to horology development and to development of other technologies, both domestic and worldwide. American watch companies were also good to their employees, being among the first in the industry to offer employee benefits, such as health care, profit sharing, pensions and a 40-hour work week.

Among the contributions of the American watch industry to horology were standardization of parts, railroad standard timepiece technology, alloy mainsprings and balance springs, non-magnetic balances, free sprung balance springs, bonding of balance springs, friction dial feet, balance wheel electric watches, development of tuning fork technology and quartz-based wrist timepieces.

Now we are in another golden age of timepiece manufacture utilizing CAD systems and computer-controlled fabrication. These capabilities may rival the golden age of masters from Breguet's era.

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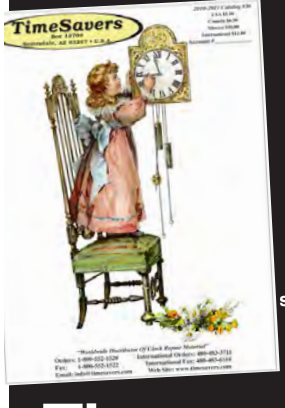

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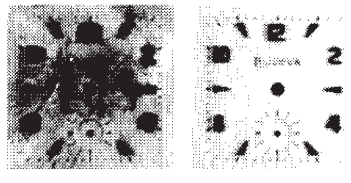

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