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September 2006



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## COVER

*This month's feature is the  
Credor Spring Drive Sonnerie*





## President's Message

Dennis J. Warner, CW

The Annual AWCI Meeting was concluded on Sunday, August 6<sup>th</sup> in Seattle, WA. This year Washington State Watchmakers & Clockmakers hosted activities. Social activities consisted of a trip to downtown Seattle for the spouses and a ride by all on the dinner train *The Spirit of Washington* and concluded with a wine tasting tour at the Columbia Winery on Friday evening. The Friday night ELM Trust Dinner and Winery Tour was sponsored by Rolex. Transportation for this event was sponsored by the Swatch Group.

Elected to serve as your Executive Board of Directors for 2006-07 are:

Dennis Warner, CW, President  
Mark Butterworth, 1<sup>st</sup> Vice President  
Gene Bertram, CC, 2<sup>nd</sup> Vice President  
Matt Henning, CW, Secretary  
Jack Kurdzionak, CW, Treasurer and Industry Advisory Board Director

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Mark Baker, CMW  
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Jim Sadilek  
Jim Zimmerman, CMW, CMC, CMEW  
Wesley Cutter, CC, Affiliate Chapter Director  
Elbert Lewis, CMW, Research and Education Council Director  
Jim Door, Past President

All of these members understand the duties and responsibilities of their office. Each has pledged their time and energy for this term of office to the AWCI and you. A personal thanks to Past President Jim Door and Parliamentarian Paul Wadsworth for help in making a smooth transition between the two Boards.

(Continued on page 29.)



## Executive Director's Message

James E. Lubic, CMW

Congratulations to all the newly-elected AWCI Directors. I look forward to working with all of you during the upcoming year, and congratulations to all the award recipients.

The October issue of the *Horological Times* traditionally is the issue that we report to our members on the activities of the Annual Convention and Educational Symposium. This month I would like to thank a number of people who did a lot of work to make AWCI's 46<sup>th</sup> Anniversary and Convention a success.

Many members work behind the scenes prior to or during the convention and symposium. Without their grassroots help it would be almost impossible to move our convention around the country. Tom Payne, CMW, John Schuitemaker, CW, Karen Lindeman-Rohrer, and Jeff Grief, CW are a few of those members who volunteered their time. Thank you for all you did to make the convention a success. I'm sure there were others from the Washington State Watchmakers & Clockmakers who helped and I apologize for not naming all of them.

I would also like to thank Elaine Rolf, Instructor of North Seattle Community College Watchmaking Program, for hosting an AWCI Certified Watchmaker assessors session just prior to the AWCI Convention. Thank you for allowing us to impose on your classroom for 3 days. Without this type of support from our REC schools, conducting our AWCI CW testing would be much more difficult.

Ryan Bramlett and Adam Kantz, North Seattle Community College students, maintained the Hospitality Room during the convention; thank you Ryan and Adam, it was also a pleasure to meet both of you.

Thank you to Rolex USA for sponsoring the ELM Charitable Trust Annual Fundraising Dinner. This was the third year that Rolex USA has sponsored this event, which everyone looks forward to attending.

Transportation for the convention was sponsored by Swatch Group USA for the third year; thank you Swatch Group USA.

Richemont S.A. provided all attendees of the convention with an AWCI t-shirt. We appreciate and thank Richemont for sponsoring these t-shirts for a third time also.

(Continued on page 29.)

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David Christianson,  
CMW, CMEW, FAWI

# Questions & Answers

## Question

I have an 8-day mantle clock. It has the name Lady Isabel on the case. That is the only other identification we have, and it would be nice to know who manufacturers this.

The movement does have a bell that rings on the half hour, and one hammer that rings on every hour. Our problem is the escape wheel has a tendency of skipping four or five teeth and does hang up occasionally. I have checked the pinions and I find a little excess end shake and side shake on two pinions.

I have checked the teeth and they looked decent.

We would appreciate any suggestions that you may have to correct this.

*John J. Heilman, Rugby, North Dakota*

## Answer

Your black wood flat-top mantle clock was made by the Waterbury Clock Co. of Waterbury, Connecticut. Although I cannot find a reference to the "Lady Isabel" model, most of the clock manufacturers of

the late 19<sup>th</sup> and early 20<sup>th</sup> centuries named their various models of clocks instead of numbering them as they did later into the 20<sup>th</sup> century.

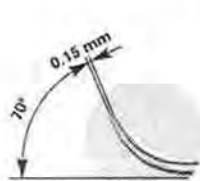
The black wooden flat-top mantles seemed to appear in about 1889 and were made into the 1930s, as a general rule. From the style of your clock case I would say yours was made about the year 1900. The same movement as yours was used very frequently by

(Continued on page 31.)



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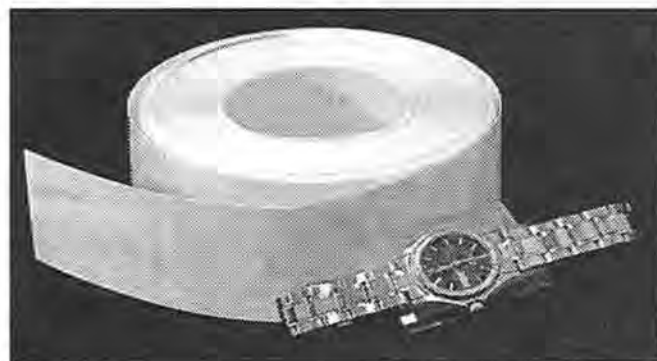
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Ron DeCorte, CMW

# Credor Spring Drive Sonnerie

## Part 1: The Bell

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The sound of a bell has a special place in life. At one time it is both soothing for the inner soul and gathering our attention. Surely we have all experienced the power of a bell, true and clean and peaceful. So it is that Credor (a branch of the SEIKO watch company) brings us their Spring Drive Sonnerie. The name Credor comes from two French words, “cret” meaning top and “d’or” meaning gold. I suppose “Crest of Gold” would be a good translation. By the way, for simplicity purposes I will refer to the Credor Spring Drive Sonnerie as Credor Sonnerie in this article.

Let me begin by explaining what is a Sonnerie. The Sonnerie has a somewhat mythical status in the world of watches; it gathers our attention without the owner’s intervention, unlike a typical repeating watch that requires the owner to actuate a button to experience the chimes. From the beginning, Sonneries have occupied the highest position amongst striking watches, and rightfully so as they are the most complicated of all striking mechanisms.

Japan’s love affair with the bell spans many centuries. From the temple bell to the Orin bell to the wind bell hanging from a tree, all are highly regarded in life. Naturally, and I mean literally and figuratively, a bell is at the heart of the Credor Sonnerie.



*A large temple bell, struck from the left by a timber suspended by ropes.*



*An Orin bell, usually placed on the table and struck by a small mallet (bottom of frame).*





*Credor Sonnerie bell.*



*Typical minute  
repeater gong.*



*Credor Sonnerie.*

The Sonnerie bell is a true bell while the repeater gong is comprised of two circular wires attached to a foot via two screws. The sounds are quite different. The bell has a rather long, sustained note, while the gong is a bit more staccato.

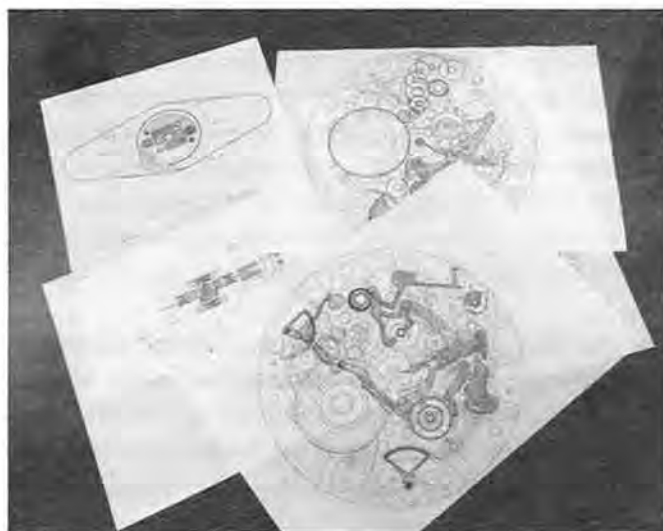
Please visit the Credor Sonnerie website <http://www.seikospringdrive.com/sonnerie/sound/index.html>, where you can experience the sound for yourself. Note: for more accurate sound reproduction, you may wish to let the file download once completely and then play it again. You won't be disappointed.

Let me expand on the idea and origins of the Credor Sonnerie. The SEIKO Watch Company has a long history of horology dating from 1881. And so it was that in 1881, Kintaro Hattori started a humble clock repair and sales enterprise in the Ginza area of Tokyo. By the late 1900s, the operation had grown to include clock manufacturing and watch manufacturing. The seed was sown and has been nurtured by three generations of

the Hattori family since, and will certainly be for many generations to come. By the way, the word SEIKO means precision.

### Micro Arts Studio

In the year 2000 the Micro Arts Studio was established by SEIKO-Epson. The main mission of the Micro Arts Studio is to preserve the heritage of watchmaking for the coming generations, and for the public. What is it that sets the Micro Arts Studio apart? Well, first of all





*Yours truly with the Micro Arts Artisans: Back row, left to right: Hirose Nobuyuki, Shiohara Kenji, Ron DeCorte, Maejima Masaaki, Yoshifusa Nakazawa. Front row, left to right: Oguchi Tetsuo, Moteki Masatoshi, Nakata Katsumi, Takahashi Osamu.*

it is comprised of a small group of people, only 8 at the moment, who have been hand selected for their particular skills as related to the group. Maybe it's the passion that the Micro Arts Studio brings to their work that is most important.

It was in early 1999 that Mr. Masatoshi of the Micro Arts Artisans was in Switzerland making a presentation. While on the train he experienced the sound of a sonnerie pocket watch worn by a gentleman nearby. Immediately upon returning to Japan the challenge of a sonnerie was offered, and accepted, by the Micro Arts Studio. Challenge might be too light a word since very few watch companies have ever undertaken such a test. The Micro Arts Studio has certainly passed the test.

For me as a watchmaker, I've experienced countless striking watches (quarter repeaters, five minute repeaters, minute repeaters, and sonnerie), inside and out. The Credor Sonnerie is one of the finest I've ever heard. Believe me that statement was not easy to make, but I stand by my words.

## The Details

Before we get into the details I should mention that the watch featured in this report is a prototype. Small changes may take place between now and when actual production watches become available in early 2007.



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*Push button that will activate the sonnerie upon demand.*

I will return to Japan in late 2006 to make a detailed technical report on the sonnerie mechanism and photograph some actual production watches.

The Credor Sonnerie is a true sonnerie, striking the hours on passing. In other words, when set in Sonnerie mode, the watch automatically strikes 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12 at the zenith of each hour. When set to Original mode, the watch automatically makes three strikes on each of the following hours, 03:00, 06:00, 09:00, and 12:00. And of course Silence is Silence. But wait, there is more...

Located on the side of the watch at about the 8:00 position is a push button that will activate the sonnerie upon demand. Even if the watch is set to silence or original mode, the last hour will be struck. Example: if it is 7:20 and the upon-demand button is pressed, the watch will strike 7 times on the bell.

The sonnerie barrel has been decorated in the shape of a bell flower. Notice the hand polished screws and beveled jewel settings.

At the bottom portion of the face the sonnerie mode is indicated clearly.

The pierced front plate serves as a dial and provides an excellent view of the ultra complicated sonnerie mechanism.

The power reserve, or "MARCHE", is indicated in the upper left portion of the face. The Spring Drive movement that the Credor Sonnerie is built around has 48 hours of power reserve.

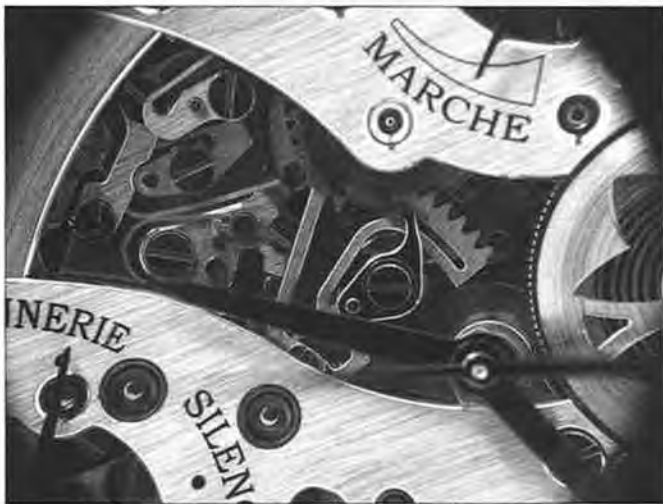


*Sonnerie barrel.*



*Bottom portion of the face of the sonnerie mode.*

Power reserve for the sonnerie mechanism is located in the upper right portion of the face. The sonnerie mechanism has 60 hours of power reserve, or to be more precise about 400 strikes of the bell.



*Pierced front plate.*



*Upper left portion of the face.*



*Upper right portion of the face.*



*Detailed 3-D view shows excellent finishing and attention to detail.*

In conclusion, the Credor Sonnerie is a fine work of art that pays tribute to the Japanese traditions of craftsmanship. The SEIKO Watch Company should be proud, and anyone interested in striking watches should certainly give the Credor Sonnerie a serious look, and listen.

Stay tuned for Part 2 of this article.

*This article is reprinted courtesy of Ron DeCorte and TimeZone.com.*



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# The Importance of the Wristwatch in World War I

## Part 1

MAJ Eric Hollister

*I am an Army Major currently serving with the 25<sup>th</sup> Infantry Division in Hawaii. My interest in horology began with the discovery that my grandfather's watch was "real"—a 1949 Hamilton Gilbert. I contacted a local watchmaker (AWCI member Mark Mongillo) to give me lessons, and have been restoring vintage watches as a hobby ever since.*

The tactics used on both sides near the end of World War I were unprecedented in their level of decentralization, complexity, and necessary coordination. Operations conducted on highly precise timetables became the norm, and success of a plan depended on the synchronization of many different elements, from Division Headquarters to Artillery Batteries to Machine Gun Teams. This meant that everyone needed to be on the same sheet of music, as it were, in order to bring all these elements together. In short: Everyone needed to know what time it was. This growing military dependence on time is easily accepted, but difficult to prove. Wristwatch history, personal vignettes, and historical sources can help trace this trend, but it takes a careful look at the official Equipment Manuals, Field Manuals, General Orders, and other publications to cement the idea that the watch was a key component of successful tactics in the war. The advent and proliferation of the wristwatch, while certainly not responsible for the evolution of tactics at the end of World War I, at the very least enabled the synchronization and control of the small unit and individual maneuver that eventually brought about the war's end.

The history of the development of the wristwatch is ironically imprecise, and changes depending on the source. Generally speaking, what we now know as the wristwatch came to being in the latter half of the 19<sup>th</sup> century, and definitely began in Europe. Who did what, when, is debatable. Basically, the wristwatch began life as an altered form of the pocket watch, wherein soldered lugs were attached to the case, permitting the use of a strap. Early American wristwatches were often made by converting lady's pendant watches in a similar fashion. Another variation consisted of a leather

strap with a holder, into which a pocket watch could be slipped and read like a wristwatch (Faber 7).

Considering the appearance of these early examples it comes as no surprise that the wristwatch, at least where men were concerned, was very unpopular. At a time when the pocket watch was a manly symbol of status, it was considered extremely effeminate to wear a watch (especially a converted lady's model!) on your wrist on a thin strap (Faber 9). This male aversion to the "strap watch," as it was called at the time, was so great that, were it not for two wars, the pocket watch might well have maintained its dominance far into the twentieth century.

The first of these wars was the Boer War (1899-1902). Technological and tactical advances made during this war required a new precision, and trying to dig out a pocket watch while maneuvering proved impractical in battle. British soldiers fitted their watches into the aforementioned leather strap, and found this placement to be highly useful. The first of many instances where a watch dealer used the manliness of soldiers in an attempt to sell wristwatches appeared in 1900 in the form of an "Unsolicited Testimonial" from a Boer War veteran lauding the advantages of a wristwatch (Brozek 93).

The second war was World War I, which, more than anything else, saved the wristwatch from extinction. The manliness of the fighting man, combined with advances in strap and watch movement technology, made an appeal to the male consumer that could not be resisted. American soldiers who had been exposed to wristwatches during the war fed the demand upon their



return. Watchmakers emulated the design of the basic World War I trench watch, going so far as to retain the pierced metal top cover that protected the watch's fragile crystal in the harshest of conditions (Faber 11-12). Long gone was the effeminate, converted lady's watch. In its place was a large, rugged, manly watch that had returned victoriously from combat. Advertising was in step with the times, with phrases like "A Real Man's Wrist Watch" and "Manly watches for manly men" in bold print (McGeorge 132; Faber 10).

There is no doubt that many soldiers wore watches on their wrists during World War I. Proving this, however, is an extremely difficult thing to do. Records of actual military procurement of wristwatches have not been found, and may not exist. Many sources spout vague statements without accompanying documentation. Watch history websites contain items such as Princeton Watches' "1918: Omega supplies US Army with Wrist Watches," and the Hamilton Watch Company's "[Hamilton supplying] wristwatches for General Pershing and his troops who were fighting in the European trenches." These



*Soldiers wearing wristwatches. Photo courtesy of: The National World War I Museum, Liberty Memorial*

conflicting statements lead to some obvious questions. Who supplied the Army, Omega or Hamilton (or both)? Did they supply everyone? These claims were not only limited to the Allied soldiers. The Princeton Watch site also tells us that 93,000 wristwatches were

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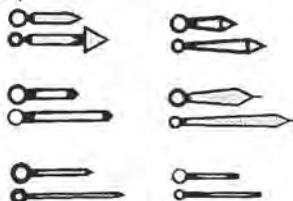


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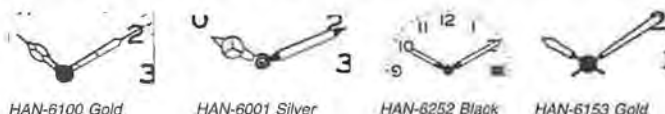
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sold in Germany in 1902, while John Brozek informs us that "German troops at this time were largely issued the more primitive 'pocket watch' designs [referring to the leather strap arrangement described above]" (94).

Personal vignettes can somewhat help to prove wristwatches were worn by soldiers in World War I. In his letter to the *Military Collector & Historian* journal, Haig Sergenian describes how his father and fellow soldiers used to poke fun at wristwatch wearers in their unit by mocking the action of checking the time. In a letter to the same journal, J. H. MacKendrick describes the town of Galt, Ontario giving a wristwatch to all soldiers enlisting for wartime service. A song called "The Wrist Watch Man" about the soldiers of the American Expeditionary Force (AEF) was penned in 1918, as was a column in *The Stars and Stripes* entitled "The Wrist Watch Speaks," describing the war from a watch's point of view (McGeorge 132-3).

The Army Corps of Engineers website provides more detailed information, stating that roughly 1,000 Hamilton pocket watches were purchased for use by the Engineer Corps during railroad operations in France. Whether these are the watches the Hamilton Company refers to on their website is unknown. Even more compelling evidence of the presence of wristwatches in the Great War is in the photos taken during the war itself. Jonathan Gawne's book *Over There* shows numerous individuals wearing watches, from Privates to Lieutenant Colonels.

Similarly, Charles Woolley's *Uniform's and Equipment of the Imperial German Army 1900-1918* also shows various soldiers of different ranks and specialties sporting watches. In a photo from 1917, he goes so far as to imply that the pictured German Engineer's wristwatch was an issued item (140). This, and previous claims that the Germans were issued watches, can be somewhat supported by the success of German infiltration tactics and their development of the rolling barrage. Certainly such complicated maneuvers could not have succeeded without the ability to synchronize the actions of many different groups. Further support is found in a biography of Field Marshal Erwin Rommel. In August 1917, as a company commander during the battle for Mount Cosna on the Rumanian front, Rommel personally positioned ten separate machine gun teams, giving each "exact targets and timings" (Fraser 56). It would appear watches were prevalent in the German Army.

Another source of information is the online auction site eBay. At any given time there are between 15 and

20 World War I trench watches being auctioned. The fact that so many of these 80-year-old watches are still around says something about the quantity that must have existed during the war years. How many actually saw service in the war is obviously unknown, but many are engraved in such a manner as to dispel any doubts of their wartime history.

The official documents of the United States Army shed some light on the issue of wristwatch proliferation among the troops during the war. *The Field Service Manual* of 1908 shows that an Infantry Battalion of 1,024 personnel was authorized a total of 37 watches, at least 29 of which being the wristwatch variety. Of these 37, 29 were for the officers, and 8 were for the soldiers performing signaling duties (13). The 1914 version of the same manual is basically unchanged regarding watch issue (15).

General Order Number 12 of January 1918 authorizes each observation station of the Regimental Intelligence Service a watch. This authorization was expanded two months later to give each Infantry Regiment twelve luminous dial watches (wrist or pocket not specified). (Historical Div. 174, 268)

In May of 1918, the *Equipment Service Manuals for Service in Europe: Series A-No. 1* appears to have authorized 271 watches to an Infantry Regiment of 3,741 soldiers. Wrist-type watches were generally specified, with all requiring luminous dials. The placement of these watches is very specific, with watches being issued to soldiers in the Headquarters Company, Observation Stations, Signal Platoons, the Sappers and Bombers Platoon, the One-Pounder Cannon Platoon, and the Machine Gun Company. Three months later, the August version of the same publication had lowered this number to 158. Oddly, *No. 15* of the same series (also published in August 1918) authorized 761 watches for an Infantry Division of 28,059 soldiers, with the Infantry Regiment designated only 53. All of these watches were designated as wrist-type, luminous dial. The reason for the disparity in the number of watches for the Regiment is unclear; however, these documents clearly show the proliferation of watches in the AEF.

"The Importance of the Wristwatch in World War I" will continue next month.

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## PARTS MESSAGE BOARD

The American Watchmakers-Clockmakers Institute **Parts Message Board** is available on line at **[www.awci.com](http://www.awci.com)** Click on the Parts Forum in the Top Links box. Guests are free to browse our topics and posts but only validated AWCI members will be able to actively post messages and communicate with one another via private messaging.

The purpose of this board is to aid our members in finding watch parts, clock parts and tools. This board is not open to generic advertising posts; therefore, web addresses and e-mail addresses should not be included in public messages.





Russell Allen

# Coincidental Time

## Part 1

*Russell Allen graduated from Trinity University in May of 2002 and shortly thereafter decided to explore watchmaking. He graduated from the Lititz Watch Technicum in Lititz, PA in August.*

As a requirement for graduation from the Lititz Watch Technicum all students must complete a thesis project. This assignment was intended to give students an opportunity to slightly stray from the school's rigid curriculum and explore an area of horology where each has a particular interest.

Many students have decided to complete complicated repairs or restoration projects, often entailing the fabrication of integral components. Others have done the bulk of their thesis project in the library doing research and writing papers on important watchmakers or historical movements within horology.

And while all of these ideas/projects are demanding and indeed interesting, I sought to do something a little different than what was done in the past.

I wanted to use my project to propose a new way of thinking, a new idea and a new twist on the theory of horology, which has come about as a natural outgrowth of my education from elementary school through the Lititz Watch Technicum.

Ever since the day in high school geometry when the teacher offered us extra credit if we could determine, to a fraction of a second, at what time both hands on a clock are in perfect alignment, I have been intrigued by the fact that while this phenomenon occurs 11 times on a conventional dial it largely

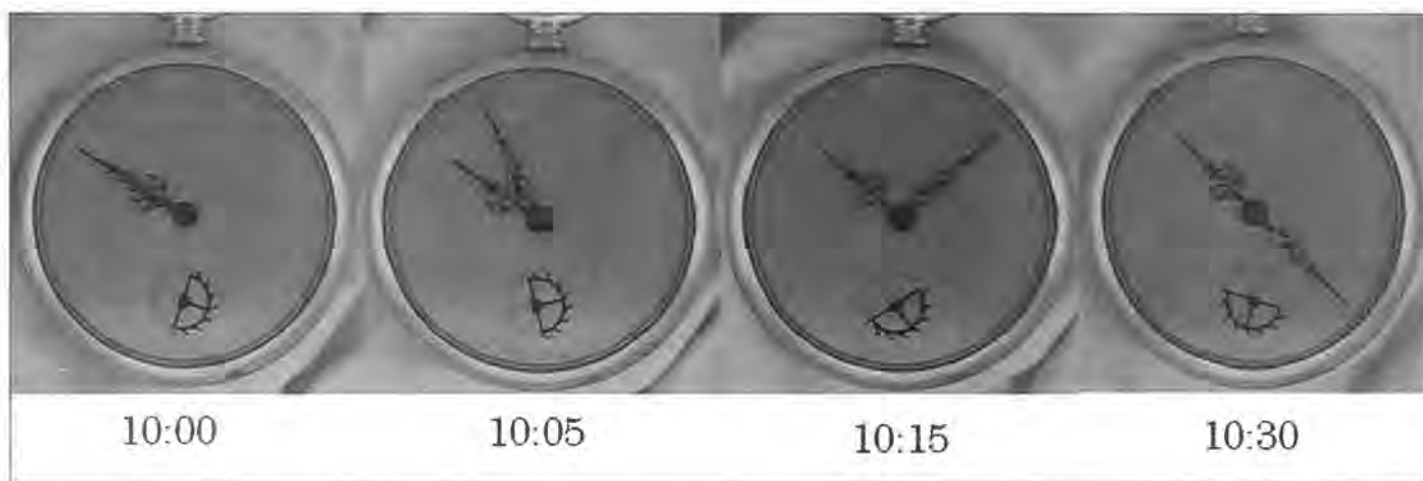
goes unnoticed. It seemed to me that those eleven instances ought to be significant.

For my thesis project I was determined to build a watch, based on the ETA 6497 in which the hands align every hour on the hour. Likewise, the minutes would be determined by the relative position of the hands to each other. For example a 90 degree angle between the hands indicates quarter past the hour while an angle of 180 degrees would signify half past, etc.

This project is about much more than simply the alignment of the hands however. This project is about questioning the status quo. It is about challenging previously held ideas and breaking new, completely different ground. This project is about one person (with the help and assistance of others of course) stepping outside the lines to do things differently. Not necessarily better or worse, but differently.

In order for this project to come together and for the watch to run in such a way that the hands align correctly, which would enable the user to actually determine the correct time, a lot of work had to be done.

The entire premise of this idea is based on the hour hand of the watch moving at the same rate as on a conventional watch. That is to say that the hour hand of a conventional watch travels 30 degrees of a circle or  $1/12$  of a rotation in one hour.



Also, on a conventional watch the minute hand travels 360 degrees of a circle or 12/12 of a rotation in one hour. Thus, the minute hand points towards the same location every hour on the hour.

In practice, this results in the hands aligning at the 12 o'clock location on a conventional watch. After one hour, the minute hand has traveled 360 degrees while the hour hand has traveled 30 degrees. This results in the minute hand again pointing at the twelve o'clock marker while the hour hand points at the one o'clock marker. This continues throughout the day, again with the minute hand pointing at the 12 o'clock marker every hour on the hour while the hour hand points to the correct hour marker.

Therefore in order for the hands to align every hour on the hour the minute hand would have to travel 13/12 of a rotation or 390 degrees, while the hour hand still traveled 1/12 of a rotation or 30 degrees.

The first obstacle to overcome was the speed at which the minute hand rotates around the watch dial. The original approach undertaken at this point was to re-engineer the counting train (consisting of the center wheel to the escape wheel) such that the center wheel (thus the cannon pinion and minute hand) would rotate 1/12 again as fast as it originally had. However many calculations proved that the ETA 6497 would not support a redesigned counting train for this purpose.

The speed at which the counting train moves is a direct function of the number of vibrations per hour of the hairspring in the watch. And by simply manufacturing a new hairspring from scratch that vibrated faster than the pre-existing hairspring, I was able to increase the

speed of the center wheel (thus the minute hand) by 1/12 of its original rate.

Before I could do this however, I had to determine the exact length, or rather the exact number of vibrations per hour for the hairspring.

Using a rather simple formula I was able to determine the vibrations per hour, and thus the length of the new hairspring.

$$\frac{Z1 \times Z3 \times Z5 \times Z7 \times 2}{Z2 \times Z4 \times Z6} \times N1 = Vh$$

Given:

Center wheel rotations per hour:  $N1 = 13/12$

Center wheel teeth:  $Z1 = 80$

Third pinion leaves:  $Z2 = 10$

Third wheel teeth:  $Z3 = 60$

Fourth pinion leaves:  $Z4 = 8$

Fourth wheel teeth:  $Z5 = 70$

Escape pinion leaves:  $Z6 = 7$

Escape wheel teeth:  $Z7 = 15$

Vibrations per hour:  $Vh = ?$

In essence this formula is the same as most for a multiplying gear train in which the driving wheels provide the force for the driven pinions. This formula takes into account the fact that for every one movement of the escape wheel there are two vibrations of the hairspring (thus the "2" in the numerator).

Here we see that by substituting our actual values for the variables in the equation we are left with the following equation.

$$\frac{80 \times 60 \times 70 \times 15 \times 2}{10 \times 8 \times 7} \times 13/12 = Vh$$

Which works out to:

$$19500 = V_h$$

Therefore, we find that in order for the center wheel to move 13/12 of a rotation in one hour we must have a hairspring vibrating at a rate of 19500 vibrations per hour. Not surprisingly this is 1/12 again as fast as the conventional 18000 beat hairspring.

This new hairspring, which beautifully sped up the entire watch unfortunately, also sped up the hour wheel (and hour hand), which must rotate at the same rate as in a conventional watch. To navigate my way around this obstacle I determined that modifications had to be made to the motion train of the watch in order to sufficiently slow down the hour hand.

To determine exactly how to do this I had to perform another series of calculations. This was a bit more difficult than determining the length of the hairspring, for there are many more variables, or unknowns in this formula.

Formula for calculating number of teeth in the motion train:

$$\frac{N4}{N1} = \frac{Z1 \times Z3}{Z2 \times Z4}$$

Given:

Rotations of cannon pinion:  $N1 = 13/12$

Rotations of hour wheel:  $N4 = 1/12$

Cannon pinion leaves:  $Z1 = ?$

Minute wheel teeth:  $Z2 = ?$

Minute pinion leaves:  $Z3 = ?$

Hour wheel teeth:  $Z4 = ?$

This formula follows the general rule for reduction trains in which the driving force is transferred from the pinions to the wheels.

As I began to work with this formula I was unsure about whether or not I would be able to use any of the pre-existing wheels or pinions, as such I was forced to calculate the left side of the equation, i.e. the known. And based upon that figure I had to work backwards in order to find a configuration of teeth and leaves that would achieve my desired result. Therefore:

$$\frac{1/12}{13/12} = \frac{Z1 \times Z3}{Z2 \times Z4}$$

As I started this process I did so under the assumption that most of the wheels and pinions would maintain a similar tooth count. As such I initially used the same values for the cannon pinion and the minute wheel pinion, essentially hoping that those figures would prove to be correct in the end. As we shall see this did in fact turn out to be true. So for the values for Z1 and Z3 I used 10 and 12 respectively. This gave me a value of 120 in the numerator.

$$\frac{1/12}{13/12} = \frac{10 \times 12}{Z1 \times Z3} \quad \text{or} \quad \frac{1/12}{13/12} = \frac{120}{Z1 \times Z3}$$

Based on this calculation I realized that the sum total of teeth of both the minute wheel and the hour wheel would have to equal  $120 \times 13$  or 1560. I then determined that the square root of 1560 was approximately 39.5 and realized that both wheels would need to have approximately 39 or 40 teeth

Luckily, the existing hour wheel has 40 teeth. And by making a new minute wheel, this one with 39 teeth, the equation would work out perfectly.

$$\frac{1/12}{13/12} = \frac{12 \times 10}{39 \times 40}$$

Which works out to:

$$\frac{1}{13} = \frac{1}{13}$$

Therefore I found that by keeping the same cannon pinion, minute wheel pinion and hour wheel tooth count, and simply making a new minute wheel with 39 instead of 36 teeth, I should be able to adequately slow down the hour hand so that it turns at a rate of 30 degrees per hour ala the conventional ETA 6497.

While brainstorming ways of doing this I came up with three methods, two methods that were mechanically "correct" and a third method that was much more feasible given my constraints regarding time and resources. I based the first method off of the pre-existing cannon pinion and modified the rest of the motion train accordingly. The second method, rather than keeping the cannon pinion constant, used the pre-existing centers and based the entire train off of that. Still, the third method used both the pre-existing cannon pinion and the same location of centers.

I figured that the first two methods, while "correct," would require slightly more time than I would be able



to commit to the project at this point. So I decided that if I were to make a new minute wheel with 39 teeth while using the existing cannon pinion and centers, the meshing with the cannon pinion, while not ideal would most likely have been close enough such that the watch would function as intended. Again, this is not the ideal set up, or configuration, but I felt as though it would work just fine. In the end this proved to be the case; the feel of the watch while setting the hands is not perfectly smooth. It feels quite similar to that of a Zenith El Primero, which itself doesn't set perfectly smoothly.

Next month I will describe the process I used and the mechanical steps that I took to make this idea come to life.



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Jack Kurdzionak, CW

# From the Workshop

## You Are Invited

Do you have a solution to a watch or clock repair problem that you want to share with our membership? Do you have a question about a repair problem you would like to ask? I invite you to participate in this column with your suggestions, questions, and comments. It is easy. Just e-mail me at AWCI <magazine@awci.com> or write using the old standby known as the postal service. You can even fax me at 513-367-1414.

I will do my best to help you help the membership. By sharing your questions and suggestions, all of our members can benefit from our combined knowledge and experience. The ideas, tools, techniques, and products presented in this column suggested by the author and any manufacturer, supplier, advertiser, or AWCI itself does not endorse contributing members.

## Mystery Bezel Solution

Last month's column asked the readers to solve the problem of an entirely new bezel design. The tachymeter bezel pictured (Figure 1) counts down to 37 MPH rather than the traditional 60 MPH. This bezel converts the vehicle speed from metric to English units and assumes the vehicle is traveling at a constant speed over a 1-kilometer distance. The bezel readout gives the vehicle's speed in miles per hour. The member or members who solved this mystery will be mentioned in next month's column. The above correct answer was verified by two sources. An e-mail was sent to our member Jerry Sussman asking his thoughts on the mystery bezel and a phone call was placed

to a manager at the watch company. Within a day or so, Jerry, an MIT professor of engineering and computer science, answered the e-mail. He explained that this bezel converted the vehicle speed from metric to English units as explained above. Within a few days, the manager called and verified Jerry's explanation. He also explained that the bezel was produced in Switzerland by designers who confused English and metric units when they designed this particular bezel. The bezel went into production without anyone noticing the design error until an observant salesperson in a retail shop brought it to the manufacturer's attention. Future issues of this model will be equipped with the traditional tachymeter bezel. Will this watch with its unusual bezel become a collector's item in the future similar to a coin or stamp issued with an accidental flaw? Time will tell.

*Jack Kurdzionak*



Figure 1

## Another Mystery

A watchmaker serviced an automatic calendar movement, Tissot Cal. 786. After the complete overhaul was finished, the watch rate recorder showed the watch to be running as well as when it was new in the late 1960s. The beat, amplitude, average rate, and delta were all better then when the watch was new. The watch was placed into its case; its water resistance tested, and put on the bench for an hour or so before the watchmaker had an opportunity to put it on the automatic winder. As he was about to put the watch on the automatic winder, the watchmaker noticed the watch had gained over ten minutes. He put the watch back on the rate recorder to make certain everything was in order. Immediately he thought, "Maybe the main-spring is too strong or there is a hair-spring problem," but that was not the case. The amplitude was 275 degrees and all other test parameters were OK. The watch was demagnetized and left on the bench overnight. By the next morning, the watch gained several hours. Examine the photo of the actual movement in question (see Figure 2). The automatic bridge and its components have been removed. See if you can figure this one out from the information given. Bear in mind that everything looks fine on the Witschi Expert timing machine and the escapement made the usual sounds. Drop locks and total lock were good. The hairspring was flat, round and clean with no coils touching. Magnetism was not an issue. Please send an e-mail with your answer to [thewatchmaker@verizon.net](mailto:thewatchmaker@verizon.net). A not too costly prize, donated by an AWCi advertiser, will be awarded to the member submitting the correct answer. In case of a tie, the winner's name will be drawn from the list of all who answered correctly. Thanks.

*Jack Kurdzionak*

## Does Your Shop Offer a Written Warranty?

Ask two watchmakers their thoughts about oiling a watch and one will get at least three opinions along with a heated argument. Ask the same two watchmakers their opinions about watch repair warranties and be prepared for a filibuster. Exactly, what is a warranty? According to Webster's, a warranty is: "A statement, usually in writing, of the integrity of a product and of the maker's responsibility for the repair or replacement of defective parts." Warranties are either unlimited (very rare) or limited. An unlimited warranty has no limitations, period. One unlimited warranty that comes



Figure 2

# CLOCKS

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to mind is for Zippo windproof cigarette lighters. Zippo will repair or replace any lighter, regardless of how old at no charge. A limited warranty, carries conditions such as: a time limit the warranty is in force, defects and problems covered by the warranty, the manufacturer's options to remedy the defect, the customer's responsibilities, and a list of exclusions (items not covered by the warranty).

One manufacturer's warranty states the following. "This watch is warranted by us for two years from its original purchase date (time limit). If a manufacturing defect develops (items covered by the warranty) during this period, we will repair or replace the watch (remedy). The customer must provide a dated proof of purchase (customer's responsibility). This warranty is limited and does not cover bracelets, crystals, straps, batteries, abuse, misuse, water damage, or defects related to unauthorized service (exclusions)." The five warranty components listed previously are time, items covered, remedies, customer responsibilities, and exclusions.

The aforementioned warranty is straightforward. The manufacturer clearly states that a broken crystal, a mangled bracelet, or a watch that went through a washing machine and dryer cycle is not covered. Warrantors may, at their option, make exceptions to the rules, and repair damaged watches that are clearly outside of the warranty, but it is always at their option.

Watchmakers offering a warranty for their repairs need the same five basic components as in manufacturer's warranties, bearing in mind that labor and parts are being warranted and not the entire timepiece as it would be from the original manufacturer of a new product. The watchmaker warranty needs a time limit. It must clearly state exactly what the warranty covers. Does it cover all parts of the watch or only the ones replaced by the watchmaker? Does it cover misuse, damage by collision, water damage to the movement or case, time-keeping accuracy, bracelet or strap failure, unauthorized service, etc.? Exactly what is covered and what is not covered (exclusions). What remedy does the watchmaker offer? The watchmaker's warranty must state the customer's responsibility. Is a sales receipt required? For mail order work, who pays the postage?

Discuss warranties with other watchmakers, but be prepared to spend considerable time listening and talking. When you have defined the provisions of the warranty you will offer, put it in writing on the customer's invoices and post it prominently in the shop.

*Jack Kurdzionak*

### **A Guarantee in Addition to a Warranty**

Independent watchmakers service a wide variety of timepieces from late model to antique, many of which were made by manufacturers who long ago went out of business. Late model watches are robustly constructed and not prone to shock or water damage; not so with vintage and antique pieces. These are often delicate and require extra special care during use. Watchmakers often advise their customers to be careful with their special and vintage timepieces. All too often, the advice is unheeded and these watches are returned with problems within the warranty period. Some are legitimate comebacks; a part may have failed; the watchmaker may have missed something during the original service, or something went awry. Other problems such as water damage to the movement, a broken balance staff, or broken stem may not be warranted, but they can create unpleasant issues. From the customer's point of view, the watch was serviced but does not run. Customers seldom admit getting their watch wet and they never drop them more than a few inches and even then, it is onto a soft foam pillow.

One store manager uses a slightly different approach when explaining the store's warranty policy. In addition to the regular warranty, any vintage watch repaired by the store gets an additional ironclad guarantee, which is a firm promise of something (legally different than a warranty). The manager guarantees the watch to get rusty every time it is exposed to water, regardless of how small the amount of water. It also is guaranteed to break each and every time it is dropped. If the watch does not get rusty the first time it gets wet, or break the first time it is dropped, the manager says please try again. This approach may seem a bit silly, but it drives home the point to the customer that the vintage watch is a delicate machine that deserves special care to keep it running. The shop manager, in sharing this story, reminds us that many owners of vintage timepieces, especially if this is their first vintage timepiece, need to be made aware of the limitations inherently designed into those watches. The original owners of vintage timepieces understood the delicate nature of a fine watch. They did not expect them to be water resistant and shock resistant, unlike the purchasers of new watches today who expect them to withstand severe treatment and still run.

*Jack Kurdzionak*



# SEEKING CANDIDATES FOR THE AWCI BOARD OF DIRECTORS

The committee involved with securing candidates to run for the AWCI Board of Directors is seeking recommendations from the membership. If you plan to suggest a possible candidate, please send that individual's name and background to: Nominations for Board of Directors Committee, AWCI, 701 Enterprise Drive, Harrison, Ohio 45030-1696 or e-mail to: [nominatingcomm@awci.com](mailto:nominatingcomm@awci.com)

Each recommendation will be carefully considered by the committee. Candidates will be selected on the basis of their local association or AWCI experience, geographic location, present job status, horological experience, and willingness to serve. The nominating committee will notify each candidate whether they have or have not been selected by the committee by December 30, 2006.

The deadline for membership to nominate a candidate for the AWCI Board of Directors is December 1, 2006 to be considered for the 2007 election.

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January 8-11, 2007	The Watchmaker's Lathe, Introduction
February 5-9, 2007	Modern Mechanical Chronographs
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June 4-8, 2007	The Watchmaker's Lathe, Introduction
June 25-29, 2007	Precision Timing
July 9-13, 2007	Modern Mechanical Chronographs
August 27-29, 2007	Modern Automatic Watches (3-day course)
October 22-26, 2007	Basic Watch Repair, Servicing and Adjusting
November 5-9, 2007	Basic Quartz & Quartz Chronographs

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April 2-5, 2007	AWCI Training Facility	Harrison, OH
May 21-24, 2007	AWCI Training Facility	Harrison, OH
June 18-21, 2007	North Seattle Community College	Seattle, WA
July 23-26, 2007	Saint Paul College	Saint Paul, MN
August, 2007	TBA	
September 17-20, 2007	AWCI Training Facility	Harrison, OH
October, 2007	TBA	

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or call toll free 1-866-FOR-AWCI (367-2924)**



# BULLETIN BOARD

## RESPONSES

Federal Glass Crystal Catalog

Joseph Miller, Fresno, OH, and Bob Wise, Indianapolis, IN, responded to the request by Michael Doyle, Sacramento, CA, for a Federal Glass Crystal Catalog.

## ITEMS STILL NEEDED

Sir Francis Drake Falling Ball Clock

Gordon Beach, Yuma, AZ, is looking for technical/parts information for a Sir Francis Drake Falling Ball Clock, 1981, made in England.

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 or requests to:

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## *In Remembrance*

AWCI has been notified of the passing of the following members:

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Laurie Penman

# Topping Wheels

## Part 2

It is clear that the only gear tooth forms that can be topped with the machine shown in Part 1 are those that conform to a part of a true circle. There are several of these, as illustrated in Figure 1: full ogive, 2/3 ogive, 1/3 ogive and half round (often termed simply as "round"). However, wheels are nearly always full ogive or, in some antique clocks, round. The other ogive forms are seen in pinions. It is not normally necessary to top pinions and since there are far fewer teeth,

reducing the diameter by hand and micrometer is not as tedious as for a wheel. In addition, of course, new teeth cannot be inserted into a pinion and this is a common reason for wishing to top a wheel. Consequently the machine detailed here is intended for wheels only.

The actual path that the file takes for the two forms of wheel teeth can be as shown in Figure 2, however a half round tooth of

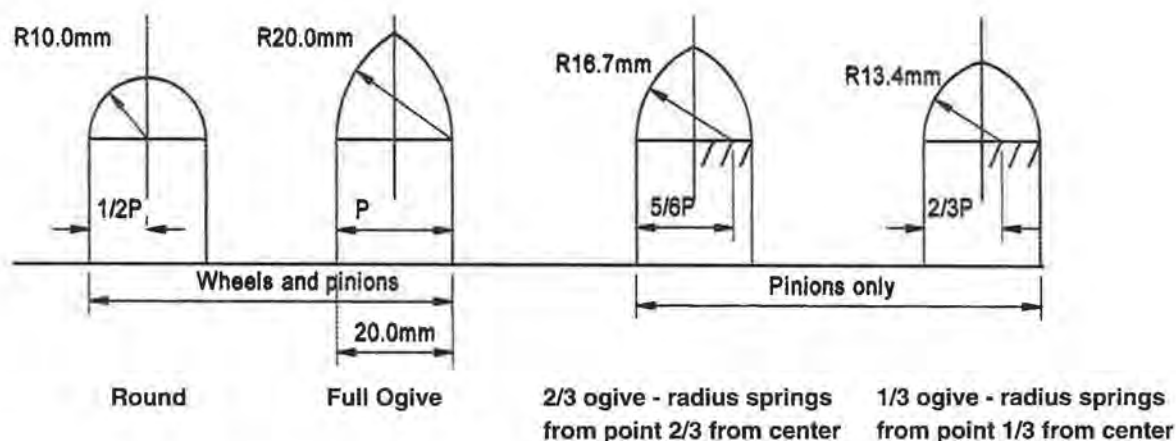
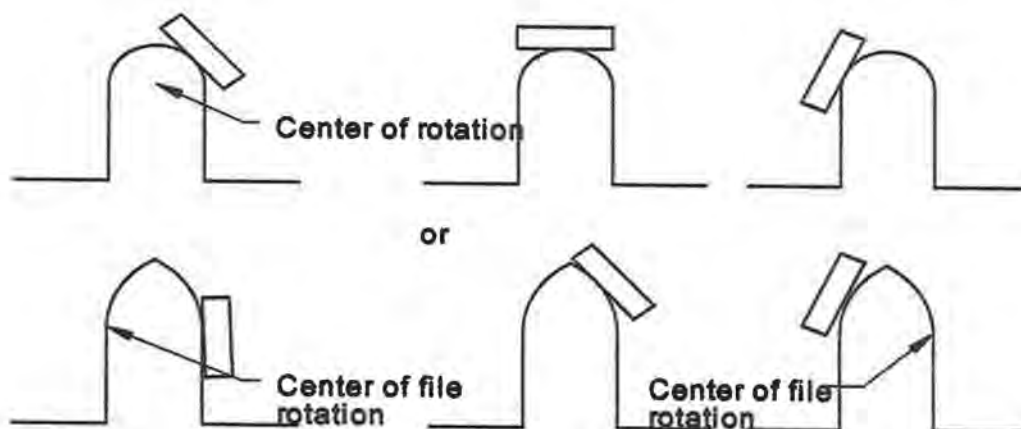


Figure 1



The path that the file takes for semi-circular and full ogive wheel teeth.

Figure 2

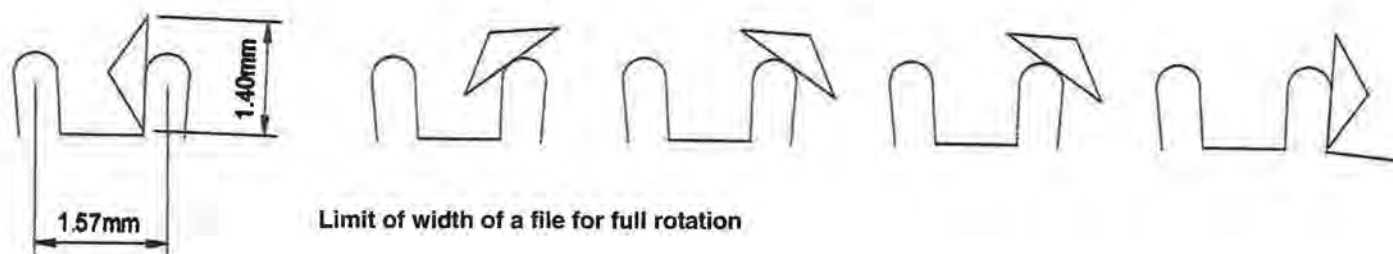


Figure 3

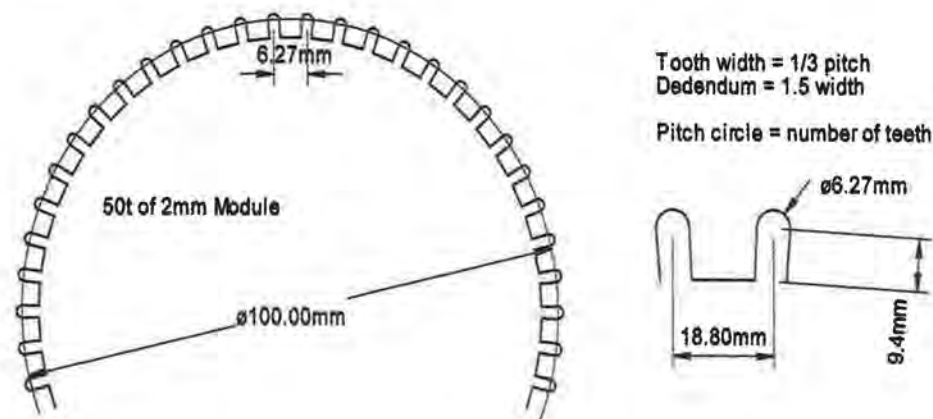


Figure 4

0.5 mm module requires a barette file that is 1.4 mm wide (Figure 3), which is hardly a practical tool. The solution is the same as for the full ogive; file one half of the form and then turn the wheel over. This allows room for a barette file of at least 6 mm width to be used for 0.5 mm module.

Wheel teeth with half round tops generally date from the 17<sup>th</sup> and early 18<sup>th</sup> centuries. I have not come across any widely accepted formula for the dimensions of these wheels. Figure 4 shows an approximation that should suit most antique wheels with round teeth; a module of 2 mm has been used to here increase the scale of the drawing. Any replacement wheel would be based upon the dimensions of whatever remained of the original, and that would be the final arbiter for the form of the replacement. However, the drawing is a close enough approximation to show the limits applying to the shape and size of the file if only half the profile of a round tooth is filed at each setting (Figure 5). The actual dimensions of the tooth and file are 0.5 mm module and 6 mm wide respectively.

Note that there is an antique form known as "the rule of thumb," which is about the best description possible; the form is not a half round but thumb shaped. To reproduce this form a shadowgraph is needed and drawings made to discover arcs that come close to

reproducing the original. A restorer does not often come across this type of wheel, I think that it is probable that they generally came from low-quality clockmakers and the clocks have "died."

It has to be remembered that although a great deal has been written on the theory of gears and their forms, practical clockmakers frequently did not have the mathematical knowledge to appreciate the theory in the 17<sup>th</sup> and 18<sup>th</sup> centuries, nor the means to turn it into practice. The clock industry turns on approximations, literally.

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## Tool Details

The topping machine must fulfill four requirements:

A. Indexing and locking of the wheel must be positive.

B. The "offset" of the ogive radius center from the tooth center must be adjustable.

C. The distance from the file's cutting face to the center of the arc

forming the addendum of the tooth must be adjustable.

D. Different diameters of wheel must be accommodated.

This makes the tool expensive in manufacturing time, but for a clock repairer who frequently makes replacement wheels for clocks older than fifty years or so, or who replaces

wheel teeth in wheels and barrels, it should prove to be a time-saver. Remember that by using a simple circular saw to "gash" blanks for new wheels, this machine will produce fully formed teeth without the necessity of buying a range of gear cutters.

## Indexing

A simple click is not good enough, because the tooth spaces may be so different from one wheel to another as both size and form of tooth alter. Although the file will not exert much force on the teeth, the wheel does need to be locked as well as positioned for each cut. I have used a fixed finger on the slide that you see in Figure 6, and a little spring-loaded finger to pinch the tooth against the fixed one. This is a sub-assembly and it mounts on the end plate, or bracket of the complete machine, using a fixed post that also serves as the pivot for the sub-assembly.

Because the duty that this tool needs to perform is light, the only restraints on the sub-assembly are the pivot just mentioned and the locking nut A. The wheel blank (I show two wheels merely to indicate the range of blank dimensions possible.) is clamped loosely by wing nut C.

Starting with a blank that has been gashed (all the tooth spaces cut with a saw) a tooth is grasped by the finger and sprung clip and locking nut B tightened. The sub-assembly is rotated slightly until the tooth is in the desired position relative to the file (This will be defined in Part 3.) when the locking nut A is clamped. Assuming that the adjustment of the file itself has been carried out, the process is simply one of making a few strokes of the file to make one side of its profile and then releasing it from the indexing fingers so that it may be moved one space and then clamped again.

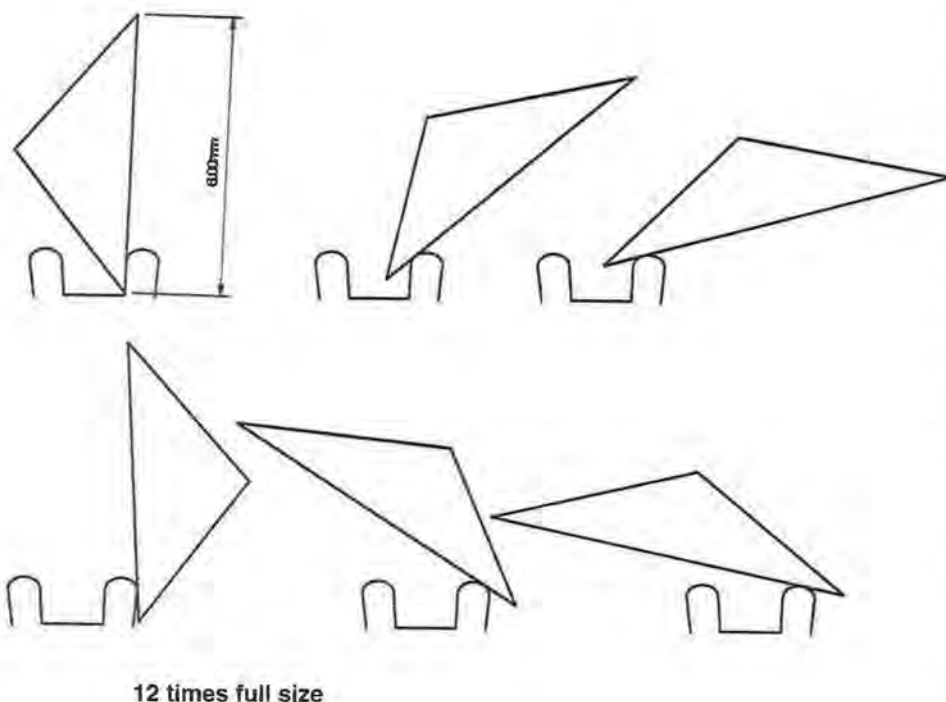
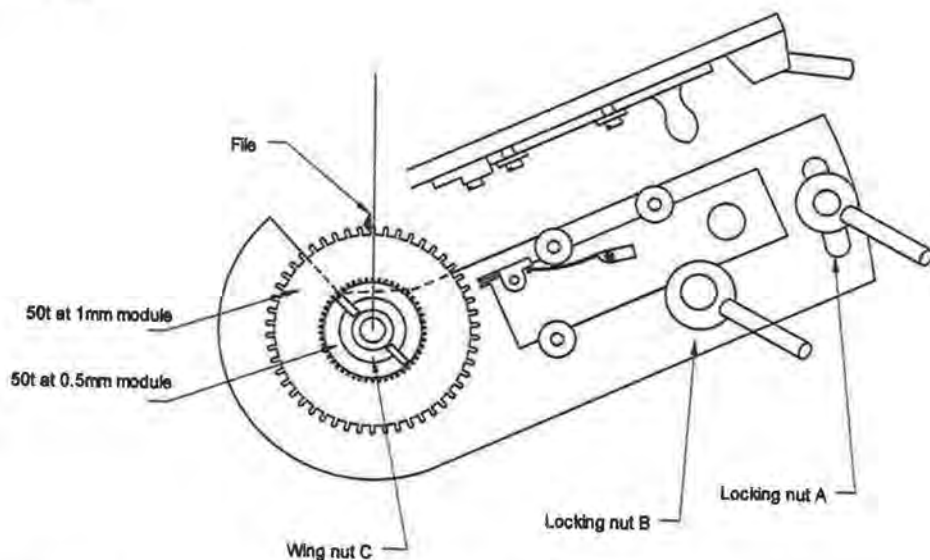


Figure 5



This sub-assembly mounts on the end plate of the machine

Figure 6

## President's Message

(Continued from page 2.)

If during the year you have any questions about the structure, politics or everyday operations of AWCI please contact the Board members or me. Financial questions should be directed to Treasurer Jack Kurdzionak. Executive Director Jim Lubic, CMW and the AWCI staff members can be contacted for requests concerning AWCI headquarters information or materials. Jim is charged with the administrative activities of the Institute carried on by the headquarters office of the Institute. E-mail addresses are published in *Horological Times*.

It was an honor and great experience to have Antoine Simonin as a guest, a speaker and an award winner. He presented an all day lecture to the Chronometer Club, was a presenter during our Saturday seminars and was awarded the prestigious "FEL-LOW-American Watchmakers-Clockmakers Institute."

The "Lifetime Achievement Award" was presented to longtime friend, instructor and Seiko Technician Scott Chou for his continuous contributions to individual watchmakers, local chapters and the AWCI.

Plans are being formulated for the 2006-07 meeting to be held in Cincinnati, OH and the following year 2007-08 in St. Louis, MO.

Everyone left with a feeling that this is going to be a united, fruitful year. Look for more information about the annual meeting in next month's *Horological Times*.

I am looking forward to working for and with each of you this year.

## Executive Director's Message

(Continued from page 2.)

Finally I want to thank all the Symposium presenters: Antoine Simonin, The Escapement & Oiling Procedures; Bob Macomber, Antique American Wooden Clocks - Making and Installing Bushings; Ed Ueberall, Railroad Pocket Watches; Julian Berg, Opening and Running a Clock Shop; Jack Kurdzionak, The Professional Watchmaker: Behaviors, Practices and Certification; Vince Schrader and Jerry Faier, jointly presented on the new AWCI watch and clock certifications.

Thank you to all who displayed at the Vender Fair: Terry Kurdzionak of Eckcells, Zina Hoyt of W.T. Hoyt Company, and Elliott Alexander of Micropower Battery Company. Thank you Terry Kurdzionak for all you do year after year to make the Vendor Fair a success, and thank you Barbara Goldstein for helping Terry.

Finally, Immediate Past President, Jim Door and his wife Merrienne, and his father, Wes Door FAWCI, and mother Betty; thank you for your dedication to AWCI.

Last but not least the AWCI staff; thank you for your hard work and dedication.

I apologize if I forgot anyone. I can assure you that everyone's efforts are appreciated.

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Wes Cutter

# Affiliate Chapter Report

We had a very good meeting at the Marriott in Seattle, Washington. The weather was fabulous (it was reported to us) even if none of us saw any of it. We were called to order and heard a welcome address from the retiring President Jim Door who was justifiably proud of his home site of Seattle, Washington.

Jack Kurdzionak, CW, then introduced the Keynote Speaker Antoine Simonin, former WOSTEP director and currently a Rolex Geneva consultant. Mr. Simonin talked about a variety of things with some of his key points being that a watchmaker's world was only 40 cm square, and that we need to look up and see the rest of the world and what is going on in it. Some of the bullet points he discussed were: of the 8 million people in Switzerland 10 years ago, 35,000 were working in the watch industry and now there are 40,000 (but to put that in perspective, in 1976 there were 90,000 and it dropped to 23,000 by 1981); the watch industry is starting to remove some of ETA's dominance, with new plants making new replacements and older forms of watches (for example in China they have 10 women on a production line who put out 25,000 watches a day putting the hands and dials onto already assembled movements); Rolex is just completing two new buildings that will house 1,000 people for after-sales service; and in a recent look through a watch periodical (from Switzerland) there were 65 complications in just that one watch magazine so there continues to be a need for qualified watch people, yet many of the newly trained Swiss just want to work on a computer and not in the 40 cm square that he talked about in the beginning. It was a very interesting lecture from a noted expert in the field.

We then went through the affiliate chapters' annual reports. Some highlights were: the Massachusetts chapter is celebrating its 50<sup>th</sup> year; Minnesota had its 80<sup>th</sup> convention; North Carolina revived its newsletter to regular publication times with a new editor on the way; Capital Area Guild of Texas continues to increase membership and member activity; Washington State "restarted" their chapter with an excellent technical program each month for the past year; Virginia overcame the loss of a clock class by the state (for the last 30 years) and have started their own class for clock repair/workshop with over 30 people signed up for spring already; the Chronometer Club is over 190 members strong and is aiming for 200, while still publishing a great quarterly newsletter and hosting the internet discussion group, and all in all it was a positive report.

There were three motions made to the Board on Sunday. One was asking for a Constitutional amendment that would allow for more flexibility in the investment choices for the AWCi Perpetuation Fund. It passed and the Board wrote a proposal and submitted it to the Constitution & Bylaws Committee. Stay tuned, as a vote of the membership will probably be coming in the spring.

Second was a motion that any AWCi project involving over \$50,000 to start or over \$150,000 total should be electronically distributed to members in a needs-based cost proposal, which would include clearly stated goals and clearly defined metrics with a process which will define progress toward achieving these goals. Members will have at least two days to comment to the AWCi committee on the merits of such a proposal before the Board of Directors approves these projects. This proposal also passed.



Third was that AWCI needs to communicate/broadcast the training/certification process to add value to the 21<sup>st</sup> Century Watch Certification so that the general public will request (and know to request) certified watch repair. If AWCI needs money to finance this we would like to have the watch companies be asked to contribute, as they are beneficiaries of this publicity also, and this one was moved to committee for cost considerations and implications, etc.

Last was for the Board's information only: the Affiliated Chapters group is going to start an educational fund with the aim that ALL students will have their AWCI memberships and possibly related events (i.e. 21<sup>st</sup> Century Watch exams, etc.) be at reduced or no cost. We already raised \$20 and the details will be coming soon as to how this is all going to work, so look deep into those Affiliated Chapters' checkbooks.

Yours truly, Wes Cutter was elected Chairman; Dan Spath was elected Vice-Chair. It was a very positive chapter meeting and adjourned by noon. This should be an exciting year.



## Questions & Answers

(Continued from page 4.)

Waterbury and over the years came with plain brass plates; highly polished brass plates and with steel plates.

As to the escape wheel hanging up: If I understand you right, it sounds like the tips of the escape wheel are hitting the impulse surfaces of the pallets rather than the locking faces as they should, giving a skipping action. This means that either the center distance between the pallet arbor and escape arbor is too great, or the pallets are too far apart.

Your movement's pallets should span six teeth (almost seven). If they do then they have not been altered and all you'll need to do is bring the pallet arbor slightly closer to the escape arbor (i.e., bring the pallets slightly deeper into the escape wheel teeth). Be careful, it won't take much movement to reset the distance. Your movement is provided with an adjustable bridge on the front plate that holds one of the pallet arbor pivots. Rotate that bridge slightly clockwise to decrease the depth.



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# Book Review

Robert D. Porter, CMW

*Wristwatch Chronometers—Mechanical Precision Watches and Their Testing*, by Fritz von Osterhausen. Schiffer Publishing Ltd., 4880 Lower Valley Rd., Atglen, PA 19310; ISBN: 0-7643-0375-9

This 9½" x 12¼" high-quality hardcover book contains 211 pages that present a detailed explanation and comparison of the observatory testing procedures used by the observatories in Geneva and Neuchatel, Switzerland, as well as a discussion of the testing procedures performed by the German Hydrographic Institute in Hamburg, Germany, and Kew Observatory in England to confer the much sought after *chronometer* status to



high precision mechanical wristwatches. This book is well written and is illustrated with over 60 large dial and movement photographs of wrist chronometers by known makers.

The first section of this book introduces the reader to the world of chronometry by explaining the origin and meaning of the word *chronometer* as it relates to the testing of precision timepieces, and how that testing was carried out by various agencies.

Pictures and examples show actual testing certificates and results earned by most of the Swiss producers such as: Longines, Omega, Patek-Philippe, Rolex, Vacheron & Constantin, as well as the German companies of Junghans and GUB, as a few examples. The testing of electric chronometer wristwatches is also discussed in detail.

Many highly detailed charts and graphs throughout the book compare the testing results of various manufacturers to give the reader insight into the highly competitive world of watch manufacture. The winning of chronometer trials and certification often translated into an economic advantage for winning companies who could then tout that success in company advertisements to spur sales. Many of us in the watch business will remember the famous advertising slogan: "Longines, The World's Most Honored Watch".

The last section of *Wristwatch Chronometers* offers many excellent larger-than-life photographs, many in color, to whet the appetite of any collector of fine watches. This is an excellent book that belongs in the library of anyone wanting to know just about all there is to know about the world of wristwatch chronometers.



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### CALIFORNIA

Ayala, David L. — Irvine, CA  
Brueggeman, Walter K. — Tehachapi, CA  
Creed, Harry C. — Santa Rosa, CA  
Davenport, Mark L. — Northridge, CA  
Decker, Richard A. — San Jose, CA  
Foreman, J.M. — Cambria, CA  
Garbe, Bruce R. — South Pasadena, CA  
Holub, William C. — Bellflower, CA  
Kann, Lee Ambrose — Anaheim, CA  
Kelton, Burl — Van Nuys, CA  
Putterman, Milton — Petaluma, CA

### COLORADO

Bays, Marvin L. — Westminster, CO  
Page, Mancel E. — Grand Junction, CO

### CONNECTICUT

Bystry, Peter — Windsor, CT  
Krutolow, Alvin — Danbury, CT

### FLORIDA

Del Castillo, Julio — Tampa, FL  
LeBeau, Leonard J. — Largo, FL  
Matz, Benjamin — Boca Raton, FL  
Schlueter, Robert L. — Cape Coral, FL  
Trujillo, Clodovald — Tampa, FL  
Wilsey, Robert L. — Lake City, FL

### ILLINOIS

Becker, Gunther A. — Lombard, IL  
Blanchard, Laurence A. — Quincy, IL  
Craft, George E. — Freeport, IL  
DeRuntz, James — Granite City, IL  
Heyerman, Harold A. — Peotone, IL  
Jordan, James W. — Maryville, IL

### INDIANA

Botkin, William E. — Muncie, IN  
Calvert, Harold K. — Noblesville, IN  
Hood, Clarence — Terre Haute, IN  
Lohrmann, Robert E. — Rockville, IN  
Schaefer, Walter B. — Speedway, IN  
Stinnett, Merrill — Marion, IN

### IOWA

Bartels, Donald J. — Clinton, IA  
Glessner, Curt F. — Waterloo, IA  
Kurka, Richard C. — Fairfield, IA  
Roth, Milton E. — Waterloo, IA

### KANSAS

Sutton, Lionel — Ottawa, KS

### LOUISIANA

Lindsay, Donnie R. — Alexandria, LA

### MAINE

Labbe, Roger S. — Biddeford, ME

### MARYLAND

Craig, Stanley H. — Hagerstown, MD

### MASSACHUSETTS

Hersey, Walter — Reading, MA  
Perry, Edmund — Taunton, MA  
Ramos, Albert — Fairhaven, MA

### MICHIGAN

DeLorenzo, Tancredi — Grosse Pointe, MI  
Fulton, William C. — Mount Clemens, MI  
Tuthill, F.S. — Albion, MI

### MINNESOTA

Kelly, Donald W. — New Ulm, MN  
Nelson, Robert A. — Richfield, MN  
Pary, Robert A. — New York Mills, MN  
Woodward, Howard D. — Saint Paul, MN

### MISSISSIPPI

Wimberly, A. L. — McComb, MS

### MISSOURI

Grayson, David Michael — Festus, MO  
Neilson, George E. — Cape Girardeau, MO  
Porter, Robert D. — Ellisville, MO

### MONTANA

Brown, Thomas G. — Polson, MT  
House, Alvin J. — Hamilton, MT  
LeDuc, Gorvan — Laurel, MT  
Sharples, Franklin A. — Chinook, MT

### NEW JERSEY

Chessari, Emil J. — West New York, NJ  
Coats, John J. — Newton, NJ  
Frystak, Henry — Linden, NJ  
Loeser, Henry — Fort Lee, NJ  
Pobereskin, Isadore — Marlboro, NJ

### NEW MEXICO

Buttner, Karl — Albuquerque, NM

### NEW YORK

Doerrer, Frederick W. — Dolgeville, NY  
Graziano, Philip — Hudson, NY  
Rapp, Harold L. — Roslyn, NY

### NORTH CAROLINA

Book, Kenneth A. — Aberdeen, NC  
Dietzel, Charles F. — Brevard, NC

Lamb, James T. — Wilson, NC  
Smith, Julian J. — Warrenton, NC  
Strickland, Leaman — Wendell, NC

### OHIO

Broughton, James H. — Columbus, OH  
Fulkerson, Frank W. — Toledo, OH  
Jaffee, Monroe J. — Toledo, OH  
Kiser, Willard — Ironton, OH  
Lingenfelter, Jacques R. — Loudonville, OH  
Pater, Donald W. — Hamilton, OH  
Pater, Gerald E. — Hamilton, OH  
Rife, Thomas F. — Dayton, OH  
Smith, Leslie L. — Cincinnati, OH  
Sneary, Richard — Port Clinton, OH  
Stevens, Milton C. — North Bend, OH

### OKLAHOMA

Denney, K.C. — Tulsa, OK  
Hawkins, Bennie C. — Oklahoma City, OK  
Smith, Byron — Texhoma, OK

### PENNSYLVANIA

Allalunis, Simon — Pittsburgh, PA  
Bender, Paul E. — Belleville, PA  
Cehelsky, George J. — Bethlehem, PA  
Kemmerer, Jack — Franklin, PA  
Markley, Robert C. — Willow Street, PA  
Norcross, Albert G. — Forty Fort, PA  
Parker, C. Thomas — Carlisle, PA  
Sollenberger, Herbert P. — Mechanicsburg, PA  
Verruni, Joseph C. — Plymouth Meeting, PA

### RHODE ISLAND

Jacobson, Bernard — Providence, RI  
Zompa, Joseph J. — Providence, RI

### SOUTH CAROLINA

Buyck, Fred J. — Columbia, SC

### TENNESSEE

Haley, Andrew E. — Memphis, TN

### TEXAS

Bishop, Jack — Pasadena, TX  
Brice, Bobby E. — Bay City, TX  
Dorer, Dick — Fredericksburg, TX  
Fulwiler, Jack H. — Abilene, TX  
Home, H. R. — McAllen, TX  
Malicke, Frank — Flower Mound, TX  
McCarty, James W. — Carrollton, TX  
Neill, Harold B. — Nacogdoches, TX  
Peek, Benjamin K. — Hitchcock, TX  
Walton, Carey E. — Dallas, TX  
Wysong, Harry E. — Austin, TX

### VIRGINIA

Davis, Earl O. — Winchester, VA  
Fisk, Paul F. — Charlottesville, VA  
Hardy, Clarence E. — Roanoke, VA

Hartman, Ewell D. — Richmond, VA  
Merten, William M. — Norfolk, VA  
Palen, Stanleigh W. — King George, VA  
Rudibaugh, Richard J. — Chesapeake, VA

#### WASHINGTON

Ghan, David L. — Seattle, WA  
Sandberg, John R. — Wenatchee, WA

#### WISCONSIN

Case, Harold L. — Waukesha, WI  
Jaeger, Gerald G. — Sheboygan, WI  
Johns, C. R. — Fountain City, WI

#### CANADA

Zoller, Horst R. — Saskatoon, SK

#### Members 30 to 39 years

#### ALABAMA

Mielke, Daniel Howard — Selma, AL

#### ALASKA

Augustin, Eugene E. — Fairbanks, AK

#### ARIZONA

Alchenberger, W. — Green Valley, AZ  
Bjornson, Stan — Phoenix, AZ  
Caldwell, Timothy — Scottsdale, AZ  
John, Peter K. — Phoenix, AZ  
Lucic, Christopher A. — Oracle, AZ  
Lynes, Willis L. — Kingman, AZ  
Mast, Melvin — Morristown, AZ  
Minard, Dayton A. — Sierra Vista, AZ  
Smith, Terry O. — Tucson, AZ  
Steinbach, Walker — Tempe, AZ  
White, Thomas H. — Phoenix, AZ

#### ARKANSAS

Carter, Theron C. — Mountain Home, AR  
Ellis, Donald D. — North Little Rock, AR  
Lacey, Vernon — Paragould, AR

#### CALIFORNIA

Banks, A.C. — Mariposa, CA  
Bartow, S. A. — Fortuna, CA  
Bennett, A.L. — Grass Valley, CA  
Bernecker, Ludwig — San Francisco, CA  
Bertrand, Thomas N. — Fair Oaks, CA  
Biagi, Louis A. — Oakland, CA  
Brouzes, Keith — Modesto, CA  
Edison, Mark J. — Fair Oaks, CA  
Frohlich, Karl Heinz — Simi Valley, CA  
Giggiberger, Jose — Santee, CA  
Hampton, Scott — Lafayette, CA  
Highfill, Paul — Santa Maria, CA  
Ikawa, Jack — Fresno, CA  
Kalincsak, Imre — Riverside, CA  
Lieu, Chi D. — San Francisco, CA  
Mazza, Richard A. — Beverly Hills, CA  
Mendoza, Bernardo E. — San Jose, CA  
Mizushima, Henry H. — Sacramento, CA  
Sanin, Gonzalo — Los Angeles, CA  
Sweetser, Larry D. — Fairfield, CA  
Vystroil, Karel — Newark, CA  
Wong, George B. — Berkeley, CA  
Wylie, Hanse E. — Orange, CA  
Yalenian, Varoujan — Los Angeles, CA

#### COLORADO

Cooper, David E. — Boulder, CO  
Fetcher, William M. — Steamboat Springs, CO  
Mattson, David — Colorado Springs, CO

#### CONNECTICUT

Curley, William J. — Waterbury, CT  
Pavkov, Raymond E. — North Haven, CT

Riggio, Tony — Westport, CT  
Tyler, T.R. — Mystic, CT

#### DELAWARE

Escheu, Alfred — Wilmington, DE  
Woods, John Paul — Bethany Beach, DE

#### FLORIDA

Aretz, Ronald G. — Sarasota, FL  
Bernstein, Daniel — Hollywood, FL  
Codella, Michael — Coral Gables, FL  
Dunlap, James R. — Sarasota, FL  
Eichermueller, Max — Cape Coral, FL  
Gereg, Samuel W. — Niceville, FL  
Lareau, Maurice D. — Longwood, FL  
Luce, John W. — Tampa, FL  
Maggard, Grover Douglas — Tampa, FL  
Pedzy, Edward A. — Jensen Beach, FL  
Roscinski, Edward J. — Tampa, FL  
Waalewyn, Anthonius — Palm Beach, FL  
Yore, John W. — Riverview, FL

#### GEORGIA

Cash, Ned J. — Brunswick, GA  
Davenport, Larry G. — Roswell, GA  
Painter, Madison H. — Ellijay, GA  
Sanger, Leon A. — Brunswick, GA  
Wilson, Gary D. — Lawrenceville, GA  
Zettle, Rita A. — East Ellijay, GA

#### IDAHO

Grover, F. Martell — Rexburg, ID  
Hollingsworth, Gene I. — Emmett, ID

#### ILLINOIS

Bruce, Gary — Princeton, IL  
Dobbles, Paul G. — Bismarck, IL  
Donovan, Jack — Normal, IL  
Eckel, Allan D. — Champaign, IL  
Graska, James C. — Lansing, IL  
Grigsby, C. Smith — Mount Carmel, IL  
Gustafson, Robert G. — Rock Island, IL  
Niwa, Frank — Countryside, IL  
Ramsey, Charles L. — Decatur, IL  
Richardson, Mark W. — Mendota, IL  
Smith, Bernard W. — Decatur, IL

#### INDIANA

Bradley, Robert B. — Brookville, IN  
Christianson, David A. — Kendallville, IN  
Cinotto, William R. — Whiting, IN  
Heilman, Philip K. — Indianapolis, IN  
Hoellein, Rudolf — Indianapolis, IN  
Myers, Stephen B. — Wabash, IN  
Settle, Steven D. — Bloomington, IN  
Shirey, Leslie R. — Syracuse, IN  
Vance, Ray T. — Lawrence, IN

#### IOWA

Wilshire, Howard — New Hampton, IA

#### KANSAS

Kenzy, Layne — Winfield, KS  
Rea, Jack C. — Wichita, KS  
Spahr, Karen — Oberlin, KS

#### LOUISIANA

Casso, Kenny Raphael — Baton Rouge, LA  
Wade, C.C. — Bogalusa, LA

#### MARYLAND

Cherry, Ray F. — Baltimore, MD  
Ecker, Ralph G. — Boyds, MD  
Farmer, Todd A. — Hagerstown, MD  
Fribush, Samuel M. — Reisterstown, MD  
Graves, J. Rodney — Salisbury, MD  
Kong, Ching — Derwood, MD  
Smith, C.W. — Derwood, MD

#### MASSACHUSETTS

Brown, Joseph E. — Sudbury, MA  
Ditello, James S. — Pittsfield, MA  
Marcus, Barry J. — Milford, MA  
Mastromattei, Antonio — Revere, MA  
Meek, Jonathan F. — Amherst, MA  
Tanguay, Brian P. — Gardner, MA

#### MICHIGAN

Altounian, Manouk — Livonia, MI  
DuBry, Kathleen M. — Tecumseh, MI  
Harris, Charles L. — Flint, MI  
Jerue, Jerry L. — Climax, MI  
Nyman, Eric — Escanaba, MI  
Pickett, Lee E. — Ann Arbor, MI  
Sheidler, Alan R. — Rochester, MI  
VanSweden, John M. — Kalamazoo, MI  
Winarski, John — Fraser, MI

#### MINNESOTA

Albers, Terence D. — Long Lake, MN  
Arlo, David W. — Cannon Falls, MN  
Gould, William B. — Glencoe, MN  
Meffert, Raymond A. — Arlington, MN  
Morneau, John B. — Saint Paul, MN  
Streed, Donovan P. — Waseca, MN  
Tuttrup, Terry L. — Waseca, MN

#### MISSISSIPPI

Bossen, Thomas J. — Brandon, MS  
Rawls, Winford — Tylertown, MS

#### MISSOURI

Franke, Joe — Columbia, MO  
Martin, John S. — Jefferson City, MO  
Wrigley, Eugene C. — Kansas City, MO

#### MONTANA

Grocholski, Gary W. — Billings, MT  
Miller, Robert A. — Billings, MT

#### NEBRASKA

Jones, Joe — Auburn, NE  
Kumor, Frank J. — Bellevue, NE  
Robinson, James E. — Kimball, NE

#### NEVADA

Sadilek, James R. — Carson City, NV

#### NEW HAMPSHIRE

DeCook, John W. — Claremont, NH

#### NEW JERSEY

Berthoud, Bernard — Long Branch, NJ  
Mattice, Virginia S. — Mount Laurel, NJ  
Richter, Paul — Fairlawn, NJ

#### NEW MEXICO

Hoog, Robert S. — Albuquerque, NM

#### NEW YORK

Bell, Thomas E. — Bethpage, NY  
Crofoot, Howard S. — Locust Valley, NY  
Freedman, Jack — Brooklyn, NY  
Gordon, Ronald — New York, NY  
Hanley, Patricia A. — Rochester, NY  
LaDue, Dale — Rochester, NY  
Spicknall, Cameron C. — Elmira, NY  
Wadsworth, Paul D. — Hilton, NY  
Zamora, Alfonso — Buffalo, NY

#### NORTH CAROLINA

Aponte, Emilio — Newport, NC  
Campbell, James A. — Lowell, NC  
Dagenhart, Roy — Harrisburg, NC  
Deitz, William R. — Hickory, NC  
Hall, Gary Wayne — Clinton, NC  
Longberg, Keith — Concord, NC  
Matthews, Edward C. — Holly Springs, NC  
Rondinone, David J. — Kernersville, NC



Shuping, Mack R. — Winston Salem, NC  
Simpson, Billy M. — Monroe, NC  
Suits, James P. — Thomasville, NC

#### **NORTH DAKOTA**

Herrud, Alan — Langdon, ND

#### **OHIO**

Bosse, Kenneth B. — Cincinnati, OH  
Cooper, David M. — Worthington, OH  
Dulmage, James G. — Columbus, OH  
Grove, James H. — Granville, OH  
Huss, Norman C. — Sylvania, OH  
Johnson, William H. — Tallmadge, OH  
Ludwig, Klaus — Brecksville, OH  
McKinney, Charles F. — Carlisle, OH  
Montgomery, Jacob E. — Union, OH  
Riggs, James J. — Bryan, OH  
Rinker, Carl G. — Atwater, OH  
Shafer, David G. — Cincinnati, OH  
Troyer, Monroe L. — Sugar Creek, OH  
West, John E. — Norwood, OH

#### **OKLAHOMA**

George, Horace A. — Oklahoma City, OK  
Mullican, Larry J. — Oklahoma City, OK

#### **OREGON**

Fleming, Theodore S. — Eugene, OR  
Jacobs, David A. — Beaverton, OR  
Keller, Stevan T. — Bend, OR  
Lint, Clifford A. — Bandon, OR  
Peterson, Randall E. — Heppner, OR

#### **PENNSYLVANIA**

Baer, Earl E. — Kutztown, PA  
Bishop, Robert F. — Glenshaw, PA  
Chellman, Alva C. — Port Matilda, PA  
Hoxie, Kenneth C. — New Holland, PA  
Keck, John F. — Port Matilda, PA  
Kucharczuk, John B. — Allentown, PA

#### **RHODE ISLAND**

Paul, Edward F. — Warwick, RI

#### **SOUTH DAKOTA**

Barfoot, Kenneth M. — Custer, SD

#### **TENNESSEE**

Cline, Walter J. — Memphis, TN  
Richards, Dannie Bob — Germantown, TN  
Williams, Burkett — Athens, TN

#### **TEXAS**

Aleman, Peter G. — San Angelo, TX  
Anderson, Curtis M. — San Antonio, TX  
Burckhardt, Fred S. — Fort Worth, TX  
DuBois, James B. — Magnolia, TX  
Freeman, Troy L. — Quanah, TX  
Gage, Rex A. — Decatur, TX  
Hada, Eugene B. — New Braunfels, TX  
Hagle, Robert L. — Dallas, TX  
Murphy, Pat — Sweeny, TX  
Norman, H.J. — Graham, TX  
Rogers, Tim — Sinton, TX  
Schultz, Charles — San Antonio, TX  
Warner, Dennis J. — Cedar Park, TX  
Wingate, Robert M. — Dallas, TX

#### **UTAH**

Fulks, James K. — Farmington, UT  
Taysom, Vernal J. — Cedar City, UT

#### **VIRGINIA**

Bruckhart, Robert G. — Richmond, VA  
Culotta, Paul W. — Hampton, VA  
Graves, J. Rodney — Norge, VA  
Harris, Donald R. — Bluefield, VA  
Lanum, Lewis S. — Danville, VA  
Mister, Thomas H. — Virginia Beach, VA

Reha, William J. — Virginia Beach, VA  
Soukup, Charles F. — Richmond, VA  
Tompkins, Lemuel A. — Ashland, VA

#### **WASHINGTON**

Door, Wes — Kennewick, WA  
Eberhart, William R. — Bellevue, WA  
Macomber, Robert L. — Sequim, WA  
Pounder, C. J. — Spokane, WA  
VanVleet, Donald G. — Tacoma, WA

#### **WISCONSIN**

Aagaard, Jerry L. — Salem, WI  
Bergey, Mark O. — Whitewater, WI  
Biederman, William I. — Sparta, WI  
Debbink, Jeff — Cedar Grove, WI  
Doolittle, Mark — La Crosse, WI  
Gardner, Glenn D. — Madison, WI  
Gerber, Michael L. — Sun Prairie, WI  
Kania, Eugene — Milwaukee, WI  
Kent, Raymond — Racine, WI  
Leeseberg, Kenneth K. — Montello, WI  
Nett, Don — Appleton, WI  
Nummi, Harry R. — Superior, WI  
Pederson, Greg — Eau Claire, WI  
Sambas, Raymond J. — Rhinelander, WI  
Sheppard, Eugene F. — Janesville, WI  
Smiles, Allan J. — Ashland, WI  
Smith, Joseph M. — Racine, WI

#### **WEST VIRGINIA**

Hughes, Stephen T. — Spencer, WV

#### **WYOMING**

Blakely, Mabel G. — Lander, WY

#### **CANADA**

Barthau, David — Stouffville, ON  
Riley, David C. — Kingston, ON

#### **INTERNATIONAL**

Drader, Frank — E. Sussex, United Kingdom  
Mora, Rodolfo D. — Panama 5, Panama  
Richardson, S. H. — Waiuku, New Zealand  
Switzer, Charles Wm. — Victoria, Australia

#### **Members 20 to 29 years**

#### **ALABAMA**

Hua, Thomas — Anniston, AL  
Lovellady, Ronny A. — Decatur, AL  
Prickett, Joseph C. — Jacksonville, AL  
Swafford, John W. — Madison, AL

#### **ARIZONA**

Anderson, Charles — Cottonwood, AZ  
Arnold, Jack A. — Surprise, AZ  
Battain, Remy — Kingman, AZ  
Baumbach, Richard A. — Phoenix, AZ  
Baxter, John M. — New River, AZ  
Berger, Steven — Scottsdale, AZ  
Bunkelmann, Dick — Kingman, AZ  
Burkey, Roy B. — Tucson, AZ  
Campagne, Jay — Tucson, AZ  
Di Stefano, Rosario — Scottsdale, AZ  
Faier, Jerry M. — Glendale, AZ  
Moore, Ted — Ehrenberg, AZ  
Neblett, W. P. — Tucson, AZ  
Rich, Michael J. — Tucson, AZ  
Van Kempen, Willem S. — Vail, AZ  
Vogt, David E. — Chandler, AZ  
Zander, Leroy E. — Prescott, AZ

#### **CALIFORNIA**

Allen, Don M. — Benicia, CA  
Armentrout, Dean — Laguna Beach, CA  
Arnold, Lawrence F. — Mariposa, CA  
Bernard, Lawrence E. — San Francisco, CA

Buster, Donald D. — Huntington Beach, CA  
Butterfield, D.E. — Oakdale, CA  
Chang, Enrique S. — San Ramon, CA  
Collison, T. A. — Murrieta, CA  
Dabrowski, Juliusz — San Francisco, CA  
Davis, Charles E. — La Verne, CA  
Davy, R. G. — La Crescenta, CA  
Doyle, Michael J. — Sacramento, CA  
Dudley, Charles G.K. — Reddley, CA  
Gao, Genway — Campbell, CA  
Grass, John — Redwood City, CA  
Gravenkamp, David A. — Yreka, CA  
Gunalp, Asim M. — San Diego, CA  
Heyler, Emil — San Jose, CA  
Johnston, Daryl — Chico, CA  
Jokschi, Dennis P. — Marysville, CA  
Kita, Shig — Napa, CA  
Knobloch, E. William — Lincoln, CA  
Koch, Dayton — Auburn, CA  
Kroker, Donald — Fresno, CA  
Krupnick, Igor — LaJolla, CA  
Lantz, Stone J. — San Francisco, CA  
Loeb, Alexander G. — Newport Beach, CA  
Manis, Steven — Pacifica, CA  
McPherson, Donald M. — Petaluma, CA  
Meyer, John H. — Los Altos, CA  
Miller, David T.A. — Camino, CA  
Murray, Michael P. — Gardena, CA  
Nim, Lee Hung — Redwood City, CA  
Petersen, Wayne — Sonoma, CA  
Price, David — Chester, CA  
Public Library — Los Angeles, CA  
Rider, Allison L. — Watsonville, CA  
Rider, Ron — Watsonville, CA  
Rigsby, Kenneth Donald — Los Angeles, CA  
Rolland, Earl F. — Pacifica, CA  
Roper, Harvey W. — Auburn, CA  
Rybicki, Louis — Solvang, CA  
Uchida, Kingo — Port Hueneme, CA  
Weck, Robert W. — Walnut Creek, CA

#### **COLORADO**

Albert, Frank — Golden, CO  
Binsfeld, Robert E. — Lafayette, CO  
Burrows, Thomas A. — Grand Junction, CO  
Kimberlin, Ron — Lakewood, CO  
Miller, Jeffrey C. — Denver, CO  
Naleski, Kip — Colorado Springs, CO  
Oswald, Llewellyn K. — Broomfield, CO  
Phillips, Rodney E. — Fort Collins, CO  
Soraci, Paul — Loveland, CO  
Tanke, Karl R. — Littleton, CO  
Zaltsberg, Felix — Denver, CO

#### **CONNECTICUT**

Crump, Kirt H. — Madison, CT  
Gagnat, John — South Windsor, CT  
Galasso, Vincenzo — Hamden, CT  
Haynes, Bruce A. — Torrington, CT  
Jahnke, Paul W. — Monroe, CT  
Koulmey, Rene J. — Woodbury, CT  
Meunier, David J. — Putnam, CT  
Mills, Robert J. — Ivoryton, CT  
Ohr, Andrew L. — Wallingford, CT  
Thurston, Dwight W. — Canton, CT  
Zieroth, Elmer A. — Durham, CT

#### **DELAWARE**

Koch, Bernard C. — Wilmington, DE

#### **FLORIDA**

Aguilar, Adriano — Palm Springs, FL  
Barnes, R. A. — Bradenton, FL  
Bragman, David — Lake Worth, FL  
Bransford, Thomas — Deland, FL  
Bucknam, Gordon D. — Indianalantic, FL  
Buerkle, Walter — Naples, FL  
Carbonneau, Robert — Pensacola, FL  
Crider, Paul H. — Altoona, FL  
Erickson, Eric J. — Jacksonville, FL

Foshee, Clyde R. — Lakeland, FL  
 Frazier, Maurice W. — Jacksonville, FL  
 Genovese, Anthony — Fort Myers, FL  
 Greene, Clifford R. — Cantonment, FL  
 Heisler, Scott — Winter Park, FL  
 Leavitt, Robert G. — West Palm Beach, FL  
 LeBeau, Richard J. — Saint Petersburg, FL  
 Liebman, Melvin — Port Saint Lucie, FL  
 Nisi, Michael J. — New Port Richey, FL  
 Parigian, Ernest — Hollywood, FL  
 Polachek, Barton R. — Orlando, FL  
 Pullin, Thomas M. — Venice, FL  
 Ramirez, Antonio — Homestead, FL  
 Sodano, Antonio — Palm Beach Gardens, FL  
 Spivey, Paul M. — Archer, FL  
 Terwilliger, Robert — Miami, FL  
 Tilem, Joel — Boca Raton, FL  
 Tope, Ernest R. — Tampa, FL  
 Triftmacher, Lothar — Jacksonville, FL  
 Wiles, Christopher — Naples, FL  
 Worley, Orville — Pensacola, FL  
 Wright, Leo A. — Vero Beach, FL

## GEORGIA

Ariail, David — Decatur, GA  
 Judy, Michael W. — Warner-Robins, GA  
 Marsh, Dewey B. — Augusta, GA  
 Roy, Richard J. — Villa Rica, GA  
 Sharp, Michael A. — Griffin, GA  
 Sidebotham, Thomas E. — Savannah, GA  
 Sussman, Hy — Augusta, GA  
 Womble, Ashley — Marietta, GA

## HAWAII

Dier, Bernard R. — Waipahu, HI  
 Goda, Ben — Honolulu, HI  
 Kawafuchi, Roy S. — Honolulu, HI

## IDAHO

Spinden, Robert — Nampa, ID

## ILLINOIS

Bauer, Joseph F. — Antioch, IL  
 Bom, Alfred — Decatur, IL  
 Buyer, Ralph C. — Freeport, IL  
 Casstevens, Rex — Saint Charles, IL  
 Cavarretta, Samuel — Carbondale, IL  
 Dickerson, Kent — Highland, IL  
 Dowell, James W. — Pana, IL  
 Foster, Joseph E. — Eureka, IL  
 Franklin, Leonard M. — Edgewood, IL  
 Gardner, David M. — Urbana, IL  
 Grau, Wesley — Gurnee, IL  
 Guentert, Andrew — Richton Park, IL  
 Hinrichsen, Mark — Eureka, IL  
 Horstmann, Paul — St. Anne, IL  
 Houk, Tamara — LaGrange, IL  
 Irvin, Bert G. — McLeansboro, IL  
 Iverson, Roland R. — South Elgin, IL  
 Johnston, Charles H. — Cobden, IL  
 Kwiatkowski, Paul T. — Grant Park, IL  
 LaChapelle, James T. — South Elgin, IL  
 Maneke, Charlie — Alton, IL  
 Maoloni, Anthony J. — Western Springs, IL  
 McCutcheon, Raymond W. — Chicago, IL  
 Mikolite, Kent — Chicago, IL  
 Mulliken, David F. — Champaign, IL  
 Palmer, Robert — Lombard, IL  
 Partington, Joe — Oaklawn, IL  
 Paul, Steven — Glen Carbon, IL  
 Ruschke, Lawrence J. — Crystal Lake, IL  
 Schroeder, T. William — Chicago, IL  
 Spinner, Steven — Chicago, IL  
 Stephens, David L. — Palatine, IL  
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