HOROLOGICAL™ TIMES

November 2002

American Watchmakers-Clockmakers Institute

WATERPROOF Crown Assortments

Long Post

These two crown kits are very useful when retrofitting and offer convenience for general repairs. Both include yellow and white crowns and feature long posts which reduce the need for stem replacement. The different tap and tube opening sizes help you make the repair efficiently and economically.

Med.& Long Post

Crown Sizes: 3.0mm–4.0mm
Tube Openings: 1.60mm–2.0mm
Tap Sizes: 10, 11, 12
Post Length: 1.5mm

#83.018 $34.95

Crown Sizes: 3.0mm–5.5mm
Tube Openings: 1.60mm–2.5mm
All Tap–10 with medium and long posts

#83.024 $44.95

Screw Down Crown ASSORTMENT

#83.148 $24.50

Refills Available

An easy way to replace those hard to find threaded crowns. Each crown includes a friction case tube. Includes eight crowns: 1 each 4.0mm, 4.5mm, 5.3mm and 6.0mm in yellow and white.

Pusher Crowns for Pocket Watches

Esslinger & Co.
Pusher-Type Crown Assortment
#83.038
8 Pcs. All Tap - 10

#83.038 $29.95

Includes antique, square, and modern styles. All are yellow, tap 10. 8-pieces total. Refills available.

Pocket Watch Crown Kit

NEW

Plastic compartment box contains 12 different sizes of popular type crowns. In yellow or white; refills available.

#83.206 (Yellow) $19.95
#83.209 (White) $17.95

Crown Cutters

NEW

Used to enlarge the opening on watch crowns. Set includes 3 sizes: 2mm, 4mm, & 6mm.

#64.086 $25.95

Esslinger & Co.
80 Years Young – And Growing

1165 Medallion Dr. • St. Paul, MN 55120
Toll Free Phone Orders 1-800-328-0205
Toll Free Fax Orders (24 Hrs) Fax: 1-800-548-9304

HOROLOGICAL™ TIMES

An Official Publication of the American Watchmakers-Clockmakers Institute

EDITORIAL & EXECUTIVE OFFICES
AWI, 701 Enterprise Drive, Harrison, OH 45030
Phone: Toll Free 1-866-367-2924 or (513) 367-9800
Fax: (513) 367-1414
E-mail: awi@awi-net.org Web Site: www.awi-net.org
Office Hours: Monday-Friday 8:00 AM to 5:00 PM (EST)
Closed National Holidays

Donna K. Baas: Managing Editor, Advertising Manager
Katherine J. Ortt: Associate Editor, Layout/Design Associate

James E. Lubic, CMW: Executive Director & Education & Technical Director
Lucy Fuleki: Assistant Executive Director
Thomas J. Pack, CPA: Finance Director
Laurie Penman: Clock Instructor
Nancy L. Wellmann: Education Coordinator
Sharon McManus: Membership Coordinator
Mary Huff: Shipping Coordinator
Melanie Frye: Receptionist/Secretary
Steve Jones: Audiovisual Manager

HOROLOGICAL TIMES (ISSN# 145-9546) is published monthly and copyrighted by the American Watchmakers Institute, 701 Enterprise Drive, Harrison, OH 45030-1696. Subscription price for the public is $70.00 per year ($6.50 per copy). Members subscription is $25.00 which is included with annual dues of $70.00. Periodicals postage paid at Harrison, OH 45030 and additional entries. POSTMASTER: Send address changes to *HOROLOGICAL TIMES*, 701 Enterprise Drive, Harrison, OH 45030-1696.

CONTENTS

VOLUME 26
NUMBER 11
NOVEMBER 2002

FEATURE ARTICLES

COLUMNS

DEPARTMENTS

EDUCATION

SPECIAL INTEREST

COVER

This month's cover features a Waterbury Regulator No. 61 restored as an apprenticeship project.

President's Message

Jack Kurdzionak, CW

Every year at this time the president appoints, subject to confirmation by the Board of Directors, the members of AWI's constitutional, standing, and special committees. Much of our work is done by the good people who volunteer for the often-thankless task of serving on one or more of our committees. Constitutional committees are those mandated by our constitution. Members of the Finance Committee formulate our annual budget. They work very hard for you to deliver the best value for every one of your dollars that are spent. The Nominating Committee for the Board of Directors is responsible to nominate the best-qualified members we have to run for a seat on the board each year. Members of our Constitution and Bylaws Committee are responsible for evaluating any suggested changes to our constitution. The Judicial Committee, although not often consulted, is the final arbiter of any constitutional dispute that may arise. The Perpetuation Committee is responsible for the management of the James M. Dodson Perpetuation Fund in which the bulk of AWI's investments are kept.

Standing committees are those that are listed in our bylaws but not mandated by the constitution. The Membership Committee's jobs include growing the Institute's membership, publicizing AWI's benefits to non-members, and honoring our members for meritorious service. The Education Committee is responsible for developing educational programs for our members and to maintain and expand our certification programs. Our Media Committee is responsible for *Horological Times*, our website, and our book reviews. The Strategic Action Committee formulates our medium- and long-range plans for the future. Special committees (there are none at this time) are appointed as necessary and dissolve when their task is completed. The Parliamentarian, who has a thorough understanding of Robert's Rules of Order, monitors Board meetings to assure fair play for all participants.

None of the people who have volunteered to serve on committees will receive any compensation for their hard work other than the satisfaction of helping the membership. To all of them from all of us, "Thanks for volunteering to serve AWI this year."

Executive Director's Message

James E. Lubic, CMW

This month's issue contains a lot of information regarding the newly-approved committees, their members, committee assignments, and how to contact them. Don't be shy about contacting a specific committee regarding an idea that you might have. All ideas are welcome.

Every now and then I receive a question from a member that makes me wonder if there are other members that might have the same question, or maybe we (AWI) haven't done a good job of informing our members. This is what prompts the remaining portion of this month's message.

Question: *Are AWI's certification designations trademarked*?

Answer: Yes they are. This was a very lengthy process that started in the spring of 2002 and finally ended this past April with the issuing of trademarks for the following certification designations.

Certified Master Clockmaker (CMC)	Certified Clockmaker (CC)
Certified Master Watchmaker (CMW)	Certified Watchmaker (CW)
Certified Master Electronic Watchmaker (CMEW)	Certified Electronic Watch Technician (CEWT)

What this means is that only those individuals that have earned one of the above certification designations has the legal right to use it in conjunction with their business or name. If you, as an AWI member, take and successfully complete one of the Institute's certifications you will receive one year of regular AWI membership free.

I received several phone calls lately regarding the availability of One-Dip. The one cleaning chemical that we all use for cleaning hairsprings seems to have disappeared from all the supply/material houses' shelves. After speaking with a couple of the supply/material houses, I have good news to report. The supply houses have been promised that within the next two weeks they will receive their orders of One-Dip in 8 oz and 16 oz containers. The 2 oz, 1 quart, or 1 gallon size containers will no longer be available.

If you would like to experiment there is a new product that your supply house most likely will have from Polychem. Polychem's QS – 85LO is a citrus scented non-chlorinated solvent degreaser. This product may be a good replacement for One-Dip, but is untested by anyone I know. This product is available in one gallon containers and the cost is in the $35 to $40 range.

ETA Movement Extravaganza


ETA 955.114/3


ETA 955.424


ETA F05 11A


ETA F04 11A

ETA 956.414

ETA 978.002

ETA F03 11A

MIYOTA 2035

Prices good through November 30, 2002!

We reserve the right to limit quantities!

MOVEMENT	USE FOR	SIZE	FEATURE	REG.	SALE
ETA 955.114/3		11-1/2	SS-DATE	$13.95	**$11.95**
ETA 955.424		10-1/2	SS-D/D	13.95	**11.95**
ETA 956.414/3		8-3/4	SS-DATE	13.95	**11.95**
ETA 978.002		5-1/2 - 6-3/4	2 HAND	24.95	**19.95**
ETA F05 11A	ETA 955.414	10-1/2	SS-DATE	11.95	**9.95**
ETA F04 11A	ETA 956.414	8-3/4	SS-DATE	11.95	**9.95**
ETA F03 11A	ETA 956.114	7-3/4	SS-DATE	11.95	**9.95**
MIYOTA 2035		6-3/4 - 8	SS	5.95	**2.95**

Notice the Miyota Movement? Check out the price!

Energizer

Need batteries?
Add Energizers to your order!

ORDER TODAY! IN STOCK AND READY TO SHIP!

The Wm. S. McCaw Company
Since 1913

1722 Madison Avenue
Toledo, Ohio 43624

Phone: 419-243-3720
800-472-0200
800-537-0343
Fax: 419-243-0321
800-245-6481
mccawco@worldnet.att.net

VISA

MasterCard

AWI

JIDA

Wholesale Watch Materials • Tools and Findings • Jewelry • Boxes

Questions & Answers

Question

I am interested in having an English translation of the French book titled *Le Echappement A Cylindre (1729-1950), Le Haut-Doubs, center mondial au XIXe siecle*, by Henry L. Belmont (1985).

I have been interested in the history of cylinder escapement watches for several years. I have read many books on the history of watches, most of which briefly mention that cylinder escapement watches ceased production in the year 1950. I have been trying to find out exactly when cylinder escapement watch production ended, and what was the manufacturer and model of the last production cylinder escapement watch. I was hoping that the book, *Le Echappement A Cylindre*, would provide answers to these questions since it is the only book, to my knowledge, that is devoted solely to the history of the cylinder escapement.

I attempted to translate this book into English on my own using a French/English dictionary and certain Internet translation sites; however, I found that an accurate translation is beyond my capability. My motive for a translation is for my own use only, but if others were interested I would share the results without seeking any financial profit.

I hope this letter clarifies my purpose in acquiring a translation of the book.

Paul H. Nordeen
Holt, MI

Answer

Manuel Yazijian referred your question to me. I hope I'll be of, at least, some limited help.

As you know the cylinder escapement was invented by Thomas Tompion, perfected by his student, George Graham (1673-1751) and used by such eminent makers as Julian Le Roy, Urban Jurgensen, John Arnold, John Elliott and Abraham Breguet, all using a ruby cylinder and a steel wheel. The cylinder escapement found widespread use in the thin LePine movements and was instrumental in watchmakers abolishing the fusee in favor of the going barrel in watch movement design; albeit, using a steel cylinder and a steel wheel.

Le Echappement A Cylindre (1729 - 1950) is the premier book providing the background to the manufacture, workforce and methods of producing the cylinder in the L' Haute - Doubs area of France in the 19th century (the valley running parallel to the French side of the Jura Mountains—the mountains so famous for watchmaking both in France and Switzerland). I have included a copy of the late Henry Fried's review of the Mr. Belmont's work, both the book and the review were published in 1985.

According to Mr. Fried's review, the French produced the millions of cylinder escapements used by makers in France, Switzerland and Germany; and since this 1985 book covers the cylinder escapement from 1729 to 1950, I would assume that the last commercially made cylinder escapement was made in 1950. Since these escapements were made by numerous firms throughout the area, each making individual components of this escapement and bringing the components together at the watch manufacturer's assembly plant; it would be virtually impossible to identify the makers of the very last commercially made cylinder escapement.

Translating a text is a daunting task, especially a horological text. Perhaps the above will help you. You might try contacting the French Horological Society for a more definitive answer to your question as to who made the last cylinder escapement.

David A. Christianson,
CMW, CMEW,
Technical Editor

Question

A few pictures of a pocket watch are included for the purpose of identification. Thank you for your help.

Ken Jackson
Chapel Hill, MO

Answer

I can give you some historical background on your watch movement, but unfortunately I cannot identify the maker. It was the nature of Swiss watchmaking at the time: rough movements were purchased from an ebauche

(Continued on page 17.)

Borel

For the Latest in Watchmaker's Tools & Parts
visit @www.JulesBorel.com, click on products

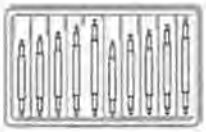
Borel

Extra-Long & Buckle Spring Bars in Stainless Steel

Extra-Long SB Asst.
SB-XL60 $ 14.95

Now available in strong stainless steel, these extra long spring bars for those fashion or older Go-Go watches that have been trouble in the past. Contains 6 each of five sizes, in both 1.80 & 2.00mm dia., 60 pcs. total. In a plastic box. The five sizes are;

20 - 26mm, 24 - 30mm,
28 - 34mm, 32 - 38mm,
36 - 42mm.

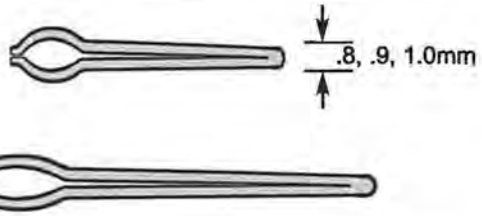


Buckle SB Asst.
SB-B144 $ 19.50

A complete assortment with four diameters of the special single-flange with short tips spring bar for foldover buckles. Contains 6 pieces each of 24 sizes, for a total of 144 pcs. in a 24 bottle see-thru plastic case.

7 sizes of 1.2mm dia. from 8 - 18
8 sizes of 1.3mm dia. from 8 - 18
7 sizes of 1.5mm dia. from 10 -18
2 sizes of 1.8mm dia, 16 & 18mm

Stainless Steel Cotter Pins in three diameters



All three assortments are in a 36 bottle see-thru plastic cabinets. These pins are used for connecting certain types of watchband links. They have also been used to tap into the link holes to replace an unavailable screw. Each assortment includes 165 pieces, 5 ea. of 33 lengths ranging from 4.5 to 20.5mm, and are in either the regular .9mm diameter, or the thinner (.8mm), or the thicker (1.0mm).

Available in three assortments

MCP90	Standard, .9mm diameter	**$ 19.95**
MCP80	Thin, .8mm diameter	**19.95**
MCP100	Thick, 1.0mm diameter	**19.95**

Borel

Jules Borel & Co.
1110 Grand Boulevard
Kansas City, MO 64106-2348

Order Desk 800-776-6858
Order FAX 800-776-6862
Local 816-421-6110

Borel

J.M. Huckabee, CMC, FAWI, FBHI

Ask Huck

About Mounting the Watchmaker's Lathe to the Watchmaker's Bench

Question

Where do you mount the lathe on your watchmaker's bench? How close is it to the near edge, and how high is the spindle from the bench?

Answer

My watchmaker's bench is 38 inches high. I purchased it new 41 years ago. I was reluctant to drill, or otherwise mar the bench for lathe mounting. My previous bench was about 2 inches lower, previously owned, and I never liked the lathe position on it. I removed the lathe pedestal and purchased a Borel stand-alone base. I liked that set up, but never liked the height. I suspect you have a similar opinion about mounting your lathe. You are the final judge as to whether you drill a hole in your bench, use screws, or something else.

A watchmaker's bench is no place to do clock service work. Later, I almost ceased doing watch work. At that time I purchased two benches that are 4 feet long, 2 feet wide and 34 inches high. Suddenly, I found the lathe and Borel base was near ideal for my height and vision. I had a couple of padded stools that were a little too high. I cut their legs to a top height of 22 and 23 inches, and that was just right. It took me many years to find my choice. Now I have 6 lathes, different bases, but all the same spindle height.

Here is the advantage of a stand-alone lathe: You can position it any way you choose that makes your work more comfortable. When I do work on a faceplate, I turn the lathe so I'm looking directly into the faceplate. Being right-handed, I usually run the faceplate jobs with the motor reversed, and my working hand on what is called the rear of the lathe bed.

I urge each reader to be aware of traditional work practices, but also urge you to be ever searching for a way that is more comfortable and more productive.

Lathe Motors, Belts, and Pulleys

Question

What material do you recommend for belts and splices for the clockmaker's lathe?

Answer

Here are the first and second of "Old Huck's" laws of probability on the belt subject.

1) The belt will either break or slip during every important job.
2) The number of times the belt slips or breaks per job is proportional to the urgency of completing the job.

A good belt is not elastic. It should be supple and the splice should run smoothly over the pulleys. Use longer belts and there will be fewer slippage problems than with very short ones. The motor needs a quick and easy method to adjust belt tension. A belt that does not ride the bottom of a "V" pulley is less apt to slip. Plastic belts are usually unsatisfactory unless they have a core thread to prevent stretch.

After fighting this subject for more than a half-century, I've never found a perfect drive belt.

Overall, I believe a leather belt to be equal, or better than anything I have used. The problem is how to make a smooth-running splice.

Leather has good traction, limited stretch and is very supple when oil soaked. The ends can be skived to a half-inch lap joint and glued. They will teach you "Old Huck's" two laws of probability.

Over the years, I have settled on a leather bootlace spliced with a small hook made from a paper clip.

Belt loads and problems are much greater at the speeds and cutting rates used in clockmaking. I feel confident our watchmaker friends have fewer belt problems.

Screw-Down Crown Sale

Our most popular assortment of screw-down crowns and corresponding tubes is now available at tremendous savings!!! Sending your watch in for matching can result in individual costs of $12.00 to $15.00. This assortment can pay for itself after only 3 crowns.

Assortment # WM30.001 Regular $79.95

Sale Price $39.95

Gaber & Company

1501 Reedsdale Street
Cardello Building
Pittsburgh, PA 15233

(800) 792-2820 Phone
(800) 322-8331 Fax
Gabertools@AOL.com E-mail

Fred S. Burckhardt, FAWI

Our American Legacy

The Hamilton Watch Company started in business in June 1892, in Lancaster, Pennsylvania, in the plant that originally housed the Keystone Standard Watch Company. This group also purchased part of the Aurora Watch Company in Aurora, Illinois. Production actually started in 1893, aiming their timepieces at the railroads as they became popular with the railroads because of their accuracy.

The company made watches for the Ball Watch Company in Cleveland, Ohio. They were all 21 or 23 jewels. Railroad watches accounted for over half of the company's production, but later this decreased to about 10%.

In 1957, Hamilton marketed the first electric watch, the Hamilton 500. This was followed by the Model 505, an improved version. This was the beginning of a new era in timepieces and timekeeping.

Hamilton continued in operation until 1959. It is now owned by a Swiss conglomerate.

In the 1970s, the United States, once again, shone brightly as the forerunner of the quartz watch. All this history is contained in AWI's Benjamin Matz book, *The History and Development of the Quartz Watch*.

As you can see, the American watch companies had their ups and downs, but we must remember, the early people who built this great American industry started with nothing. It lasted about 100 years, going from zero to the greatest mass producer of fine watches. The wars, the Depression, the Swiss and Japanese, and other far East countries, finally defeated the once great American industry. In George Daniels' book, *English and American Watches*, he says, "Today there is not a watch factory in the world that does not owe something of its success to American inspired methods."

The past articles were written only to give you a very brief history of the American watchmaking industry. There were many more watch companies and, of course, many more watchmakers. It is hoped that the articles will serve to whet your appetite for more information about our great legacy.

Bibliography

Complete History of Watchmaking in America, Charles S. Crossman

Time and Timekeepers, Willis I. Milham, Ph.D.

The Watch Factories of America, Henry G. Abbott

Almost Everything You Wanted to Know About American Watches and Didn't Know Who to Ask, George E. Townsend

American Watchmaking, H.C. Harrold

Watches 1850-1980, M. Cutmore

English and American Watches, George Daniels

NOTE: All these books are available on loan from the ELM Charitable Trust-Henry B. Fried Library.

The

American Watch Guild LLC

announces

the creation of the

International Watch Collectors Society, LLC

The **Society** will provide members with the following news and information

- Calendar of major watch sales & auctions.
  - Antiquorum, Christie's, Phillips & Sothebys
  - The previews of upcoming auctions.
  - Reports: photographs, prices and auction results.
- Announcements from significant watch firms of new releases and limited editions.
- Establishment of regional chapters where the collectors can meet and have guest speakers from noteworthy watchmaking factories.
- A book club.
- Question and Answer service by Stuart Unger, noted watch authority & author.
- Annual meeting at the Concours d'Elegance at the summer Jewelers of America Show held at the Javits Center in New York.
- Booklets such as:
  - *How to Buy a Watch*
  - *How to Detect a Counterfeit*
  - *The Care and Service of Timepieces*
  - *Where to Find the World's Finest Watches*
- Emerging new master watchmakers and their creations.

For Information and application for membership
write or fax:

International Watch Collectors Society, LLC

257 Adams Lane • Hewlett, NY 11557 • Fax: 516-374-5060

Letters to the Editor

All letters to the editor must be signed and bear the address and telephone number of the writer. Your address and telephone number will not be published without your permission. AWI reserves the right to edit letters for length and content. All letters should be concerning the Institute and/or issues specific to the field of horology. Please send your letter via: E-mail: dbaas@awi-net.org; Fax (513) 367-1414 or mail to Horological Times, *"Letters to the Editor," 701 Enterprise Drive, Harrison, OH 45030-1696.*

Dear Editor and
AWI Board of Directors:

In recent years I, like many of you and others in the watch and jewelry industry, have become complacent and have turned away from the most talked about and critical issue that is threatening our very existence. That issue is spare parts!

I thought by making a few phone calls, and ranting and raving to my watchmaker's association that all would be taken care of and all my problems would disappear. I soon discovered this is not so.

Many customers are under the assumption that if you sell a particular watch line and have a watchmaker on the premises that you have access to parts to repair that watch. But this couldn't be further from the truth! They are not warned that the only place parts or service can be obtained is possibly only one place in the U.S. These factory service centers are not completely owned by private individuals, but are owned and subsidized by foreign watch companies. In recent years many of these companies have been bought and added to other watch companies creating larger and more powerful conglomerates. Many parts houses here in the U.S. are concerned about staying in business if the current restrictions on parts continue and possibly get worse. Our jobs as watchmakers, whether we repair high-grade watches or low-end watches, will cease to exist if parts houses go under. Restricting fair trade and competition is called price fixing and running a monopoly, all which is illegal in this country.

The very essence of being a watchmaker is our ability to obtain parts and compete in a fair and open market! Since the mid-1970s our watchmaking schools have gone from 44 to 10. Membership will continue to fall until the independent watchmaker is gone. We won't have the AWI or other trade publications, only a company newsletter.

That's why I am starting a campaign to petition our government to make them aware of the policies and practices of some of the watch companies here in the United States of America. But I can't do all this alone. I need the support of the AWI and other trade publications to make this work. Many ideas have been proposed from lawsuits, to banning repairs on watches that won't supply parts, to negotiating with foreign watch manufactures to supply further training on their watches. All, I feel, are unfortunately futile. A campaign directed toward our government officials, such as congress, senators, or representatives would better serve this effort—perhaps by composing a form letter and posting it on a web site where it can be downloaded and signed by all who want to make a difference.

I know that the AWI position has been to work with industry, provide training and many other services. However, on behalf of watchmakers, clockmakers, the public, and other related industry services, I hope that AWI would be willing to allow the members who feel strongly about this to use the AWI website, yahoo group, or at least a link to the association's e-mail, as a place to post information or even possibly the form that I mentioned.

I have mentioned this idea to many of my colleagues and parts houses and all are willing to get involved. In fact, I have heard from some people whom I don't know, who want to know where they can sign up! Without even trying, the ball has begun to roll. It's now our responsibility to follow through with deliberate and complete resolve!

Don Rigsby, CMW
Los Angeles, CA

Dear Mr. Rigsby:

AWI's position with regard to spare parts has two major components. First, we wish to work with the manufacturers and distributors of watches and clocks in order to assure that our members can obtain an adequate supply of spare parts to repair these timepieces, now and in the future. Second, our members need supportive educational services from the industry in the form of continuing education and up-to-date technical information so that all of our 4200+ members can do the quality of work needed by the industry.

Please refer to the Executive Director's message, page 2, January 2002 *Horological Times* for more detailed background information regarding spare parts issues.

Our "AWI Matters" Yahoo group is available to all members for the discussion of horological issues that are of concern to them, whether AWI related or not. Mr. Rigsby and all members are invited to share their concerns regarding the availability of spare parts on this forum.

Jack Kurdzionak, CW
AWI President

Questions and Answers

(Continued from page 4.)

manufacturer and finished by a finishing firm in rather large numbers, often without identification, which is the case with your watch.

Your watch represents a finished movement often known as a LePine calibre, although it is more correctly known as a Swiss bar movement. It is a very typical movement that evolved from the original LePine movement of the 1750s, when Paris fashion dictated thinness and simplicity in clothing and accessories. LePine responded with his bar movement with a suspended mainspring barrel that permitted a thinner watch than the prevalent fusee movements in use at the time.

Your watch is a 4th generation version of the Swiss bar movement, which was made in large ebauche factories and sold to watchmakers (usually in large finishing shops) to be hand fitted with mainspring barrels, train jewels, escapements, and balances; and then finished to the maker's and his customer's specifications. This particular ebauche (or blank) movement was produced from 1850 to 1885.

The LePine style movement lent itself to mass production by ebauche factories, first in France by Frederick Japy and then later in Switzerland. Although mass produced, the watch components and parts were not interchangeable because they needed to be hand fitted. Machines allowing for the precise tolerances and repeatability needed for interchangeability had not been invented by this time.

Hope this will help.

David A. Christianson, CMW, CMEW
Technical Editor

David LaBounty, CMC and
Andrew LaBounty

A History of the Waterbury Clock Company

(1857 – 1942)

Editor's Note: Andrew LaBounty, Apprentice Clockmaker, is a sophomore at Olathe North High School in Kansas. He is serving as an apprentice under his father, David LaBounty, CMC, FBHI. The apprenticeship program was written by Jerry Faier, CMC. This article documents Andrew's project of restoring a Waterbury Regulator No. 61.

The Waterbury Clock Company, founded March 5, 1857, began as a venture into the lucrative clock market by the ambitious Benedict & Burnham Corporation, heretofore the "B&B Corp." Being a company specializing in the production of brass, and with clock movements being made of brass, the B&B Corp. made its first attempt at utilizing its goods for the measurement of time by investing heavily in the business of a clockmaker named Chauncey Jerome with the understanding that Jerome would buy brass from no other brass company. Thus began a short cooperation that ended with Jerome striking out upon his own business with $75,000 of B&B's brass, which they sold to Jerome at a profit. Having only begun to satisfy the needs of impatient people waiting for, and trying to catch trains, B&B began their own clock company: The Waterbury Clock Company!

It started in an old mill, very near to the main factory of the B&B Corp. Strapped for good clockmakers, the corporation decided to honor Jerome's brother, Noble Jerome, with the title "chief foreman of movement production." So began the famous clockmaking business in Waterbury, CT on March 5, 1857 as a company of the Benedict & Burnham Corporation. The Waterbury Clock Company was described in its time by Chauncey Jerome in his autobiography as being a company of famous "first citizens of that place" including a senator and one of the richest men in the country. He also spoke of his brother, the chief movement mechanic, as being "as good a brass clockmaker as can be found." A great grief struck the Company in 1861, however, when Noble Jerome was killed by a falling balustrade while strolling in the merry month of May. Silus B. Terry replaced Noble as master clockmaker. Silus B. Terry, apprenticed by his father Eli Terry, later founded the Terry Clock Company with his sons. Incidentally, Eli Terry also apprenticed the famous clockmaker Seth Thomas who created his own company when Silus B. was but two years old.

After the Civil War, in which most of Waterbury's employees participated on the Union side, the Company erected two large case-building shops. They were hardly used, though, before both caught fire and caused $25,000 damage, equaling about $270,000 in 2002 currency. Half of that was safely insured, and another case shop was built upon the same site. From here, the Waterbury Clock Company kept getting larger and more flushed with employees. In 1867, the first known catalogue of Waterbury

clocks was released by the New York Sales Agency. Waterbury clocks occupied only a small fraction of the myriad of companies represented by the catalogue but that was soon to change. The company continued to grow and, by 1875, had opened several offices in Chicago and San Francisco. By 1881, their own catalogue contained 94 of their own clocks on 122 pages. Ten years later they had grown to a full 175 pages offering 304 models of their own design.

Until this point, Waterbury had been offering chiefly commonplace clocks. Their fame was truly made, however, when Waterbury, in 1892, began to build watches for the Ingersoll Company, who sold them as dollar watch alternatives to the expensive watches of the time. These became known as Ingersoll Watches, and were produced by an offshoot of the Waterbury Clock Company, the Waterbury *Watch* Company. This became an extremely profitable venture for both parties, yet when Ingersoll went bankrupt due to several mistakes involving the purchase of "defunct" watch companies, Waterbury lost its most valuable customer. During the time in which Waterbury was producing the Ingersoll-Waterbury watch, clock production held, but did not increase much. A few new clocks were added, but their catalogue was very much standard as it always had been.

Waterbury continued on its way, eventually creating the "Mickey Mouse clock" and the "Timex", though by 1942 it had already ceased to be its own corporation, having been bought out by Norwegian investors and moved to Middlebury, CT. Now, the Waterbury Clock Company lives on in its legacy of vintage antique timepieces and in the Timex Corporation which it birthed.

A Brief History

The Waterbury Regulator No. 61 was produced during Waterbury's business peak from 1903 to 1917 because of demand that stemmed greatly from the advancements made in the railroad. With the railroad came schedules, and people needed to know what the time was to a greater accuracy than simply night or day. As such, precision regulators were found chiefly in train stations, banks, and hotels, yet demand grew for smaller timepieces, such as precision watches, in large cities. In addition, people began to move to those cities where time became important in one's work place instead of generalized on one's farm. As the world became more modernized and in effect, *smaller*, time became a necessity not only to keep trains from colliding and economy running, but also for the common man who simply wanted the time of day.

Precision movements before the railroad, however, existed primarily as scientific advancements quite beyond the public's field of use. The early clock began with but one hand, the hour hand, which showed the time within about 30 minutes the time of day. As people became more and more interested in keeping track of time, a minute hand was added allowing ease of time measurement to within approximately 30 seconds. Precision clocks were those with a second hand, which measured to the second and finer, dependant upon the clock. Today, in such a time-based world, the common clock has a minute hand and most often a second hand. In 1903, The Waterbury Regulator No. 61 was among those clocks with a second hand and probably considered nearly extraneous in its accuracy. At that time, no one needed to know the time to within a second, except perhaps in the railroad's case and those persons servicing the precision watches. Presently, the Waterbury Regulator No. 61 remains a superbly accurate clock even by today's standards of a precision movement.

The Process

To Begin – The Take Down

The first day of work began on the morning of February 27, 2002; ninety years after the presentation of the clock to the school by the class of 1912. We (David LaBounty, CMC, FBHI and Andrew LaBounty, Apprentice) received permission from Asst. Principal Mr. Carmody to remove the clock's movement, dial, weight, and

pendulum from the case and take it to our shop (then operating from home) for restoration. First, the pendulum was removed and placed to the side. Next, the weight was detached and placed with the pendulum. Finally, to take the clock movement and dial out of the case, it was necessary to loosen the seatboard screws that held the metal box encasing the movement. After doing so, the metal box and movement, attached with the dial, were easily transported as a unit. The work had begun that would take place everyday during seventh hour for about a month.

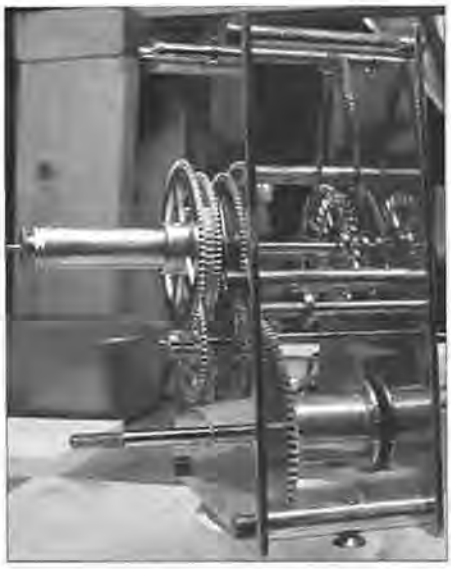
At the Shop – Cleaning it up

The first step in restoring the movement was obviously to remove it from both the dial and the metal box that encased it. To achieve this, the taper pins that held the dial to the box and the screws affixing the movement to the box were all removed. In addition, the hands were removed to take

the dial off. After the movement was taken out, several observations were made concerning the general state of the movement. It had indeed, been restored previously. It was obvious that it had been bushed (discussed later) in some places that were not entirely necessary and not bushed in places where it would have been more helpful. It was also painfully obvious why the piece kept bad time, or more likely *no* time. Several pivot holes were worn, the pendulum was badly adjusted with the beat adjuster set far to the left, the escapement had far too much entrance drop and little to no exit drop, and it

was probably set up incorrectly. All of the problems with performance are easily taken care of with no cost to the school, yet there is an aesthetic scar on the escape pallet arm placed there purposely by an unknown repairman. Unfortunately, it serves no cause for good or ill but to mar the otherwise gorgeous workings of a Waterbury Regulator 61, and it is irreparable. Apparently, someone took a punch and a hammer and beat consistently 16 times on the edge of the steel pallet arms. Again, it is senseless, useless, and obscene, so of course I'd like to point it out as a previous injury and not a recent one. Everything else seems to be in order and original, making for a beautiful timepiece. Having made these observations and taken pictures, the movement was then off to the ultrasonics to be cleaned. An ultrasonic tank is used because the ultrasonics agitate the liquid, causing small implosions, and knock off more dirt and grease than is possible any other way. First the movement was placed in an ultrasonic tank filled with ammoniated clock cleaning solution to remove the grease and dirt, as well as to brighten the brass. Then, it was rinsed in water to take off the ammonia solution and placed in an ultrasonic

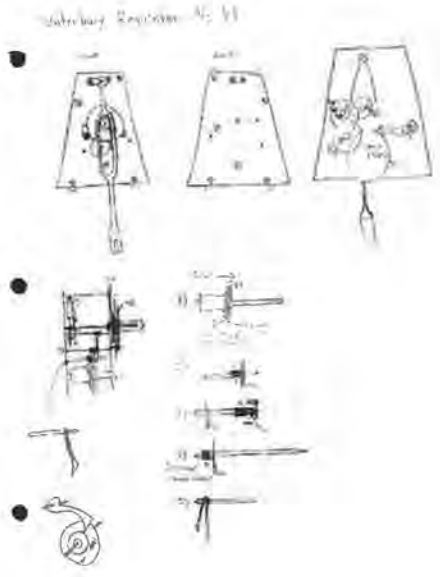
rinse solution of 50% xylene, 50% mineral spirits to bond with and remove the water. Finally, it was put in the dryer for several minutes at about 125° F to evaporate the rinse solution.



When it was finished, it was photographed again and ready to be disassembled.

On Paper – Making a Map

Before I could take the movement entirely apart, it had to be drawn so I would be able to put it together again with the gears in their proper places. To do this, I drew circles and numbered them in a hierarchy to display the order in which they went, then



drew each individual gear to show "which way was up". Since there are two plates, it is very easy to put a gear's opposite end in the wrong hole, so not only did I have to know their order, but also the relationship of their pinions to wheels, which end went "down", and the characteristics of each individual gear. The difference between pinions and gears should be explained. A wheel is, of course, a toothed disk that drives other gears. A pinion is a smaller portion of the gear, either in the shape of a lantern or a cut, smaller wheel that mates with the wheel of an adjacent gear. The pinion is the *driven* and the wheel is the *driver*. Another difference is that pinions have fewer "teeth" than a wheel, but they're called "leaves" instead. In fact, if a wheel has less than 20 teeth, it is considered a pinion, and the teeth are then called leaves. Both a wheel and a pinion together on a steel shaft is representative of a gear. At any rate, I had to know where the wheels and pinions were positioned on each gear, and where each gear was positioned between the plates. In addition to drawing the movement, I also examined it for any damage I hadn't already noticed. One thing that made itself apparent was the warped condition of the hand nut. Placing it in a hole on an otherwise flat block, I pounded it gently flat with a *brass* hammer so as not to mar the surface. Thus, I straightened the hand nut.

Taking it Apart and Determining Beats per Hour

Finally, real work could begin with the gears themselves outside of the movement. To take the movement apart was a simple matter of taking out five screws and pulling the front plate straight upward to avoid bending any pivots or shafts. This done, the gears were exposed and could be removed and replaced as needed according to the drawing which showed which pivot hole was which. Once it was apart, I had to count teeth to determine the beats per hour (BPH) of this particular clock. The BPH of a clock is the number of "tick-tocks" a clock makes in one hour. If the clock isn't set to its specific BPH, it doesn't keep time. Some BPHs can be looked up in a book, but most must be calculated using a "gear train calculation". To make a gear train calculation, one only uses the gears in-between the minute hand and the escapement (from which issues forth the "tick-tock" noise). You want to find the number of "tick-tocks" in an hour caused by the passing of escape teeth through the escape pallets, and the only constant you know is the minute hand, which invariably makes one revolution in an hour. With the minute hand as your beginning point and the escapement as the ending point, you simply engage in a series of conversions from wheel teeth to pinion leaves until you find the number of teeth on the escapement that pass a single point in exactly one hour. The Waterbury Regulator No. 61 happens to have a "seconds pendulum" which I knew from the beginning meant that it had to have 60 beats in one minute times 60 minutes in one hour for a total of 3600 BPH. Happily, my gear train calculations reflected that exactly, as shown below:

$$\frac{80}{12} \times \frac{72}{8} \times (30 \times 2) = 3600 \text{ BPH}$$

There are 80 teeth on the center wheel (which drives the minute hand), 12 leaves on the pinion that mates with the center wheel, 72 teeth on the "3rd wheel" (that shares the shaft with the above pinion), eight leaves on the escape pinion that mates with the "3rd wheel", and 30 teeth on the escape wheel. The tooth count of the escape wheel is multiplied times two due to the fact that there are *two* noises, tick and tock, that occur when each escape tooth enters and exits the pallets (for a total of two beats per tooth).

Polishing Pivots – The Dreary Part

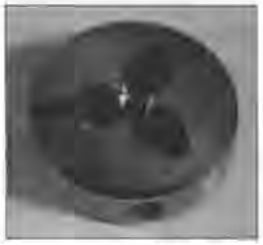
Next, it was time to polish the bearing surfaces of the clock, called the pivots. The pivots are the ends of the gears that turn in the plate, and if they're not polished, the clock will be sluggish and possibly stop. This is mostly due to the dirt that will be trapped in the scratches on the pivot plus the high amount of friction caused by the rough surface. In addition, the pivot holes will wear more quickly into oblong holes causing gears to mate improperly and perhaps come into a locking situation. Needless to say, the pivots must be polished and clean before the clock can achieve maximum efficiency, so that is what I set out to do. To accomplish this, I used a tool called a jeweler's lathe, which holds the shaft of the gear and turns it on its axis so that the pivot is spun and can then be polished using a file, burnisher, and other tools. First, the file is used to dress the surface uniformly, and remove any deep gouges. Next, a cutting burnisher is used to lessen the

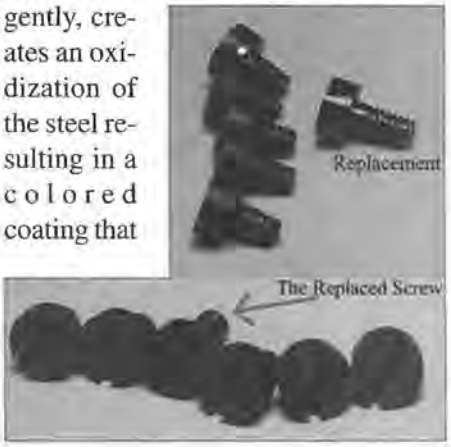
scratches further, and acts as a very smooth file and technically isn't really a burnisher at all. Finally, a true burnisher is used. A burnisher is a piece of metal, usually very hard, that has very small consistent ridges on the surface whose design is to "grab" the steel of the pivot and stretch it to create a perfect polish. This must be done at high speeds and with a good amount of pressure, yet not so much of either to burn the steel. When done correctly, burnishing produces not only a beautiful shine upon the pivot, but also hardens the surface as the steel is worked and compressed. There are several things to keep in mind when polishing a pivot as well: it must be flat, straight, and the shoulder must be perpendicular and polished as well. If it isn't flat, it could trap foreign materials in the pivot hole and score both the pivot and the hole. To straighten a pivot, one must heat it gently then chuck it up in the lathe. This done, it can be carefully straightened until the whole gear turns true upon the pivot. Once straightened it may be polished. This entire process is the typical way to straighten and polish a pivot, and must be repeated for all the pivots, two to each gear. In all, I had to polish eight pivots this way, which is a minimum number for most clocks, since many contain upwards of twenty pivots. Fortunately for my patience, the Waterbury Regulators are time only, and have no extra gears to drive a chime or strike. In regards to this clock, there were no terribly deep gouges in any of the gears, however the main wheel had noticeable scratches on the surface, and all of the pivots were scratched in one way or another. Since the steel was of good hardness and quality, it was no surprise that there were no horrible gouges, but it also made it harder to polish at times.

Major Project – The Escape Wheel "Nut"

After the pivot polishing process was complete for all eight pivots, I progressed to "bushing" the pivot holes. A bushing is a small cylinder of brass with a hole in the middle designed to replace a worn hole. To replace a worn hole, one uses a hand reamer (a small handheld tool that when twisted, can cut a hole quickly to an exact size) to ream the original hole into a larger one while keeping it centered and round to accommodate the bushing. The bushing is tapped into the newly expanded hole using a punch and a hammer, which secures it, assuming the hole was reamed to a size *slightly* smaller than the diameter of the bushing. Now, with the bushing secured in the original pivot hole, the replacement hole in the bushing should be centered where the original hole was. With a cutting broach (a tool similar to the reamer, yet provides more control and a slower cutting rate) the hole can be resized to the pivot, which creates a round, true, and centered hole where the old, worn hole was. With this process in mind, I checked the gears by feeling their tightness when placed in their pivot holes.

If the gears were too loose and "flopped" around too much, I put them back in the plate to signify that those holes were worn or too loose, and needed bushing. When I came around to the escape wheel, however, I found that it became impossible to continue with out first repairing that pseudo hand nut that acts as the pivot hole for the escape wheel. The threads were bad, and the nut couldn't be screwed on tightly or far enough to determine how loose the escape wheel pivot actually was, so it had to be fixed immediately. The first step to repairing the threads was to discover what the pitch, or number of threads per inch, was for that particular screw and the diameter of the threads. With this in mind, we consulted the Machinery's Handbook for the proper tap and die set to use in order to create the new threads. We determined the diameter to be nearly the equivalent of a size 6 die, with a pitch of 40 threads per inch. This meant that the optimum set to use was the 6-40 die, but the diameter of the screw was still slightly too small for the hole it screwed into. This forced us to use a split round die, which allowed us to create an *oversized* 6-40. After discovering the correct die and the diameter of the new screw, I chose a piece of round brass stock and filed it down to the correct diameter. Then, I took the oversized 6-40 die and essentially screwed the piece of brass into the die. When it was unscrewed again, the die had cut threads into the brass. Now, with the new threads on the end of the brass, I set about cutting them off of the rod so I could use them in the nut. I cut the threads off successfully, so we were left with the old nut and new threads. First, I had to cut off the old threads from the nut. Then, we drilled a hole as though we were bushing the nut itself. Having done this, I inserted the smaller end of the threads (which I filed down) into the rim of brass that was the head of the nut and peened the end down by hammering it flat so that it wouldn't slip when it was screwed in. After the new threads were stuck tight in the rim, I drilled a hole through them, creating a threaded bushing, and eventually sized that hole to fit the escape wheel pivot. When I drilled the hole, I chucked up on the threads instead of the rim so that I could drill the hole centered in the threads. This was important since the escape wheel turned in that hole and it was necessary that it be in the center of the threads so the escape wheel wouldn't wobble. Before I sized the hole to the pivot, I polished the head of the mostly original nut and countersunk it to give the impression that it was made entirely out of one piece of brass, as the original nut was. Magnificently, it looks entirely original, and I'm very proud of it! We actually had to solder the threads to the hole, because they kept falling out during the sizing process, but it's not visible and makes the nut a good deal stronger but softens the brass somewhat. After sizing the hole, we had to shave off the end of the nut so it would screw down tightly and completely and still allow the escape wheel some end shake, or space between the plate and the shoulder of the pivot. Now, the escape wheel can move freely and securely, as opposed to being sloppy and inaccurate as it undoubtedly was with such a bad nut. In passing, there was another screw I had to create so that the plates would screw down correctly and fully. This was done in a very similar fashion, except it was done with steel and not brass. My goal was to make a longer screw to bypass a stripped upper portion of one of the pillar posts. With skill and care, I fashioned a screw out of a piece of O-1 tool steel, polished it, and blued it with gentle heating. According to the Machinery's Handbook, heating the steel gently, creates an oxidization of the steel resulting in a colored coating that not only matches the other screws on the clock, but also acts as a rust preventative. To my equal pride and dismay, it looks noticeably newer, shinier, and better polished than the original screws. The old screw is included with the clock upon setup in the school.





Part 2 will continue next month.

A Welcome Addition to the AWI Museum Tool Display

Robert D. Porter, ELM Secretary

Ms. Kathleen Pritchard has generously donated a piece of equipment that was used by the Bulova Watch Company to the AWI museum. It is a small, high-precision milling and drilling machine that stands 13½ inches high, with base dimensions of 6¾ by 9½ inches. This machine was made in Germany, although the maker's name could not be found anywhere on the machine. A small metal inventory tag identifies this item as Bulova equipment.

The spindle uses a drawbar to hold 8 millimeter collets that share commonality with WW lathe collets. The spindle can be adjusted 15 degrees either side of zero. The vertical travel of the spindle is lever actuated. The left to right travel of the table is also lever controlled, and has adjustable stops on each side of center. A large handwheel controls the front to back travel of the table. The lever actuation suggests that this machine was used in a production operation where rapid and accurate vertical and horizontal translation was important.

We sometimes forget that behind every watch or clock there is a relatively small group of toolmakers and machinists who design, build, and maintain the high-precision tools, jigs, and fixtures on which watch components are made. The ELM Trustees want to make sure these tools that are so essential to manufacturing success also receive the attention they deserve in the AWI Museum.

On behalf of the AWI Board of Directors, our Members, and Trustees I wish to thank Ms. Pritchard for her generous gift. We also thank all those Friends of the ELM (Education, Library and Museum) Trust who support our activities; you are helping us to preserve the past for the future.

The First Class of the New AWI Beginning Lathe Course

The first class of the new AWI Beginning Lathe Course. Front row, left to right: Mike Sarchet, Michael Green, Douglas Stuart, Wallace Taylor, Walt "Buddy" Mandeville, Bob Porter, instructor. Back row, left to right: Chris Browning, Hans Dalke, Tom Payne, Brian Boyet, Ray Stullick, Marcus Reinertson, Stanley Mueller.

L-R: Chris Browning, Marcus Reinertson, and Mike Sarchet hard at work on their projects.

L - R: Walt "Buddy" Mandeville, Ray Stullick, Michael Green, Hans Dahlke, and Douglas Stewart are finishing their projects.

The first class of the new AWI Beginning Lathe Course was held on September 28th & 29th in Seattle, Washington. The two-day course is intensive and covers several subjects and projects, including:

- The Watch and Clockmaker's Lathe (accessories, lubrication, alignment and adjustment, collets, belting).
- Measuring Instruments and How to Use Them (How to read inch and metric micrometers. Vernier, dial, and digital calipers. Dial indicator).
- Turning Tool Geometry (Turning tools - sharpening - rake, wedge, and clearance angles).
- Taps, Drills, and Dies for the watch and clockmaker (How to make internal and external screw threads with taps and dies).
- Turning Brass (How to make a screw. Indexing. How to make a miniature hex nut to fit the screw).
- Turning Steel (How to make a tap drill. How to make a tap. How to make a winding stem. How to make a balance staff).

Each participant was presented with a certificate and a press release for their local paper or radio station to promote their business.

A special thanks to Tom Payne, President of the Washington State Watchmakers Association, for all his help in getting this great group together and finding a place for us to hold the class.

Technically Watches

Pocket Watches and Their Maintenance
Part 54
The Reassembly and Oiling of the Valjoux 24 Timer Mechanism

Archie B. Perkins,
CMW, FAWI,
FNAWCC, FBHI

Before starting to reassemble the timer mechanism, make sure that the watch movement is in good order and is functioning correctly.

Oiling the Timer Mechanism

The timer mechanism is oiled as it is reassembled. Some parts are not oiled and other parts are oiled or greased. Oils and oiling are and have always been controversial subjects. Some will say to oil and others will say not to oil. It is usually best to do what the maker of the watch recommends if these instructions are available.

If no instructions are available from the manufacturer on how to oil the watch, then we must determine by reasoning what and how to oil the mechanism.

The purpose of oil is to reduce friction between two surfaces. If the pressure is great between two surfaces, the oil used must be heavier or thicker than for two surfaces which have very little pressure between them. Another condition that affects the need for the oil is how well the two parts are finished where they contact each other. Two surfaces that are highly polished where they touch will have less need for oil than if the two surfaces were very rough.

Another factor is the speed of the two surfaces rubbing together. Slow speed with much pressure requires a heavier oil or grease. More speed and less pressure require a lighter or thinner oil.

When oil is placed between two surfaces, we have an added resistance to the movement of the two surfaces on each other. This is a sticking condition called oil adhesion. In cases where the pressure between two surfaces is very little and the two surfaces rubbing together are highly polished, the friction will be very little. Then, if we add oil to the two surfaces, the oil adhesion may cause more resistance to movement between the two surfaces than if we had left the two surfaces dry.

Steps Used for Reassembly

Step 1. Replace the tension spring for

Figure 1

Figure 2

Figure 3

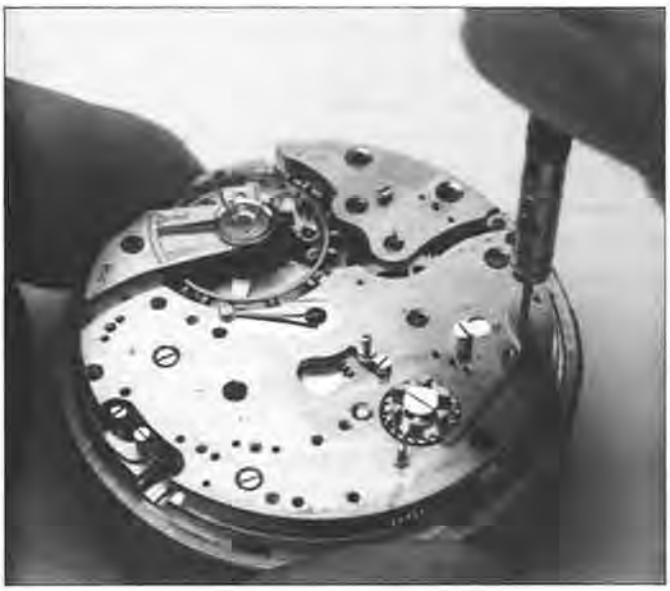


Figure 4

the chronograph runner. The spring is positioned near the edge of the hole for the chronograph runner as shown in Figure 1.

Step 2. Replace the pillar wheel onto the upper plate. This is shown in Figure 2.

Step 3. Replace the pillar wheel screw. Figure 3 shows the screw being replaced. Some heavy oil should be placed on the bearing surfaces of the screw that supports the pillar wheel.

Step 4. Replace the pillar wheel jumper. The jumper should be oiled with heavy oil where it works on the ratchet teeth of the pillar wheel. Figure 4 shows the jumper being replaced.

Figure 5

Figure 6

Figure 7

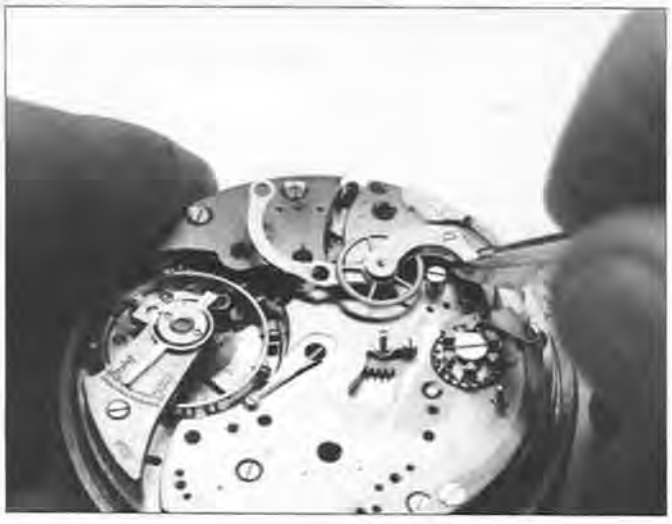


Figure 8

Figure 9

Step 5. Replace the operating lever and hook. The end of the hook should be oiled with heavy oil where it slides on the ratchet teeth of the pillar wheel. The joint between the hook and the operating lever should be oiled lightly. Figure 5 shows the operating lever being placed into position and Figure 6 shows the screw being replaced to hold the lever down on the plate. The shoulder of the screw should be oiled where the operating lever pivots. Use heavy oil.

Step 6. Replace the operating lever spring. The end of the spring where it works against the operating lever should be oiled with heavy oil. Figure 7 shows the operating lever spring being replaced.

Step 7. Replace the coupling clutch and intermediate drive wheel. Make sure the wheel turns freely in its pivot holes. Figure 8 shows the coupling clutch assembly being placed into position on the watch plate. A hole in the end of the coupling clutch lever fits over the head of an eccentric stud and the other end of the lever works against the pillars on the pillar wheel. The whole assembly is held down on the plate by the coupling clutch screw. Figure 9 shows the coupling clutch screw being replaced. Some heavy oil should be applied to the tail of the coupling clutch lever where it works on the pillars of the pillar wheel. The pivots on the intermediate drive wheel are oiled with a watch oil. The reasoning is that the intermediate drive wheel turns all the time that the watch is running which requires that the pivots be oiled.

Step 8. Replace the coupling clutch spring. The end of the spring where it works against the coupling clutch should be oiled lightly with some heavy oil. Figure 10 shows this spring being replaced.

Step 9. Replace the blocking lever spring. This spring is replaced before the blocking lever is replaced

Figure 10

Figure 11

because it is more difficult to replace the spring after the blocking lever is in place. The end of the spring should be lightly oiled. Figure 11 shows the spring being replaced.

Step 10. Replace the sliding gear assembly. Make sure that the wheel turns freely. This assembly fits onto a stud that is fastened to the watch plate. The stud should be lightly oiled with a light oil. The pivots of this gear should not be oiled. This gear has very little friction is the reasoning. Figure 12 shows the sliding gear assembly being placed on its stud.

Step 11. Replace the sliding gear spring. The end of this spring should be oiled lightly. Figure 13 shows this spring being replaced.

Step 12. Replace the blocking lever. The lever is put into place, then its screw is placed into position and screwed down part way. Then the end of the blocking lever spring is pulled back so the blocking lever can seat down on the plate. **CAUTION: Do not pull the spring back more than what is needed to allow the spring to go against the edge of the blocking lever.** After this, the screw is tightened. Figure 14 shows the blocking lever screw being tightened after the lever is seated on the plate and the blocking lever spring is against the edge of the lever. The bearing shoulder on the blocking lever screw should be lightly oiled.

Step 13. Replace the minute recording runner. This is shown being done in Figure 15. Note that the wheel is handled with the tweezers on one of the wheel's spokes. No oil is needed on the pivots of this wheel.

Figure 12

Figure 14

Figure 13

Figure 15

Step 14. Replace the chronograph runner. Handle the runner with the tweezers by one of the spokes of the wheel to avoid damaging the delicate teeth on the wheel. The runner is shown being replaced in Figure 16.

Step 15. Replace the hammer. The hammer fits onto a stud that is fastened to the watch plate. The stud should be oiled where the hammer pivots. Figure 17 shows the hammer being placed into position on the stud.

Step 16. Replace the chronograph bridge. Use care to prevent doing damage to the pivots on the chronograph runner and minute recording wheel. Figure 18 shows the bridge being replaced. The pivots on the chronograph runner and minute recording wheel are not oiled. This is because these wheels have very little friction when they operate. They are almost free floating and only turn when timing an event. Oil on these units could have a retarding effect, especially if the oil should congeal. No oil is needed on the hearts of the chronograph runner and minute recording wheel due to the high polish on the edge of the hearts and the ends of the hammer branches.

Step 17. Replace the hammer spring. This spring is replaced after the chronograph bridge is replaced to avoid doing damage to the chronograph runner and the minute recording wheel. Figure 19 shows the hammer

Figure 16

Figure 17

spring being replaced. Some oil should be applied to the end of the hammer spring where it works against the body of the screw on the hammer. This screw serves as a stud for the spring to work against. The head of this screw prevents the hammer from rising up on its stud.

Step 18. Replace the minute recording jumper and spacer. This is shown being done in Figure 20. The minute recording jumper is left dry. This is because of the polished finish on its bearing surfaces and due to the small amount of pressure it exerts against the minute recording wheel.

Figure 18

Figure 19

Figure 20

Figure 21

Figure 22

Step 19. Replace the driving wheel. The wheel goes onto the long train wheel pivot with the large end of the wheel's bushing facing downward toward the watch plate. Figure 21 shows the drive wheel being placed on the train wheel pivot. The wheel is shown being pressed down on the pivot in Figure 22. A hand seating pusher is being used to press the wheel down on the pivot. Press the wheel down until it is level with the intermediate drive wheel. Keep the pusher in an upright position when pressing the wheel down on the pivot. Care must be used to avoid damaging the pivot that the wheel fits onto and the delicate teeth on the drive wheel and intermediate drive wheel.

This series will continue next month.

AWI Directors' E-mail Address Directory

Director	AWI E-mail Addess
Jack Kurdzionak: President	jkurdzionak@awi-net.org
Jim Door: 1st Vice President	jdoor@awi-net.org
Frank Poye: 2nd Vice President	fpoye@awi-net.org
Alice Carpenter: Secretary	acarpenter@awi-net.org
Mark Butterworth: Treasurer	mbutterworth@awi-net.org
Fred Burckhardt	fburckhardt@awi-net.org
Ron DeCorte	rdecorte@awi-net.org
Wes Door	wdoor@awi-net.org
Henry Frystak	hfrystak@awi-net.org
Robert D. Porter	bporter@awi-net.org
Marshall F. Richmond	mrichmond@awi-net.org
Dennis Warner	dwarner@awi-net.org
Manuel Yazijian	myazijian@awi-net.org
John Kurdzionak: Aff. Chapter Director	jfkurdzionak@awi-net.org
Joseph Juaire: REC Director	jjuaire@awi-net.org
Tony Riggio: IAB Director	triggio@awi-net.org

Mark Butterworth

The Modern German Clock Movement

Part 28

Autobeat Mechanisms

The autobeat mechanism is one of those devices along with the floating balance that we always associate with the modern German clock mechanism. It is also true that it has been adopted by others and is common with the latest movements that we see coming out of China. I have had a number of requests for information on this topic.

The rise in use of the autobeat verge assembly coincided with the explosion in sales of the clocks in the U.S. in the early to mid-1970s. The rationale behind it is very simple: to develop a system whereby the homeowner could set up a clock by himself/herself without any special technical skill or instructions. The idea is that one could start the clock simply by taking the pendulum to one side and letting it go. At worst, it might take several tries and the clock may never be perfectly in beat, but it would still run. If the wall clock became tilted left or right for whatever reason, the clock could be restarted whether it was level or not. It is important to understand that this idea came about at the urging of the case manufacturers who were purchasing the movements. By developing this user friendly system an entire new avenue for sales opened up through furniture stores, clock kit retailers, and even direct marketing which allowed the drop shipping of the finished clock direct from the factory to the homeowner or end user and bypassing the clock repair person entirely. Up to this point it was the clock shop and clock repair person who were the chief marketers of finished clocks. At one time Emperor Clock Company of Alabama with its kit clocks was one of the largest in the world. Another company, King Arthur, also of Alabama, sold clocks by showcasing them in the center of malls and out of motel rooms for drop shipment, and in just a couple of years became one of the largest clock retailers in the U.S. In order to compete, one by one, each of the movement manufacturers developed a patented autobeat verge.

It is important to understand that from a fundamental point of view, at no time did anyone claim that the new system was superior to the old manual-adjust one that had been around for several hundred years. In fact, it was known from the beginning that there were drawbacks to the autobeat system and some inherent inefficiencies, although after its use in several million clocks, it has worked amazingly well. How is the autobeat verge recognized, how does it work, are there any special procedures in working with it, and how do we determine if it is faulty?

The easiest way to determine visually if the system is autobeat is to look at the escape wheel. Regardless of the manufacturer, the escape wheel will almost always have teeth much shorter than we are accustomed to seeing. The exception to this is the 341 and 261 series in the Hermle movements which have short escape wheel teeth regardless of whether it is autobeat or manual beat. In addition, the pallets will slip relatively easily on their arbor. In the manual beat verge the pallets are very stiffly or tightly friction fitted. This is also called by the German manufacturers dead beat, although strictly speaking both the auto beat and manual beat pallets and escape wheels are technically dead beat by our definitions.

The principle behind the system is fairly simple. The combination of shallow escape wheel teeth and slip clutch in the verge causes the orientation of the pallets to change on each swing of the pendulum when it is started at one far side. As the pendulum amplitude decreases due to the fact that the pallets are bottoming on the escape wheel on each swing, the orientation adjustment of the pallets becomes progressively smaller. Ultimately

the amplitude decreases until the pendulum loses any over swing and because the teeth are so short, the pendulum cannot be out of beat enough to stop due to that condition. That is the theory. We will see that the practice can sometimes be different.

When overhauling a movement with the autobeat verge there are in fact some special precautions and procedures. Depending on when the verge was made, most manufacturers used some type of plastic or fibre washer in the verge assembly. It is very important that these verges NOT be immersed in solution in the cleaning process. These materials can be changed or damaged by the solution and cause the friction slip mechanism to lose its tension. Even if the assembly is all metal, the solution may not all get removed in the rinse and either act as a lubricant or eventually become sticky in drying. Either condition will change the effectiveness of the mechanism. For this reason, it is also recommended that the assembly NOT be lubricated. These verges are not intended to be cleaned. The Kieninger verge especially has often been ruined by well intended repair persons.

The tension mechanism will vary according to the manufacturer. In the newer style Hermle, it is a coil spring pushing against the pallets at one end and the crutch at the other. This spring is enclosed by a plastic shroud but can still be seen on close examination. The all metal Urgos verge has a "V" type spring which presses against the pallet arbor and is totally hidden. The Kieninger has two four-fingered leaf springs pressing against plastic washers on each side of the pallets front and rear. These plastic washers are most susceptible to damage from solution or lubrication.

How do we know when the auto beat verge is defective or not working properly? That is when the slip clutch is either providing too much or too little tension for the pendulum it is driving. Although there are torque specifications for the proper operation of these, that is of little help to us since there are no commercial devices which would benefit us. There are some guidelines, however:

1. If one holds a movement with the leader in place, but without the pendulum, and turns the movement gently to one side, the clutch should be tight enough to not allow the leader to fall down. If the leader easily flops to one side, enough energy can be lost to stop the clock. In this instance, the tension mechanism should be tightened.

2. If the pendulum continues an overswing after the leader has come to a stop on one side, then the clutch fitting is too tight for that particular pendulum and the unit may not be able to set itself into beat. This condition is much less common but does occur in wall and mantle clocks with light pendulums. Either the tension needs to be lessened or the pendulum made heavier.

The advantages of the autobeat system are clear. What are the disadvantages of which we should be aware?

1. The system is inherently less efficient during operation. Each time the pallet bottoms out on the escape wheel energy is lost. This often happens even after the pendulum has "settled down" to normal running condition. As a result, the movement will be less tolerant to dirt and wear than an identical unit with a manual beat verge.

2. A given pendulum will always have less swing with an autobeat verge. This is necessarily so because the short escape wheel teeth do not allow for any overswing.

3. The spring tension can never be perfect because it is a "one size fits all" regardless of the weight of the pendulum it is driving.

4. Some clocks cases are too narrow to allow the self beat setting mechanism to work. This happens because clock cases are designed by those who understand esthetics, but not always physics.

5. In winding a clock, the clock can stop due to the fact that the escape wheel is driven backwards (unless there is maintaining power) knocking the unit out of beat. There is also a loss of power, which is not as critical in a manual beat system. As a result, the manufacturers' recommend restarting the clock by taking the pendulum to one side each time the clock is wound. The stopping of the clock is a frequent complaint on Urgos especially, as it has the shortest escape wheel teeth of all and as a result the greatest energy loss.

It is hope that you will find this information useful in understanding the history and operation of the autobeat system.

Final thought: *"When you blame others, you give up a perfect opportunity to change."*—Stephen R. Covey.

From the Workshop

Jack Kurdzionak, CW

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's easy. Just e-mail me at AWI <magazine@awi-net.org> 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 are suggested by the author and contributing members and are not endorsed by any manufacturer, supplier, advertiser or AWI itself.

Good Insulation

Do you mark a replacement watch cell when you install it? For the past 12 years, the staff at our shop has been using an ultra fine point Sanford Sharpie® permanent marker to mark every watch cell with the month and year of its installation. This mark provides a written record of the cell installation date. Writing the date on the cell, unlike a paper receipt, takes only a few seconds, is carried by the watch owner inside his watch, and cannot be misplaced. There is only one downside to this procedure. Once in a while, one of our staff will write the date on the portion of the cell that is covered by a cell strap, such as in an ETA caliber 976.002. The thin film of ink can act as an insulator when it is covered by the cell strap and causes the watch to either stop or run erratically. If you use any sort of marker on cells, please mark it in a place that is not touched by a cell strap or cell connector.

Jack Kurdzionak

A Nice Little Project

Wolf Ginandes, an AWI member from Massachusetts, needed some bench keys for American, negative setting pocket watches, but was unable to locate a set. With a little imagination, some old screwdrivers, and his lathe skills he was able to make some bench keys for himself as shown in the photo.

In his words, here is how it was done. "I measured stems from 12, 16, and 18 size watches, diagonally across the square part from corner to corner. Then I chose the worst screwdrivers I owned that measured in diameters equal to, or slightly larger than the diagonal measurements for each stem. Two screwdrivers were perfectly sized and the one that wasn't a good match got the end turned down in the lathe to just slightly larger than the diagonal stem measurement. Fortunately, the screwdriver bits were the removable kind, so it was easy to put them in the lathe and turn them down if necessary. In fact, I think that would be a necessity, because filing the squares required the bits to be chucked into the lathe.

I don't have a filing fixture for my lathe, so what I did was to make the square parts by visually estimating when each of the four flats was the right size. It was pretty easy to do by holding a stem up next to the work piece and comparing the size of the flats. Especially because I have a dissecting microscope set up over my lathe, as you can see in my attached picture. I used the index holes on the

pulley of my lathe to locate the work as I filed the flats. I filed the first side so the flat was the same size (as visually compared to the stem I was imitating) and then rotated 180 degrees and did the same on the other side of the work piece. Once that was done, I went 90 degrees more and did the third side until it met the first two sides with a nice square edge. Then another 180 degrees rotation, and I finished the last side. Since my working point of view never shifted, because the microscope is fixed, as long as I kept the flats visually centered on the work piece, the result was a pretty good square."

Know When To Say No

A few weeks ago a customer brought a Girard Perragaux automatic watch in for routine service. A quick check of the watch revealed that this watch was probably less than 10 years old and had a high-quality movement none of us had ever seen before. Whenever I see an unfamiliar or obsolete movement in the shop, I ask my suppliers about parts availability before I estimate any repairs. For the Girard Perragaux we contacted the company to ask if parts were available, should any be needed. This caution paid off. We learned that the company would sell no parts to us. The watch was promptly returned to its owner with the advice that this model should be returned to its manufacturer's service department.

All too often, watchmakers get into a bind by not checking for parts availability for the watches they are servicing before they have begun. If a manufacturer does not provide parts for a model in for service, the watchmaker is risking a lot of his time attempting to make a repair he may not be able to complete. A major luxury watch manufacturer, who does supply parts for all of its current models, can no longer supply a complete line of parts for its vintage watches. Consequently they refuse to service these vintage watches in the USA. However this company will ship any vintage watch back to Switzerland where it can be repaired from the Swiss shop's

extensive supply of existing parts. When a needed part is no longer available, the Swiss shop will even fabricate a replacement part, of course for a price. We can all learn from the example of this Swiss company. We can service watches for which parts are available or subcontract the work to a shop that can supply or fabricate parts. There is little sense in attempting to repair a watch for which parts are unavailable.

The watchmaker should seriously consider parts availability before the repair is begun, rather than when the repair is nearly completed. It only takes one obsolete or unobtainable part to prevent completion of the repair.

Jack Kurdzionak

American Pocket Watch Balance Staffs

Many watchmakers, both novice and experienced, have difficulty selecting and fitting balance staffs to American pocket watches. Several readers have asked me why selecting and fitting these staffs can be a challenge and is there any way to make the job easier.

Most American pocket watches were produced before 1930, which makes them over seventy years old. Unless the watch was never used, it has had numerous balance staff and balance jewel replacements during its lifetime. Every time a staff or a jewel was replaced, the watchmaker may have unintentionally altered the balance wheel, roller, and jewel settings slightly so that these parts no longer have their exact original factory dimensions. Today's watchmaker isn't repairing a factory fresh watch, but one that has had numerous past repairs. Difficulty #1: the watches have been altered.

Original factory replacement staffs have long been discontinued and only non-genuine ones can be obtained from suppliers. Replacement staffs available today are copies of factory parts, but very often are not made to the exacting original factory specifications. Difficulty #2: the replacement staffs may not be exact duplicates of the originals.

Most American watches were not labeled with a model number. Many were privately labeled for retail jewelers without any manufacturer's identification on the plates. The watchmaker had to be familiar with American watch models and recognize them even if they bore no manufacturer's name or model number. Difficulty #3; American watch models can be difficult to identify.

A difficult task is not impossible; it just requires more knowledge and skill to complete. Before repairing an American pocket watch, the watchmaker should have a copy of the *Illustrated Manual of American Watch Movements* available from S. LaRose Company at $12.95 (catalog #055002). This is the best catalog of American watch movements ever published and is a necessity for one who repairs these watches. With this book the watchmaker can identify an American movement and accurately order available parts, including balance staffs, by the actual factory part number.

When ordering replacement balance staffs order at least three. Six or a dozen would be better, but three is the minimum. Replacement staffs often vary slightly in their dimensions, so that having a large selection of staffs from which to choose can be very helpful when fitting one to an existing watch. A roller might fit too loosely on one staff in the assortment, be too tight on another, and fit perfectly on a third. If a watchmaker takes a chance and orders one staff for the watch being repaired, it may not fit. It's far better to have a large selection of staffs from which to choose a proper fitting staff that can be installed in a few minutes rather than spending a large amount of time making an ill suited staff fit the watch.

The watchmaker does not have the luxury of ordering a new balance wheel, roller table, or hairspring for the century old watch. He must make the new staff fit these parts that have been slightly altered each time a staff has been installed in the past. If the riveting shoulder of one staff is too loose in the balance, perhaps another will fit more closely. It is not unusual to find that the upper and lower balance hole jewels do not have the same hole size. The balance pivot can fit one jewel hole just fine and the other jewel hole may be far too loose or too tight. This cannot be solved by selecting another staff but by changing the offending jewel to the correct hole size.

Installing a balance staff in an American pocket watch can present some difficulty, but a watchmaker equipped with a Swigart catalog, a selection of balance staffs, knowledge of American watch movements, and experience can fit staffs to American watches.

Jack Kurdzionak

BULLETIN BOARD

REQUESTS

Pegna Glue

George Costantino, Schenectady, NY, is trying to locate a heat reactive crystal glue he has used for years and found to be superior to all others for certain applications. It is called Pegna Glue and used to be sold through Bergeon along with a kit that included a small heater for curing it. It was widely used by high grade manufactures.

Exacta Time Corp. Movement

Charles Dyrkacz, Ashland, WI, is seeking a source for a movement for a Swiss 13 ligne Exacta Time Corp. movement (maker of the Babe Ruth Wristwatch).

Zenith 17 Ligne Movement

John W. Swafford, Huntsville, AL, has a man's Cartier pocket watch with a 17 ligne Zenith movement. He is seeking help in identifying this movement. He needs a model number so he can purchase a balance staff.

ITEMS STILL NEEDED

L&R Model 728B Clock Movement Cleaner

Greg Bourne, Omaha, NE, is looking for a repair manual for a L&R Model 728B solid state clock movement cleaner (11-quart).

New Hermes Engravograph CA300 Calligragraph Attachment

Joseph Verruni, Plymouth Meeting, PA, is seeking information and operating instructions for a Calligragraph attachment for his New Hermes Engravograph. The Engravograph was made by Richardson's, Berkley Heights, NJ.

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:

Horological Times **Bulletin Board**
701 Enterprise Drive
Harrison, OH 45030-1696
Toll-Free: 1-866-367-2924, ext. 307
Phone: (513) 367-9800
Fax: (513) 367-1414
E-mail: dbaas@awi-net.org

As A Clockmaker Turns

Saga of the Broken Pivot
Part 5

J.M. Huckabee,
CMC, FAWI, FBHI

Introduction

The previous four parts of this series have brought our skills to the stage where we will drill an arbor to receive an inserted pivot. Thus far we have shown a long series of tool and technique study. Our objective here is to drill the arbor about 6-7 pivot diameters deep with a perfectly cylindrical hole, in the exact center of the arbor, and on its exact axis of rotation.

My initial promise was that the lathe and collet need not be perfect, the tools would be simple, and the techniques easy to understand and practice. That promise yet stands, today we will drill that perfect hole.

How Do We Begin?

Let's begin with the lathe. Study Figure 49. This lathe was built around 1910. The headstock and bed are the original pieces. I made the aluminum pulley about 40 years ago. The lathe has been in my hands over 50 years. Its collet holds a brass rod with a recently cut cup center. The bed holds a shop-built steady rest of the most simple style. Study the caption of Figure 49. That is all we require from the lathe.

A tool of "choice and excellence" is illustrated in Figure 50. We must find the exact center of the arbor we are to drill. The Magic Center Finder will do that in five seconds. If you use a pointed graver, you will need the stronger steady rest shown earlier in this series.

This escape wheel is from an AWI Student Study movement. I broke the pivot off for this exercise. Study Figure 51. Although this may be supported adjacent to the pinion, I elected to support it by the pinion cuff method. That method is not widely known in our trade.

Study Figure 52. This setup supports the operation outside of the pinion and is driven by the disc and toothpick method. The tape coupling is shown in Figure 53, and is usually my "method of choice," where feasible. I'll use that method.

With the piece running (Figure 54), the center finder bell is pressed onto the arbor end, and the center drill bit (knob) is pressed lightly. In Figure 55, the bell is retracted to feel the center motion. It's perfect!

The original pivot size was about ¾ mm diameter. I'll replace the pivot with music wire that is about 0.031" diameter. That is the size of a #68 drill bit.

The drilling plan is one diameter deep with the #68 drill bit (0.031") and an

Figure 49. Lathe requirements are simple: a steady rest, a collet and brass rod, and not excessive slack in the bearings.

Figure 50. Examples of Huck's Magic Center Finder, a great time saver. I suggest you construct several sizes.

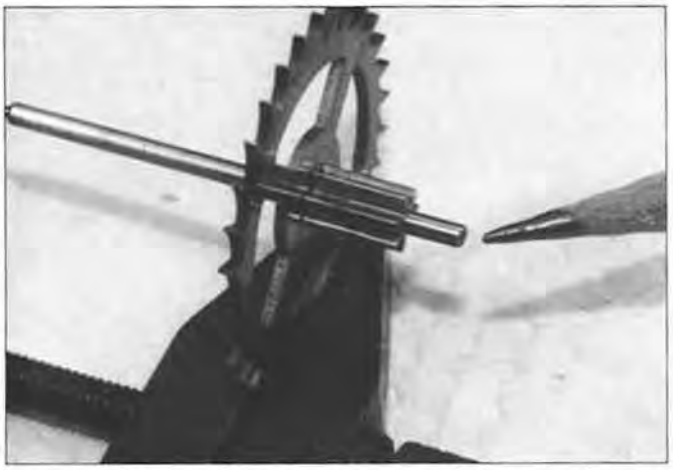


Figure 51. This is the wheel we will repivot. This is somewhat a "mid-road" example of our frequently found jobs.

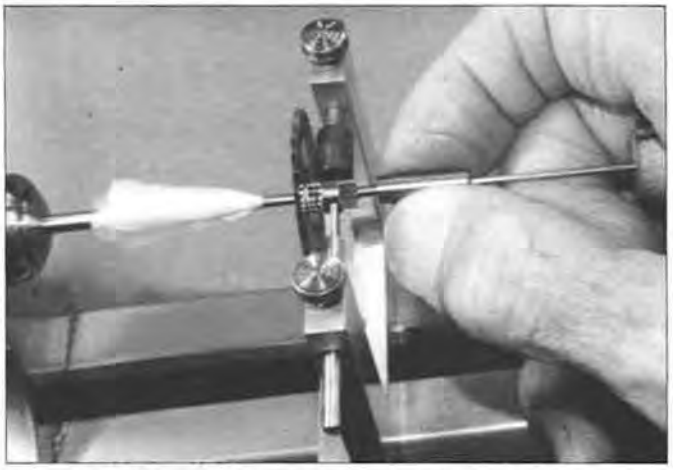


Figure 54. Tape coupling technique with pinion cuff support. My support choice would be that shown in Figure 52. Here, the Magic Center Finder locates exact drilling center.

Figure 52. This is how the disc and toothpick technique looks at high speed. I would probably choose the tape coupling technique.

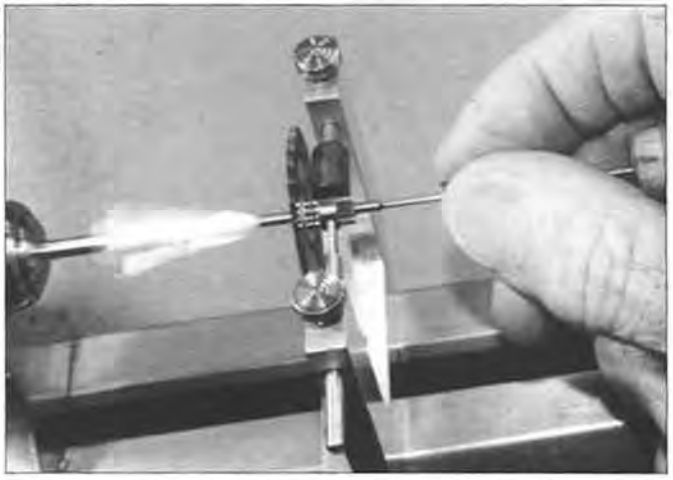


Figure 55. Job at high speed. The center finder bell is retracted, checking a perfect center. Note the pinion cuff support.

Figure 53. The tape coupling technique is my choice, where feasible. I'll use it for this job.

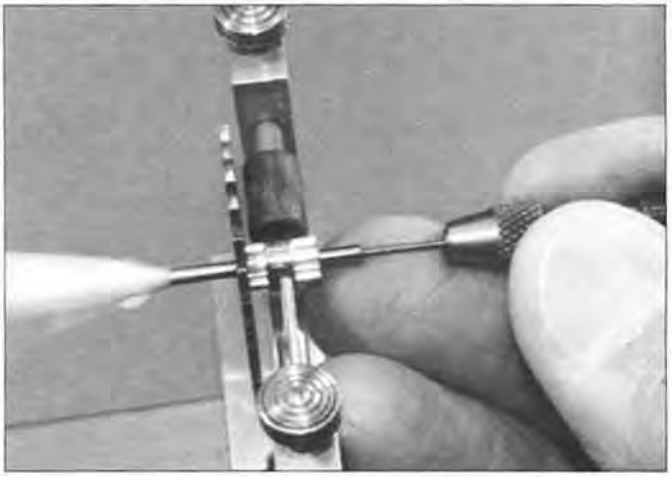


Figure 56. Pre-drilling: This bit is the exact size of the finished pivot. Diameter is about ¾ mm and one-diameter deep.

Figure 57. Place a piece of masking tape on the bit. Pull the bit out and examine the depth.

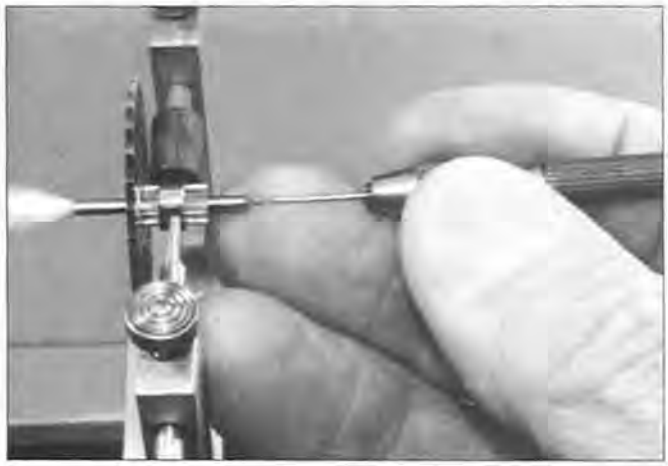


Figure 58. Re-drill with the next smaller bit to about 6 diameters deep. These are bits #68 (0.031") and #69 (0.0292") respectively. The prefinished pivot raw material is same size as the larger bit.

Figure 59. Tape the second bit and check depth. We read 0.201" which is 6-7 diameters deep. Depth is important to a good job.

Figure 60. Test the pivot raw material. This material slips into the hole about one diameter deep and stops. That's perfect!

additional depth of about 6 diameters with a #69 drill bit (0.0292").

Drilling Techniques

Drill the larger bit first. Use a lightweight holder. Hold the piece lightly. Keep the bit cutting; don't let it skid on hole bottom. Use lots of lubricant, and rest the bit on a fingertip (Figure 56) to feel cutting action. In case of hang up, let the holder spin in your fingers. With paper tape coupling, the tape usually shears and saves your bit. Clean the chips often. Take heed and be wise. A broken bit in an arbor is an absolute disaster.

Stop, place a piece of tape on the bit and pull it out to judge depth (Figures 56 and 57).

Never, never, ever hold the bit in a tailstock fixture. That will break the bit in the event of a chip hang up.

Now review Figures 56-59. How are we doing? A one-diameter hole depth the size of our finished pivot, and a smaller hole to a total depth of 6-7 pivot diameters. How long did the drilling take? Less than four minutes.

How are we doing now? Study Figure 60. Take a sample of the music wire pivot material and try it in the hole. The end must be bur free. It just slips in one diameter deep. That is the hole that will keep the new pivot straight. See Figure 60.

I tested this arbor with a fine-cut file. The file would cut, which told me the bit would cut. Annealing was not needed on this job.

The Future

Part 6 will conclude this series. I yet have a dozen illustrations to show insertion of the pivot and the test results. We are on the downhill side of this project. I already know the end. It's a perfect job.

NEED INFORMATION ON A PARTICULAR WATCH, CLOCK OR ITS MAKER?

The Henry B. Fried Library is considered to be one of the world's finest horological libraries. Hundreds of books are available for your use whether it be for finding information for yourself or a customer, doing research on a special subject, or just for enjoyable reading. Customers appreciate a person that can talk intelligently when answering their questions. Make use of the library, it will pay big dividends!

ANOTHER BENEFIT OF AWI MEMBERSHIP

Watchmaking... Finnish Style

By Terry Kurdzionak

AWI member, Nick Lerescu, of Advantage Tours, ran this year's horological tour to Finland, Russia, and Poland from June 8-June 25. Formerly known as the Henry Fried Horological Tour, the group tour has changed its name but not its focus; the "Time Trippers" still make an annual trip to foreign ports of call seeking horological points of interest. Several of the people on this year's tour are current AWI members.

While staying in Helsinki, Finland, the group visited the Finnish School of Watch Making and Micro Mechanics. The students were on their summer break, but we did meet some of the instructors who gave us a tour of the facility.

The watchmaking program lasts three years. Students pay no tuition, but spend approximately $1000.00 on the tools and material required in the three-year course of instruction. The Finnish Horological Association pays instructor salaries.

High school students in Finland can choose to take aptitude entrance exams in five areas of vocational training. Each year, approximately three hundred take the exam for watchmaking and micro mechanics. Out of that three hundred, one hundred have the aptitude, and of the one hundred, thirteen are chosen for the watchmaking curriculum, and another thirteen for the micro mechanics curriculum. Many of the watchmaking graduates have gone on to work for prestigious firms in Switzerland.

AWI members pictured here with administration and teaching staff of Watchmaking school of Finland: Tour director (far right) Nick Lerescu, Bill Lane, Irv Greenberg, Harry Blair, Jack Chipman, Jerry Freitag, Maryellen Bell, Patrick Fay, Ralph Berger, George Keiser, Allison Rider, Jim Williams, Steve Bingham, Hans Weber, Cooksey Shugart, Bernie Dier, Mike Kosienko, John Grass, and Terry Kurdzionak, Membership Committee Chairman, AWI.

In the first semester, students are taught how to make some of the tools that they will be using throughout their schooling. In the second semester, the students work on large pieces (clocks) to get a better understanding of the mechanics. Third and fourth semester are spent making bigger tools as well as hand finishing and skeletonizing watch movements. In the third and final year students make a hairspring and a balance staff.

The students range in age from sixteen to twenty-four, the average age being eighteen. The school superintendent is Mr. Jukka-Pekka Saaringn and there are six instructors of watchmaking. The school has recently begun a partnership with WOSTEP.

On the property adjacent to the school, the Finnish Watchmaking Association has its headquarters and within the building is an impressive museum of watches and clocks. After touring the museum and school, our group was taken by motor coach to a scenic harbor-side restaurant for lunch. After lunch, we returned to the school and met for an impromptu "mart" and discussion with

A watchmaker's collection on display at the "Mart".

KELLOSEPPAKOULU means watch making school!

Terry Kurdzionak at the "Mart," Finnish Horological Society.

Tools made by first semester students at watchmaking school, Finland.

Lauri Maliwa, Instructor at the watch making school, Finland.

several members of the Finnish Watchmaking Association. Several of their members spoke English, while none of our group spoke their language; however, the ability to communicate is universal when watches and clocks are put out on the table!

Our wonderful hosts served afternoon coffee and giant cinnamon buns while we traded business cards and e-mail addresses with each other. On behalf of the AWI members and the rest of the tour group, I would like to again thank Veikko Ahoniemi, Tuulia Tuomi, Jouni Pollanen, Jukka-Pekka Saaringn, Simo Yli-Talo, and Lauri Maliwa for their time and gracious hospitality.

SEEKING CANDIDATES FOR THE AWI BOARD OF DIRECTORS

The committee involved with securing candidates to run for the AWI 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; AWI; 701 Enterprise Drive; Harrison, Ohio 45030-1696.

Each recommendation will be carefully considered by the committee. Candidates will be selected on the basis of their local association or AWI experience, geographic location, present job status, horological experience, and willingness to serve.

Recommendations must be received before December 31, 2002 to be considered for the 2003 election.

2002-2003 AWI Committees' Objectives & Goals

ELM Trust
Trustees:
David A. Christianson: Chairman
Robert D. Porter: Secretary
Jim Door: Treasurer
Mark A. Baker: Battery Contest
Fred S. Burckhardt

E-mail: elmtrust@awi-net.org

Objective: The AWI Educational Library and Museum Charitable Trust was organized to aid in the advancement of the art and science of horology through activities in education. Its purposes are:
1. To lend practical assistance to the schools that engage in the teaching of horology.
2. To establish and maintain a horological library.
3. To establish and maintain a horological museum.
4. To encourage and assist students in their horological studies.

Constitution and Bylaws Committee
Jim Door, Chairman
Gene Bertram
Dennis Warner
Mark Baker
Paul Wadsworth

E-mail: constitutioncomm@awi-net.org

Objective: The committee shall consider and report on all matters referred to it as specified in the Constitution.

Goals: 1. Work with our legal counsel to formulate board-voting procedures that are in accordance with Ohio corporate law. If necessary, recommend changes to our Constitution and Bylaws to comply with state law.
2. Develop a procedure to organize the minutes and voting records of all board meetings, including teleconferences, votes by e-mail, votes by U.S. mail, votes by fax and those held at regularly scheduled meetings. AWI needs a readily accessible record of past board actions.
3. Change the spelling of the word *PRINCIPLE* (a tenet) to the word *PRINCIPAL* (a sum of money) in the Constitution and Bylaws. There are several places where we have used the incorrect spelling for this word in our financial references. Also check the Constitution and Bylaws for any other misspellings and correct them.

Finance Committee
Mark Butterworth, Chairman
Glenn Gardner
Chuck Atchison
Lou Esselman

E-mail: financecomm@awi-net.org

Objective: The Finance Committee will be responsible for monitoring the financial stability and effectiveness of all AWI financial transactions within the scope of the Constitution and Bylaws. A strong working relationship with the Executive Director, office staff, and the Board of Directors is necessary.

Goals: 1. Develop a fiscally sound, discounted dues structure for Associate AWI members. Please work with the Membership chairman on this project.
2. Work with the *Horological Times* chairman and editor to develop a creative program to increase advertising revenue significantly.
3. Present a balanced budget for the next fiscal year.

Judicial Committee
Chairman: Robert D. Porter, CMW
Members: Ron DeCorte, CMW
David A. Christianson, CMW, CMEW
Charles Cleves
Joseph L. Cerullo, CMW, CMC
Wes Door, CMW, FAWI
Alice B. Carpenter, CMW, CMEW

Robert F. Bishop, CMEW, FAWI
William I. Biederman, CMW
Fred S. Burckhardt, FAWI
Marshall F. Richmond, CMW
Leslie L. Smith, CMW, CMEW
James H. Broughton, CMW, FAWI
Robert A. Nelson, CMW, CMEW, FAWI
Ewell D. Hartman, CMW, FAWI
Harold K. Calvert, CMW
Gerald G. Jaeger, CMW, CMC, CMEW, FAWI

E-mail: judicialcomm@awi-net.org

Objective: The Judicial Committee, in cooperation with AWI's legal representative (attorney or attorneys), shall make final decisions in all areas of dispute that cannot be resolved through any other means. Strict adherence with the AWI Constitution and Bylaws is of paramount importance.

Goal: To fulfill its constitutional duties when duly requested by the Board of Directors or the members of the Institute.

Nominating Committee for the Board of Directors
Dennis Warner, Chairman
Dan Spath
Mack Shuping
Marshall Richmond

E-mail: nominatingcomm@awi-net.org

Objective: The Nominating Committee will be responsible to search amongst our membership for the best-qualified candidates to be elected to the Board of Directors in our annual election. The work of this committee is of the utmost importance to the future of the Institute because those candidates nominated and subsequently elected will be expected to provide the leadership of this Institute.

Goal: This committee will nominate candidates for the Board of Directors, all of whom shall meet the Constitutional requirements for serving as directors.

Perpetuation Committee
Jack Kurdzionak, Chairman
Mark Butterworth
David Christianson
Charles Cleves
Wes Door
James Lubic

E-mail: perpetuationcomm@awi-net.org

Objective: The Perpetuation Committee will be responsible for monitoring and making strong recommendations in regard to the investments entrusted to them through the AWI Constitution.

Education Committee
Jerry Faier, Chairman
Vince Schrader
Stanley McMahan
Rick Dunnuck
Mike Gainey
William O. Smith
Bill Russell

E-mail: educationcomm@awi-net.org

Objective: This committee's responsibility is the formulation and implementation of AWI's educational policies and programs. This committee and its subcommittee, certification, shall work together to accomplish their mutual objectives.

Goals: 1. Develop a related system of modular educational units that can lead to a member's certification in a given discipline when each of these units has been successfully completed.
2. Work with our educational director to make modular training units available to our membership, both at headquarters and in traveling bench courses.
3. Investigate educational topics in watch and clock making that can be addressed by producing educational videotapes. Work with our education director to write and produce those videotapes for which there is a need.

Certification Committee (Education Subcommittee)
Ron DeCorte, Chairman
David Christianson
Jerry Jaeger
Chip Lim
Robert Ockenden

E-mail: certificationcomm@awi-net.org

Objective: To oversee the certification of AWI members. To modify existing certification requirements and develop new certifications to meet current and future market requirements.

Goals: 1. Continue your current work on our traditional certification examinations to make them more relevant to the current requirements of our industry.
2. Work in conjunction with the Education Committee to bring to our membership new categories of certification that will demonstrate a member's proficiency in the

repair of battery, solar, and kinetic powered timepiece movements and the repair of the cases and bracelets to which those movements are fitted.

Media Committee has three subcommittees

***Horological Times* Committee (subcommittee of Media)**

Linda Chrysler, Chairman
Chip Lim
Robert L. Ockenden
Robert Porter
Frank Poye
Thomas Schomaker
Manuel Yazijian

E-mail: htcomm@awi-net.org

Objective: Work with our executive director, the editor, and president to formulate policy for our magazine.

Goals: 1. Produce a brief policy, in writing, that is published monthly in *Horological Times*, stating:
a. Procedure for submitting articles to *HT*.
b. That *HT*'s editor will acknowledge receipt of all submitted articles in a timely fashion.
c. That *HT*'s editor will make a decision whether or not to publish the article and how long it will take to notify the person submitting the article.
d. *HT*'s payment schedule for articles that are accepted.
e. Any other policy items the committee deems necessary.
2: Work with the finance committee's suggestions to significantly increase advertising revenue by pursuing new advertisers and encouraging existing ones to increase their ad space. Offering special rates to new advertisers and encouraging existing advertisers to enlarge their ads at a special rate, if it will ultimately increase revenue, should be considered.
3. Review submitted articles for content and accuracy before publication. If changes are suggested, submit those to the author for his consideration.

Book Review (subcommittee of Media)

Bob Porter, Chairman
Manuel Yazijian
Jim Sadilek
Gene Bertram

E-mail: bookreviewcomm@awi-net.org

Objectives: The Book Review Committee shall disseminate all horological publications to any member of AWI who is deemed qualified to review and report on the quality and content of the publication. Written, video, and internet publications are included in this definition.

Technology Committee (subcommittee of Media)

Manuel Yazijian, Chairman
Ron Price
Matthew Clark

E-mail: technologycomm@awi-net.org

Objective: This committee is responsible for making recommendations to the Board for further development of our electronic media including Internet capabilities and CD productions.

Goal: Keep abreast of electronic communication technology and report to the Board how AWI can use this technology to benefit its membership.

Membership Committee

Terry Kurdzionak, Chairman
Alice Carpenter
Gene Bertram
Glenn Gardner
Jerry Kincaid

E-mail: membershipcomm@awi-net.org

Objective: Increase AWI's membership and promote our organization both within the horological industry and to the public at large.

Goals: 1. Work with the Finance Committee to develop a fiscally sound, discounted dues structure for Associate AWI members.
2. Work with the Affiliate Chapters to help each of them increase their membership and to encourage all of their members to join AWI.
3. Encourage the publicity subcommittee chairman to get AWI's image into industry publications every month.

Publicity Committee (a subcommittee of Membership)

Bert Kalisher, Chairman
David M. Cooper

E-mail: publicitycomm@awi-net.org

Objective: Make AWI more visible to persons in our industry and to the public at large.

Goal: To get AWI, its activities, its membership, and what it does for our industry into the print media every month.

Honor Awards (a subcommittee of Membership)

Glenn Gardner, Chairman

Dennis Warner
Marshall Richmond
Wes Door
Jerry Kincaid

E-mail: awardscomm@awi-net.org

Objective: The Awards Committee will be responsible for making any and all recommendations in regard to special awards such as AWI Fellow, etc.

Strategic Action Committee
Tony Voight, Chairman
Joe Schrader
Doug Thompson

E-mail: strategicplancomm@awi-net.org

Objective: Recommend to the Board steps that we can take to insure AWI's future success as the premiere horological institution in the world.

Goal: Recommend to the Board the three most important policies we can implement beginning in 2003 for AWI to prosper five years from now.

Parliamentarian
Paul Wadsworth

Objective: To ensure the board adheres to parliamentary procedures.

Affiliate Chapter Report

John F. Kurdzionak

In September, the much-advertised Mid-Atlantic Horological Symposium was held in Linthicum Heights, Maryland. The Symposium was held on the campus of the Maritime Institute, a facility which "looks" and "feels" just like a university or college. But what sets it apart from other schools, is that the main focus of the entire campus is education for operating, piloting, and mastering, oceangoing vessels. However, the Maritime Institute's campus is not solely a college for mariners; it also serves as a function facility, and is large enough to host conventions for various groups. It was a most interesting location to host an event.

Although the Mid-Atlantic Horological Symposium could have, in some sense, been considered a regular AWI "Chapter Meeting," this column stated prior that it would be "so much more" than just a Chapter meeting. Indeed it was.

For example, it was not one AWI Chapter, but three Chapters that sponsored the Symposium. (Those Chapters being from Maryland, Virginia, and Pennsylvania.) Instead of lasting just one day or one evening as many Chapter meetings do, the Symposium lasted three. Instead of having just one guest speaker or theme for an hour-long presentation (such as is customary with many chapters), the Symposium offered several horological courses, speakers, and presentations over the entire weekend.

The Symposium allowed AWI members from a large geographical area (the east Coast of the USA) to learn from and network with others who are also engaged in watch and clock repair. Opportunities like these are the most important reasons to attend Chapter meetings. In fact J.E. Coleman in his writings used to say that the watchmaker lived in a 144-square-inch world (his work area on his bench top). It is now more important than it ever was, that today's watchmaker or clockmaker (or repairer, if you will) get away from his 144 square inches once in a while, and get out to a Chapter meeting to see what's going on in the repair world outside of his own shop. It will only do you, and your business, good. A good part of any business' success is dependent on its owner's willingness to get out in the "real world" once in a while, meet others in the same business, and see what's occurring in the business outside of his own shop. If leaving the workbench calls for travel to another part of the country, so much the better. Nobody in AWI ever saw what AWI members were doing elsewhere, without traveling to "elsewhere." The same holds true for everyone, everywhere. If you do not leave your shops on occasion and travel a bit, meet people, and learn things, your future success will suffer.

The Symposium was not limited to watches, clocks, and education of horologists. There were of course several enjoyable lunches, dinners, and late night "social sessions" (including a "field trip" into Baltimore one evening). A highlight was that during lunch one day, the attendees of the Symposium were treated to a special tour and viewing of the Institute's "Bridge Simulator." It is a 360 degree simulator that has a fully functional, mockup "Bridge" of a ship, that "simulates" what a ship's captain and crew would see from the bridge of that ship. The simulator makes one feel as if he's actually on the ship's bridge, and can very realistically "simulate" any of dozens of locations around the world, any of several type of ship, and practically any type of weather or situation. And it does so very convincingly! For the simulation, the group of horologists was "on the bridge" of a cargo container ship leaving Los Angeles Harbor during a snowstorm. (Yes, the simulator made it snow in Los Angeles.) When the simulated snow stopped, and the whiteout condition surrounding the "ship" cleared, this doomed ship of horologists rammed an

iceberg just outside of Los Angeles! Of course it was all "simulated" and none of the attendees was injured. After leaving the "ship," everyone safely returned to the watch or clock class he was participating in that day.

There is no reason you should not attend such events in the future, to give yourself, and your businesses, the same benefits the Symposium attendees in Maryland received back in September. All of the above professional and social benefits happened courtesy of AWI and its Chapters. Those repairers who *do* take advantage of the events that AWI and its Chapters sponsor, have an edge over those who do not. Do not be afraid to put the tweezers down once in a while, and do not be afraid to travel. Events such as Symposiums, Conclaves, Conventions, and yes, even the small, humble Chapter meetings, take place only to benefit you. You are invited to take every opportunity to attend such events in the future. You will be glad you did. If travel is required, it should be your reason to attend, and should not be your excuse to stay home. Your shop, your bench, your tweezers, that troublesome repair, and the endless phone calls from customers will all still be there when you come back.

AWI Home Study Course in Clock Repair

The new AWI Home Study Course in Clock Repair is now available. The course is based on the original correspondence course written and administered by Laurie Penman, AWI's resident clock instructor. Mr. Penman was trained in Britain as a mechanical engineer and is a clockmaker and restorer with several decades of experience. In addition to his restoration work and correspondence course, he is the author of many horological books and articles.

The course is constructed to provide information and instruction in a manner that is immediately useful in both learning clock repair and practicing it.

Within the 16 bench sets (lessons) which make up the course, you will find a fount of information. At the completion of each project, you will receive comments and suggestions from Laurie Penman and a pass or fail grade. In order to receive a certificate of completion, you will need to achieve a pass grade in each section. Mr. Penman will be available to answer questions or offer suggestions to each student.

The course package will contain all the material and information necessary for you to successfully learn the fundamentals of clock repair. Among the items included is a copy of *The Clock Repairer's Handbook* by Laurie Penman and a one-year subscription to Steven G. Conover's monthly publication, *Clockmaker's Newsletter*. You, as a paid home study course student, will be invited to attend one of two 2-day meetings at AWI where you will be able to confer with Mr. Penman and meet other students.

The cost of the course for AWI members is $750; non-members will pay $825. For additional information or to become a home study course participant, please contact AWI's Education Coordinator, Nancy Wellmann at nwellmann@awi-net.org, local phone (513) 367-9800, or toll free (866) 367-2924, ext. 303.

AWI Material Search/Movement Bank

EDITOR'S NOTE: This column is designed to work in conjunction with the AWI Movement Bank. If you can supply any of the items listed here, please send details to the Material Search Network. **Do not send the items to AWI.** Members requesting these items will be advised of their availability, and will contact you directly.

1C1 Rolex 1036 gent's stainless, case #6542GMT, *rotating bezel complete*

1C2 Gruen 18s *ratchet wheel and screw*

1C3 Audemars Piguet 2¾ x 8¾ L *pallet fork*

1C4 Waltham/Ball 16s *setting lever open face* #4760

1C6 Seiko 8523 *coil* #4002/450

1C9 B. Laval A. Stimier keywind 21L, 17J, #16123, *pallet complete*

1C10 Favre-Leuba 250 or 251 *calendar advance lever* #6710, BF#2610

If you can supply any of these items please contact: AWI Material Search Network, American Watchmakers-Clockmakers Institute, 701 Enterprise Drive, Harrison, OH 45030-1696. Toll Free: 1-866-367-2924, ext. 305; Phone: (513) 367-9800, Fax: (513) 367-1414 or E-mail: mhuff@awi-net.org.

The AWI-ELM Trust, in cooperation with the American Watchmakers-Clockmakers Institute, maintains this unique member service to assist professionals in replacing hard-to-find parts for vintage timepieces. When a member cannot locate a replacement part through normal sources, the Movement Bank/Material Search Network (which consists of movements, timepieces and materials donated to the Trust) is often able to help. There is a fee of $10.00 for each search. The fee will be waived if a part or movement of equivalent value is donated to the Movement Bank.

The AWI Material Search Network first contacts several dozen material houses and outlets on behalf of the member to determine if the missing part is available from any commercial source in the United States or Canada. If no other source is available, the Movement Bank is searched for a usable spare part. If found, the fair market value of the part will be assessed and the part made available for sale to the member. If the part cannot be found in the Movement Bank, the search will be listed in the *Horological Times*.

AWI Offers Evening Classes in Watchmaking and Clockmaking

American Watchmakers-Clockmakers Institute is offering once a week evening classes (10 consecutive Mondays) in clock and watch repair. These will be basic instructional classes loosely structured to adapt to the needs of the students.

Watch and clock classes will run simultaneously on Monday evenings from 6:00 p.m. to 9:00 p.m. at the training facilities at AWI in Harrison, Ohio. Instructors are Laurie Penman, clock repair and Tom Schomaker, CMW, watch repair. The evening class schedule is:

Session I September 9, 2002 - November 11, 2002
Session II January 6, 2003 - March 10, 2003
Session III April 28, 2003 - June 30, 2003

Cost is $350 per 10-week session. Registrants must be AWI members ($72 yearly membership). Tool and material costs are extra.

For further information or to register for a class, contact Nancy Wellmann, Education Coordinator, nwellmann@awi-net.org, local phone (513) 367-9800, or toll free (866) 367-2924, ext. 303.

Laurie Penman

Education Update

The foremost piece of news this month is the launch of our Home Study Course (HSC). I do not feel that you will want me to go into any great detail about it, that has been done already by e-mail and letter, and you can have too much of a good thing. I would like to emphasize the idea behind it because it does differ quite strongly from other correspondence courses.

I began constructing the course after buying a clockmaking correspondence course for my apprentice. It was a let down so far as I was concerned, it proceeded slowly month by month, calling for exercises in drawing, simple mathematics and simple practical work that David, (my apprentice) had left far behind him after a few months of shop work. It was a severely structured course and left no room for modification according to the abilities and the amount of time that the student could bring to it. Obviously some students would need more time than David did to absorb the skills, possibly because they were working at a daytime job, but nevertheless many of the purchasers would be members of the trade and find the slow process galling.

So I decided that a body of information should be provided that, apart from the first one or two "books," could be called upon by the student at any time and in whatever order was suggested by the work that was coming under their hands at the time. To flesh out the text and illustrations, communication with a personal tutor would be made as fast as possible, raising the possibility of actually being able to sit at the bench waiting for a useful response. E-mail and telephone made this possible. It is a system that has run since 1990 on an international basis and very successfully.

Now the AWI version provides all the books for the first year (almost a quarter of a million words with drawings) in the start up package and because most of the students will be in the Americas we have been able to make use of posting examples of work and problems between student and instructor. It was a problem when I lived in Britain and most of my students were on the other side of the Custom's barrier. Personal tuition is still the keynote and because we have the facilities here in Harrison each student has the benefit of two 2-day seminars at the School. They are free, although they still have to sleep, eat and get here!

At the completion of each project, you will receive comments and suggestions and a pass or fail grade. At the same time all the information that you need in order to take the Certification exams *is* covered so that the student should be able to take them with a great deal of confidence.

One last comment and then I'll stop enthusing over our new baby. The central part of HSC is the personal instruction, which will not take place unless you talk to me! Use the e-mail (for preference) and the telephone as often as you need it. Whether it is a matter of tidying up a technique, solving a clock problem or seeking information on the history of a particular clock, get in touch.

I was mistaken, there is another " last comment"—a purely selfish one. I am on Eastern Time! It doesn't affect e-mail of course, but you Californians who work late are unlikely to get a warm welcome from me on the telephone at eight o'clock in the evening, local time. Sorry.

EDUCATION

Bench Courses

To schedule a Bench Course in your area please contact AWI for complete information. A list of available Bench Courses is printed here for your convenience. To register for Bench Courses, please mail, phone, fax or e-mail your registration and payment information to: **American Watchmakers-Clockmakers Institute, 701 Enterprise Drive, Harrison, OH 45030-1696; Toll Free 1-866-367-2924, Phone (513)367-9800, Fax (513) 367-1414, E-mail: educate@awi-net.org** PLEASE NOTE: Registrations are limited and will be selected by the earliest date received. Please include a check or charge card number (Visa, Mastercard, Discover or American Express), card expiration date, signature and phone number. All registration fee checks and charges are processed immediately upon receipt. ***DEADLINE FOR REGISTRATION IS 30 DAYS BEFORE THE SCHEDULED DATE OF THE COURSE.*** • Indicates Bench Courses held in conjunction with a convention or purchased by an AWI Affiliate Chapter. For more information on these specific courses, please refer to the contact information provided for each class.

DATE	CLASS	INSTRUCTOR	LOCATION	FEE
NOVEMBER 2002				
9-10	Beginning Lathe	Robert Porter	San Francisco, CA	$250.00
JANUARY 2003				
11-12	Cuckoo Clock Repair	Rick Dunnuck	Phoenix, AZ	$250.00
FEBRUARY 2003				
1-2	Basic Pocket Watch Repair	Alice Carpenter	Seattle, WA	$250.00
15-16	Clock Escapement	Jerry Faier	San Francisco, CA	$250.00
APRIL 2003				
12-13	Basic Pocket Watch Repair	Alice Carpenter	Pittsburgh, PA	$250.00
MAY 2003				
3-4	Clock Escapement	Jerry Faier	Boston, MA	$250.00
17-18	Beginning Lathe	Robert Porter	Atlanta, GA	$250.00
JUNE 2003				
14-15	Cuckoo Clock Repair	Rick Dunnuck	Madison, WI	$250.00
21-22	Beginning Lathe	Robert Porter	Philadelphia, PA	$250.00
SEPTEMBER 2003				
6-7	Beginning Lathe	Robert Porter	Minneapolis, MN	$250.00
20-21	Clock Escapement	Jerry Faier	St. Louis, MO	$250.00
OCTOBER 2003				
11-12	Cuckoo Clock Repair	Rick Dunnuck	Baltimore, MD	$250.00
18-19	Basic Pocket Watch Repair	Alice Carpenter	Nashville, TN	$250.00
NOVEMBER 2003				
8-9	Beginning Lathe	Robert Porter	Dallas, TX	$250.00

AWI BENCH COURSES

Advanced Clock Repair

Beginning Lathe

Clock Case Repair

Clock Escapements

Cuckoo Clock Repair

ETA Products

Filing & Flat Polishing

400-Day Clock Repair

Hairspring Vibrating

Introduction to American Pocket Watches

Introduction to Clock Repair

Introduction to Quartz Watch Repair

Lathe Program

Mechanical Watch Repair

Micro Lathe Operations

Mechanical Chronograph

Organize Your Work Habits for Success

Platform Escapements

Repair of the Atmos Clock

Repair of the Bulova Accutron

Seiko Kinetic Quartz Watch Repair

Sequential Chime

Servicing ETA Quartz Chronographs

Striking Clocks

A Study of the Deadbeat Escapement

Swiss Auto Quartz

Classified Advertising

Regulations & Rates

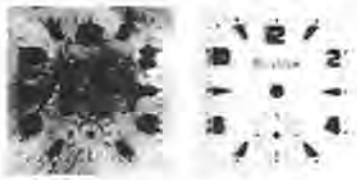
Ads are payable in advance 90¢ per word, $1.00 per word in **bold** type. Classified display ads are $40.00 per column inch, 2¼" wide. Ads are not commissionable or discountable. The publisher may, at the publisher's sole discretion and for any reason and without notice, decline to publish or republish any ad, in which case any fees submitted or paid for such ads shall be returned or rebated to the advertiser. The publisher reserves the right to edit all copy. Price lists of services will not be accepted. Confidential ads are $10.00 additional for postage and handling. The first of the month is issue date. Copy must be received 30 days in advance (November issue closes for copy on December 1st).

HOROLOGICAL TIMES
701 Enterprise Drive
Harrison, OH 45030
Toll Free 1-866-367-2924, ext. 307
Phone (513) 367-9800
Fax (513) 367-1414
E-mail: dbaas@awi-net.org

TRADESMAN

HAMILTON ELECTRIC WATCH REPAIR
Expert, experienced service on all Hamilton 500 and 505 Electric watches. Hamilton electric watches and parts always wanted. René Rondeau, P.O. Box 391, Corte Madera, CA 94976. Tel: (415) 924-6534. E-mail: rene@hamiltonwristwatch.com

DIAL REFINISHING



BEFORE AFTER

Quartz Conversions
Diamond Dial Conversions
Emblem & Name Personalization

Write for Brochures
INTERNATIONAL DIAL CO., INC.
58 W. SUGARTREE
P.O. BOX 970
WILMINGTON, OH 45177
(937) 382-4535

ELECTRONIC INSTRUMENT SERVICE
We are Factory Authorized Service for:
• **VIBROGRAF & PORTESCAP**
• **TICK-O-PRINT & L&R**
We service all makes of ultrasonics, all makes of watch rate recorders, and related equipment. 25 years experience.
JACK PHILLIPS
757 Lincoln Ave., #26 San Rafael, CA 94901
Used Equipment Bought & Sold
For Information
Call (415) 453-9266

CRYSTAL CUTTING SERVICE
Flat Mineral Glass Crystals
Quality Work
1-Day Turnaround
R.A. Time Capsule
Montoursville, PA
You'll love our price.
For more information call
1-800-WATCH-50

CLOCK, MUSIC BOX MAINSPRINGS, GEAR PINION CUTTERS, MATERIAL & PARTS CUSTOM MADE. **TANI** ENGINEERING, 1852 St. Rt. 44, Atwater, OH 44201; (330) 325-0645. Catalog $3.00.

POCKET WATCH & MARINE CHRONOMETER REPAIR
General repair and restoration of antique and complicated watches. Custom parts fabrication including staffs, verge staffs, stems, levers, and springs. Located in Massachusetts. Matt Henning, CW (413) 549-1950; www.henningwatches.com

FENDLEY & COX
WHEEL AND PINION SPECIALIST
1530 Etain Rd., Irving, TX 75060
RICHARD COX 972-986-7698
www.fendley-cox.com

VINTAGE POCKET WATCH RESTORATION. Twenty years experience, guarantee, free estimates. The Escapement, Box 606, Chenango Bridge, NY 13745; (607) 648-3777.

HOROLOGICAL MACHINING COMPANY
Pinions, wheels, gears, staffs, stems, barrels, levers, jeweling. Adams Watch Repair (417) 257-1345.

CLOCK PARTS MACHINING. Free price list. John F. Kurdzionak, 8A Central Street, Stoneham, MA 02180; Phone (781) 438-1037, Fax (781) 279-2923, www.JFKCLOCK.com

ALVIN KRUTOLOW FOR ROLEX SERVICE
Master Watchmaker, 47 years experience. Awarded technical certificate from Rolex in 1977. Service includes case & bracelet refinishing & waterproofing of case. All watch parts are genuine Rolex. We specialize in the repair of high-grade watches & clocks. Not affiliated with Rolex Watches, Inc. USA. Ask for Alvin or Marcus, (203) 792-4539.

ATMOS
Service & Repair - Original Parts Only
2-year warranty on labor
Clockmaster, Inc.
2537 So. Brentwood St. Louis, MO 63144
(314) 968-1010

GLASS CRYSTALS
For pocket watches and wristwatches. For price list/order blank: Send SASE to Mel Kaye, Box 322, Basking Ridge, NJ 07920.

DIAL REFINISHING CO. FAST SERVICE, FINEST QUALITY, quantity works welcome. Specialize on changing dial feet positions to fit the quartz movement. Send your works to: **KIRK DIAL OF SEATTLE,** 4th & Pike Bldg., Suite 625, Seattle, WA 98101; (206) 623-2452.

CLOCK & WATCH WHEEL & PINION CUTTING, REPIVOTING & INDEX PLATES
Full service custom machine work.
Mark Cooper, Rt. 5, Box 420, Alvin, TX 77511
(281) 331-9234 quailm@aol.com

DENNIS KAYE
117 Luxon Place • Cary, NC 27513
888-363-9510
Porcelain Dial Restoration
Watch • Pocket Watch • Clock
Platform Escapement Repair
Atmos Parts & Service
400-Day Clock Repair
Kundo Coil/Electric Clock Service
Prompt Reliable Service . . . Guaranteed
Call Us or Visit dialrepair.com

CLEANING, RESTORATION & PART MANUFACTURING FOR ALL TYPES OF CLOCKS & WATCHES
We service and restore all types and grades of watches and clocks. Patek Philippe, Piguet, Vacheron & Constantin, Rolex, LeCoultre, Omega, Accutron, mechanical (all complications), tuning fork, electric, quartz, fusees, alarms, repeaters, chronographs, chronometers, wristwatches, pendant watches, and pocket watches. Antique or new. Also all styles of clocks: Atmos, cuckoo, 400-day, electronic, and quartz. Special repairs welcome. Staff manufacturing, repivoting, stem manufacturing (regular and oversize), gear cutting, etc. Free estimates. Fast turnaround time. 37 years experience in watch and clock restoration and parts manufacturing.

J.S. Park, CMW, CMEW
Member AWI & NAWCC
Satisfaction Guaranteed
TIME WORLD
Stone Crest Mall
2929 Turnerhill Road #1400
Lithonia, GA 30038
Phone: (770) 482-4750
Fax: (770) 482-4751
Mon-Sat 10-9 Sun 1-6

ARTICLES FOR SALE

Rollimat Pivot Polisher Machine & Lathe Attachment. Exclusive American Distributor. Once Upon A Time, 25 West Beverley St., Staunton, VA 24401; Toll Free 1-866-877-8164, E-mail: onceuptime@lycos.com

SHERLINE PRODUCTS
10-25% OFF
Free catalogs upon request.
Starrett Collets Now Available
ANTIQUE CLOCKWORKS, LTD.
P.O. Box 201, Loretto, MN 55357
Toll Free 877-643-7698
E-mail: jgboothacw@aol.com
www.AntiqueClockworksLtd.com

eckcells
Your battery connection and more . . .
379 Main Street Stoneham, MA 02180
NOW SUPPLYING MAINSPRINGS (NEWALL)
For American-made watches
$3.50 each, $10 for 3, $36 per dozen
COMPLETE LINE OF SEITZ JEWELS
EVEREADY, RENATA & MAXELL BATTERIES
Competitive pricing, monthly battery specials
MC/VISA
TOLL-FREE 800-435-4354 PHONE
TOLL-FREE 800-690-3303 FAX

FULLY WARRANTEED
Watch Timers & Cleaners

FACTORY REBUILT WATCH TESTING EQUIPMENT
Call or Write for details:
Tel: (516) 437-8700
Fax: (516) 437-8708
VIBROGRAF U.S.A. CORP.
504 Cherry Lane, Floral Park, NY 11001
www.vibrografusa.com

maxell
Batteries
THOSE WHO PUT THEIR NAME ON THE OUTSIDE PREFER MAXELL'S NAME ON THE INSIDE
For all your alkaline, lithium and watch batteries, watch tools, watch movements, metal bands, leather bands, glasses (flat/domed), crystals, Swiss sapphire crystals, Citizen and Seiko crowns, springbars, o-rings and gaskets please contact:
Simren Canada
5730 Coopers Avenue, Unit #24
Mississauga, Ontario L4Z 2E9
Tel: 905-890-3618 • Fax: 905-507-6896
Toll: 1-800-381-3077 • Fax: 1-888-890-8878
E-mail: simren@idirect.com
Website: www.simrencanada.com

If You Repair Clocks . . .
you need our all new Catalog #28.

Timesavers
Box 12700
Scottsdale, AZ 85267• USA
480-483-3711 / 480-483-6116
info@timesavers.com / www.timesavers.com
Our 152 page Catalog #28 is $3 post paid

HENRY B. FRIED MEMORIAL – 30th Horological Tour: **Switzerland** (Basel Fair; Bayer Museum; Patek Manufact and Museum; Meet Derek Pratt and Watchmakers Vallee- Desjoux – Lemania, Atmos, Breguet; Basel Watch and Clock Mart) **England** (Brunel Clock and Watch Fair; Lord Harris Collection; Bermondsey; Portobello; Worshipful Company Clockmakers; Manor House) **Portugal** (School Horology; Sintra Clock; Collection Palace Ajuda; Museum Serpa; Alfama Antique Market). April 3-20, 2003. Brochure? 1-800-262-4284 or Lerescu@warwick.net

STUCK FOR A MOVEMENT?
or a watch part? Call Don Kroker's Watch Movements. (559) 229-8423 or write 4325 No. 5th St., Fresno, CA 93726.

NOW AVAILABLE
Discontinued SEIKO & LASSALE
Bands, Cases, Dials, Straps & Case Parts
This is an inventory of complete salesmen's samples. We have over 15,000 cases/bands in stock for immediate delivery. Crystals, dials, hands and crowns are available. Renew that old SEIKO or LASSALE customer's watch for a fraction of the cost of normal parts purchase. We have many parts that the major distributor can't supply. All parts are from U.S.A. authorized models.
Call RON CANDA
1-877-226-3259
This is a FREE call!!!
Have caseback, dial, or band numbers ready and I will let you know cost and availability.
E-mail: candajewel@aol.com
www.candowatches.com

TEC Specialties
Fine dials and labels

Catalog with refund coupon $6.00 ppd
www.tecspecialties.com
Jim Zerfing **PO Box 5042**
South Williamsport, PA 17702-0842

DASHTO INC./TOM MISTER
http://www.dashto.com
Huge and everchanging selection
Used and new horological items
Sold by internet list only
TOOLS/EQUIPMENT
MATERIAL ASSTS/PARTS
POCKET/WRISTWATCHES
WATCH MOVEMENTS
WATCH CASES & DIALS
WATCH BRACELETS/BUCKLES
MUCH MORE
WE BUY & TRADE ALSO
tom@dashto.com
http://dashto.org

Regula and H. Herr cuckoo movements. Complete selection. Great pricing. Examples: 1-day R25: $30, 8-day R34:$45. Also factory stopper new Hermle, Urgos, and Kieninger at 60% OFF our regular wholesale prices. Call Butterworth 1-800-258-5418.

MORGAN PIVOT POLISHER
USA MADE
Visit Web or call for info
(262) 539-4000
www.ClockBug.com
jim@ClockBug.com

BUSINESS FOR SALE

FOR SALE: Due to retirement, House of Clocks and Gifts - Since 1981 - Abilene, TX 79602. Draw from 150-mile radius. 3,100 sq. ft. free-standing building built in 1983. Interior remodeled in 1999. Sale of quality clocks and gifts. Clock repair and restoration for 40 years. Excellent customer base. Complete package: land, building, inventory, repair tools and 2000 Ford Van - $275,000. CAL SANFORD, "The Clock Doc" (915) 692-5605, e-mail: sanfordclockdoc@aol.com

SITUATIONS WANTED

WATCHMAKER
European experience, skilled in high quality watches and clocks, seeks position or partnership in the Chicago area. (773) 283-6690 danielsnowak@ameritech.net

HELP WANTED

LVMH

WATCH & JEWELRY

Become a part of the prestigious LVMH family of watches and jewelry in Springfield, NJ. Experience working with the craftsmanship and specialty engineering of luxury brands such as

TAG Heuer
Christian Dior
Zenith
Chaumet

Actively seeking experienced **WATCHMAKERS**. Ideal candidates must have five years of repair experience with quartz, mechanical and chronograph movements.

We offer a pleasant working atmosphere, excellent benefits including 401k, and competitive salary plus incentives.

LVMH Watch & Jewelry
Human Resources Department
960 South Springfield Avenue
Springfield, NJ 07081

Fax: 973-467-5730
human.resources.us@lvmhwatchjewelry.com

ACCUMLATIONS WANTED!!
Buying Watchmakers' Stock of Old Watches, Cases, Movements, Watch Material, all types of wristwatches from common brands to all the famous makers.
Serious buyer. Serious offers.
Don Meyer 1-800-833-3159
12900 Preston Rd. #325
Dallas, TX 75230
E-mail: donmeyer@hotmail.com

WANTED: Original bracelet for approx. 1969/70 Omega Speedmaster Chronograph (Moon Watch) (612) 333-3665

ATTENTION RETIRED WATCHMAKERS
Call us before you sell your parts, tools, and watches. We have helped over 125 watchmakers in the last three years to dispose of their accumulations. When you're really ready to sell, we're ready to buy! Phone (727) 327-3306. Ask for Jeff or Nancy. E-mail: jeffnancy@watchfinder.com

BUYING OLD ROLEX WATCHES
Explorer, Submariner, Sea-Dweller, GMT, Milgauss, Bubbleback, Cosmograph, Chronograph, Speed King, Oyster, any partial watches, movements, dials, crowns, signs, clocks, anything Rolex.
Call Don Meyer 1-800-833-3159

WATCH MATERIAL DISTRIBUTORS
Please call us if you are interested in selling your business.
All replies confidential.
Contact Pat Cassedy
Cas-Ker Co. (513) 674-7700

Experienced Watchmaker Needed
Salary up to $100,000 + Benefits
Phone 248-723-5550
Fax 248-723-5401
Contact: Mr. Efim Khankin

WATCH REPAIRER
Family-owned jewelry store seeks full-time watch and clock repairer with a minimum 2 years bench experience required. Duties include: clean, adjust and repair all makes of watches and clocks. Restore antique watch and clock parts. Will train on jewelry if necessary. Cover letter, resume & references to T.L. Biegert Jewelers, 113 West Main Street, Collinsville, IL 62234.

WANTED TO BUY

CALL ME
When you are ready to sell your movements, cases, dials, parts, or complete watches. Prompt, fair settlement. Will travel or pay shipping. Mike Bailey, P.O. Box 1118, Elgin, IL 60121 or (847) 741-1289.

WANTED: Paying high prices for chronograph and high grade watches, movements, dials, cases, & parts. Dean Sarnelle, 25 W. Beverley St., Staunton, VA 24401, phone & fax (540) 885-6064.

We pay 97% of market for karat gold scrap (any amount)! Also, buy filings, gold fill, sweeps, silver, platinum! Immediate 24-hour payment return mail! Ship insured/registered mail to: AMERICAN METALS COMPANY, 253 King St., Dept. HT, Charleston, SC 29401. Established 1960. Phone (803) 722-2073.

Books from AWI

To order the following books please call toll free 1-866-367-2924, ext 301 or visit our website at www.awi-net.org

The History and Development of the Quartz Watch By Benjamin Matz, CMW, FAWI
First Edition, published 2001, ISBN 0-9653053-0-9, *Chronos* Magazine, Denver, CO. This 6" x 9", 57-page, soft cover book offers the reader a fascinating study of the history and development of the quartz watch. This interesting book is divided into an introduction, nine main chapters, a reference section, and an index.
RETAIL: $14.95 AWI MEMBERS: $13.46

How to Build a Regulator Clock By J.M. Huckabee, CMC, FAWI
Shop drawings with critical drawing notes, 82 fully illustrated pages.
RETAIL: $18.00 AWI MEMBERS: $16.20

Military Timepieces By Marvin E. Whitney, CMW, CMC, FAWI
Marvin Whitney began his extensive research for this book in the mid-eighties. He took advantage of archive records in Washington, D.C. and travelled extensively in New York, Pennsylvania, and New England searching out little-known facts. The book contains 32 chapters and hundreds of photographs, illustrations and diagrams. This book is probably the most complete compilation on military timepieces to date.
RETAIL: $75.00 AWI MEMBERS: $67.50

Quartz Watch Retrofitting By Wesley R. Door, CMW
When there's a reason to retrofit, this book shows methods to achieve this task. Chapters include replacing a quartz movement, or changing a mechanical to quartz including replacing dial feet. Chapters include how to make a Dial Soldering Box and how to use it. The last chapter provides an easy-to-use 75-page Quartz Interchangeability Chart. This 5½ x 8½ inch, spiral bound, 180-page book includes 132 photos and drawings.
RETAIL: $29.95 AWI MEMBERS: $26.96

Questions and Answers in Quartz Watch Repairing By Alice and Buddy Carpenter
A basic understanding of quartz technology. **RETAIL: $12.95 AWI MEMBERS: $11.66**

Questions & Answers of and for the Clockmaker
This popular study guide for clockmakers has been updated by the AWI Certification Committee. This expanded version contains questions and answers and article reprints. Printed on 3-hole punch paper and shrink wrapped, this book is available with or without a binder. Each copy contains a cover to slip in the AWI binder or a binder of your own choice.
BOOK + BINDER - RETAIL: $27.95 AWI MEMBERS: $25.16
BOOK ONLY - RETAIL: $24.95 AWI MEMBERS: $22.46

Questions & Answers of and for the Watchmaker
This popular study guide for watchmakers has been updated by the AWI Certification Committee. This 250-page version contains questions and answers and article reprints. Printed on 3-hole punch paper and shrink wrapped, this book is available with or without a binder. Each copy contains a cover to slip in the AWI binder or a binder of your own choice.
BOOK + BINDER - RETAIL: $27.95 AWI MEMBERS: $25.16
BOOK ONLY - RETAIL: $24.95 AWI MEMBERS: $22.46

The Top 300 Trade Secrets of a Master Clockmaker By J.M. Huckabee, CMC, FAWI
The material in this 111-page book covers essentially all of the more difficult tasks encountered in the restoration of older American clocks. Each step is given in such detail that journeymen and students alike can enrich their skills as "with the master's touch". Most of this work can be readily adapted to other clocks encountered in the craft of clock restoration. Over 300 Photographs! Proceeds donated to the AWI-ELM Charitable Trust Student Loan Fund.
RETAIL: $26.95 AWI MEMBERS: $24.26

Twenty-First Century Watchmaking By William O. Smith, Jr., CMW, CMC, FAWI
Smith has developed a method that will enable the watchmaker to successfully make many of the replacement parts required to restore fine watches in the 21st century. Using this method and very few inexpensive tools, the watchmaker will become proficient at custom making most flat metal parts required to complete a restoration. The purpose of this book is to cover in detail the methods the author has developed during a lifetime at the bench, methods which are the quickest, easiest and least expensive way of making high-grade parts for obsolete mechanical watches. Those who become involved in the process will find it to be fascinating, enjoyable and financially rewarding. The author's skill as a craftsman, teacher and author, along with excellent photography and line drawings, combine to make the development of the skills required to make these parts from raw material a challenging yet realistic goal to attain. The reader will truly develop what the author refers to as "The Joy of Making Parts with Ease".
RETAIL: $45.00 AWI MEMBERS: $40.50

Watch & Clock Information, Please By W.H. Samelius
The writing of Samelius edited by O.R. Hagans. **RETAIL: $30.00 AWI MEMBERS: $27.00**

The Watch Repairer's Manual By Henry B. Fried
This book is frequently used as the textbook for courses in watch and clock repair. It is ideal for individual study as well. Published in 1986, the 4th edition includes the six chapters on case setting and winding systems, motor barrels and jeweled main wheels, the verge fusee watch, repairing fusee chains, how to make a verge (staff), and the duplex escapement. A total of 26 chapters comprise this 456-page book, along with a glossary, appendices, many illustrations.
RETAIL: $35.00 AWI MEMBERS: $31.50

Advertisers' Index

AWI Employee Directory

James E. Lubic, CMW
Executive Director
Education & Technical Director
1-866-367-2924 ext. 310
jlubic@awi-net.org

Lucy Fuleki
Assistant Executive Director
1-866-367-2924 ext. 304
lfuleki@awi-net.org

Thomas J. Pack
Finance Director
1-866-367-2924 ext. 311
tpack@awi-net.org

Donna K. Baas
Managing Editor/Advertising Manager
1-866-367-2924 ext. 307
dbaas@awi-net.org

Nancy L. Wellmann
Education Coordinator
1-866-367-2924 ext. 303
nwellmann@awi-net.org

Sharon McManus
Membership Coordinator
1-866-367-2924 ext. 302
smcmanus@awi-net.org

Mary Huff
Shipping Coordinator
1-866-367-2924 ext. 305
mhuff@awi-net.org

Melanie Frye
Receptionist/Secretary
1-866-367-2924 ext. 301
mfrye@awi-net.org

Laurie Penman
Clock Instructor
1-866-367-2924 ext. 318
lpenman@awi-net.org

Steve Jones
Audiovisual Manager
1-866-367-2924 ext. 308
sjones@awi-net.org

American Watchmakers-Clockmakers Institute
701 Enterprise Drive, Harrison, OH 45030
Phone Toll Free: 1-866-367-2924
Local Phone: (513) 367-9800
Fax: (513) 367-1414
E-mail: awi@awi-net.org
Website: www.awi-net.org
Office Hours: Mon-Fri 8:00 AM to 5:00 PM (EST)
Closed National Holidays

L&R provides the perfect solution for your watch and clock cleaning needs

Free Shipping on 4 Gallons or more*

Extra Fine Watch Cleaning Solution provides the highest possible polish for watch parts. Formulated for mechanical watch cleaning machines.
230.062 Gallon $33.00

Nofome Waterless Watch Cleaning Solution for all delicate watch parts, cleans uniformly with thorough results.
230.061 Gallon $33.00

#111 Ultrasonic Watch Cleaning Solution
Ammoniated cleaner provides complete cleaning.
230.063 Gallon $35.00

#566 Ultrasonic Non-Ammoniated Watch Cleaning Solution for use where ammonia fumes are unacceptable.
230.064 Gallon $39.00

#3 Watch Rinsing Solution - Quick-drying, clear, petroleum distillate. No benzol or chlorinated solvents.
230.065 Gallon $33.00

Ultrasonic Watch Rinsing Solution
Ideal solution for ultrasonic cavitation. Fast-drying, will not break down.
230.066 Gallon $33.00

Duo-Lube #1 & #2 Watch Lubricant
Two-step product allows cleaning and lubricating.
230.067 Gallon $114.00

Solo-Lube - Single-step lubricant for use in last rinse jar.
230.068 Gallon $78.00

#677 Ultrasonic Non-Ammoniated Clock Solution for heavier-load demands of cleaning clock movements. Ready-to-use, waterless and non-ammoniated.
230.076 Gallon $38.00

Clock Lube Ultrasonic Lubricating and Rinsing Solution - Complete lubricating and rinsing solution. For use with L&R #677 Clock Cleaning Solution.
230.077 Gallon $53.00

Clock Cleaning Solution Concentrate
Use only a pint of concentrate to make a gallon of solution. Highly effective for ultrasonic, mechanical or manual cleaning. A safe, water-based, ammoniated product. Contains no cyanide.
230.069 Pint $16.50
230.070 Gallon 55.00

**Orders must be in multiples of Four Gallons to receive free shipping. Solutions may be assorted. No Hazardous Shipping Charges.*

Cas-KerCo.
2550 CIVIC CENTER DR PO BOX 31167
CINCINNATI OH 45231-0167

CALL 1-800-487-0408
FAX 1-800-487-5848
LOCAL PHONE 513/674-7700 FAX 513/674-0600
Shop our web site: www.casker.com

MasterCard VISA

THOSE WHO PUT

THEIR NAME

ON THE **OUTSIDE,**

PREFER **OUR NAME**

ON THE **INSIDE.**

QUALITY. INNOVATION. LONGEVITY.

maxell

THE WORLD LEADER IN MICRO BATTERY TECHNOLOGY