

HOROLOGICAL TIMES

July 2001



American Watchmakers-Clockmakers Institute

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COVER

This month's cover feature is a
Harrison Clock by Robert P. Doris.
Photography: Marchetti



Secretary's Message

Jack Kurdzionak, CW

According to our constitution, a major part of what AWI must do is to provide educational programs to increase the technical and merchandising proficiency of its membership. AWI meets this requirement, in part, by producing and distributing educational videotapes, publishing books and a magazine, and furnishing continuing education programs to its membership. Although each and every member receives the *Horological Times* magazine each month, many others do not fully utilize all of the other educational benefits AWI has available. We have a bookstore with books and videos for sale. Yet we have members who do not own these books and videos. Continuing education classes are available in our classroom at headquarters and in selected

locations around the country, but many members have not yet attended an AWI class. *Horological Times* has a classified advertising section that is for members to advertise and promote their products and services. Although most members read these classifieds, few advertise there. It is admirable to have a wide array of educational products and services available for our membership, but educational programs and products, regardless of their quality, are of little value if they remain unused or on a bookshelf.

We know what we have available and the challenge we at AWI face is how to place these products and services in the hands of our members where they can be used to their advantage. Recently, your directors voted to issue a voucher worth \$15 to each and every member of AWI. This voucher can be used to pay for many of the educational products and services offered by AWI. Mail in this voucher with your order and take \$15 off the price of any new book or video AWI has in stock in its bookstore. Use the voucher to take \$15 off the price of any continuing educational course given by AWI. Finally, use the voucher to take \$15 off the cost of classified advertising in *Horological Times*.

In order for the educational voucher program to operate smoothly and fairly for each member there will be a few limitations on its use such as no cash value, an expiration date, not to be used in combination with any other offer, and for member's use only. Watch for more information on these details and the mailing date of the educational voucher.

Our hope is that every member will use a voucher to take advantage of what we have to offer. If we can put a book or a video in the library of every member, this program will be a success. If our continuing education programs are oversubscribed, we will have done a good job. Finally, if our magazine bulges with new classified advertising we know our members will profit greatly by promoting their services and products. Education is basic to AWI and this is basic education for all of us.



Executive Director's Message

James E. Lubic, CMW

I would like to continue on in a similar direction as our Secretary, Mr. Kurdzionak has us pointed – member benefits – free member benefits.

I know the number of members in our organization with access to the internet and using e-mail is constantly increasing. Therefore, there are a number of you that may not be aware of a marketing tool that the Institute provides free to each of its members whether you have email or not. It's called our Referral Directory. In order to be listed on the directory you must have informed us that you wanted to be listed, or you went to our website and activated your file on your own by following a few simple prompts.

The Referral Directory is a searchable data base that anyone who is looking for someone to repair a watch or clock can use.

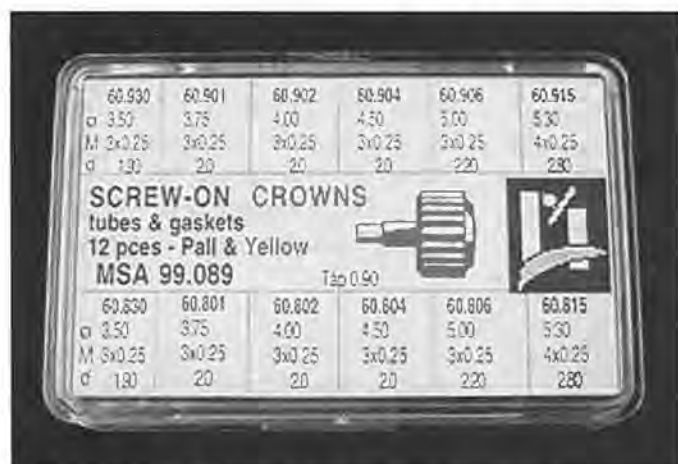
Once they find themselves at our Web Site Home Page, they would see the words "Need A Repair?" Click on that link and Mr./Ms. Public is sent to an information page, then they click on "Continue to Directory" and they are at our Referral Directory. They would then fill in and check the appropriate information, click search and voila, you could be one of the repairpersons that Mr./Ms. Public sees as a contact to help them with their watch or clock.

It is very easy to be found via AWI's "Need A Repair" page on our website if you wish to. All you have to do is contact us and say "Please add me to the referral directory on your website." We will do the rest.

If you have access to the internet and would like to activate your record so that you are included in the referral directory you may do so on your own. First go to our home page at www.awi-net.org, and then click on "Need A Repair," then the "Click Here to Continue to Directory," and then click on the "Members Only" and follow the prompts: (1) Enter your membership identification number. (2) Enter your first name (not caps sensitive). (3) Enter your last name (not caps sensitive). (4) Click on "Search" to view your record; if your record doesn't come up then that means that we didn't know you had access to the internet or e-mail capabilities. Please contact the Institute and we will fix it. (5) When your record comes up then you click on "Edit" to allow you to change the information as shown. (6) Click the box for "I want to be on the "Referral Directory." (7) Click on the other boxes as needed to describe your services – "Watch Maker/Clock Maker." (8) Scroll down the page to "Description" and enter 45 words intended to sell your services to whoever may view them. (9) Click on "Done" and you have been added to the Referral Directory.

You may also correct or add any other information on your record as needed with the exception of certification designation. If you do edit your record please e-mail the changes to Sharon McManus, Membership Coordinator at smcmanus@awi-net.org as the data base on the website doesn't communicate with the master member data base.

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Questions & Answers

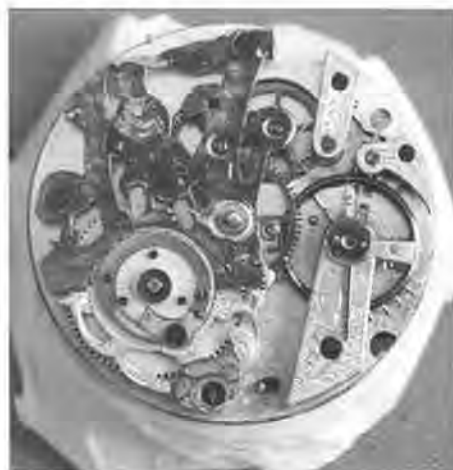
Question

Enclosed are photographs of a 19½ ligne, 15 jewel, key-wind/key-set watch in a sterling silver hunting type case. The main bridge of the lever movement is skeletonized and painted.

Do you have any information as to when the maker, Robert Roskell, lived and worked? Can you tell me what the motif might be?

I would appreciate any information you may have regarding this piece.

*Eduard Hoepfner,
Western Springs, IL*



Answer

Robert Roskell was a distinguished and successful maker of quality English watches in Liverpool from the 1790s until the early 1830s. His sons and grandsons continued the firm into the early 1900s. He is known for his use of the more dependable and accurate lever escapement: at first making the rack lever which was patented by another Liverpool watchmaker, Peter Litherland, and later the Massey detached lever.



In the mid to late 20th century, Robert Roskell and M.I. Tobias, to name just two of several well-known and well-respected makers, found that their names were being forged on inferior Swiss watches destined for the lucrative American market.

Your Roskell watch is one of these blatant forgeries. How do we know this?

1. Your watch dial and case are signed London. Roskell was from Liverpool and a part of the Liverpool community of watchmakers, with a style distinctly different from the London community of makers.
2. The watch movement itself is finished from an ordinary Swiss bar movement with a skeletonized train wheel bridge. The movement itself is of a modest quality and the engraving is crude compared to the engraving on the original handcrafted Roskell movements.
3. The skeletonized bridge is rather crudely sawn out. Thanks to the enlarged, professional quality of your

(Continued on page 36.)



Borel

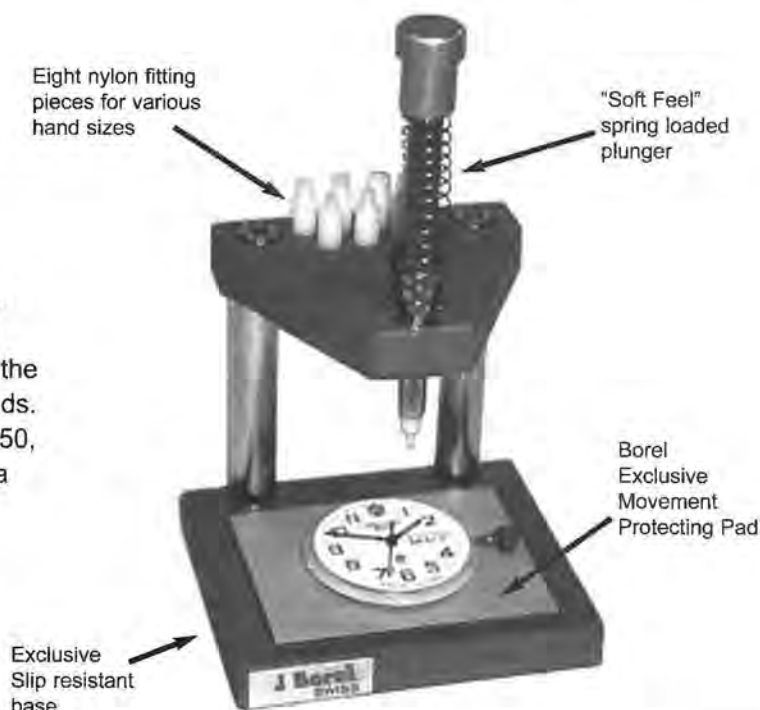
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50-0080	.50	.80	1.80
50-0160	.50	1.60	2.60
50-0220	.50	2.20	3.20
55-0070	.55	.70	1.80
60-0180	.60	1.80	3.00
70-0060	.70	.60	2.00
70-0080	.70	.80	2.20
70-0155	.70	1.55	2.95
75-0070	.75	.70	2.20

Asst. JBG15 \$24.95

Stock #	Cross-Section (mm)	I.D. (mm)	O.D. (mm)
30-0050	.30	.50	1.10
35-0060	.35	.60	1.30
40-0080	.40	.80	1.60
40-0090	.40	.90	1.70
40-0100	.40	1.00	1.80
40-0110	.40	1.10	1.90
40-0130	.40	1.30	2.10
50-0100	.50	1.00	2.00
55-0120	.55	1.20	2.30
60-0080	.60	.80	2.00
60-0140	.60	1.40	2.60
65-0120	.65	1.20	2.50

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1	.30	1.50	2.10	.60
2	.50	1.50	2.50	.40
3	.40	2.15	2.95	.40
4	.60	1.80	3.00	.30
5	.40	2.20	3.00	.40
6	.35	2.50	3.20	.50
7	.85	1.80	3.50	.40
8	.90	1.80	3.60	.40
9	.60	2.40	3.60	.30
10	.35	2.95	3.65	.40
11	1.10	2.00	4.20	.40
12	.48	3.85	4.80	.45

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Ask Huck

Lathe Types and Collet Styles

Question

Are the WW collets preferred over the Moseley or Jobber collets for a specific lathe?

Answer

Various chucks and collets are for convenience. If you must have a perfect machine and perfect accessories to do a perfect job, you are in big trouble. Everything is in a "wear out mode."

If your spindle bearings are close fitted and well lubricated, a choice of job setup and process will render a perfect result. If you must have perfection, run your job on a faceplate, cement brass, between centers, with a steady rest, or some other method that assures the highest quality result.

It has been said, "The back geared screw cutting engine lathe is the king of all tools." Old Huck says, "The watchmaker's lathe is the crown jewel of the clockmaking tools."

It is indeed unfortunate for our trade that we do not have literature available that exhaustively teaches the scope of work that can be accomplished with our "crown jewel lathe."

Question

Which watchmaker's lathe do you consider best? Do you prefer the Moseley, WW style, or some other lathe?

Answer

This is an easy question. I never met a lathe that I didn't like. Within physical limitations, the lathe will do anything your skills require of it.

Of the watchmaker's lathe styles, I have less preference for the IME and Geneva lathes because the bed shape is not as readily adaptable to shop-built and nonstandard fixtures and accessories.

The flat beds of WW and Moseley lathes readily accommodate an endless number of specialized fixtures.



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Robert D. Porter,
CMW

Repivoting for the Watch and Clockmaker

Part 4

Replacing a Missing Fourth Wheel Second Hand Bit

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We completed the pivoting of the third wheel in Part 3. We will now replace a missing second hand bit on the 4th wheel in Figure 27. A drill center is being turned in a cement brass in Figure 28. A drill the same size as the 4th wheel pinion is drilling the cement brass in Figure 29. Figure 30 pictures an alcohol lamp being used to keep the shellac in the hole warm until the pinion is running perfectly true while being held in place with pegwood in the tailstock. The lamp is then removed to allow the shellac to cool.



Figure 29

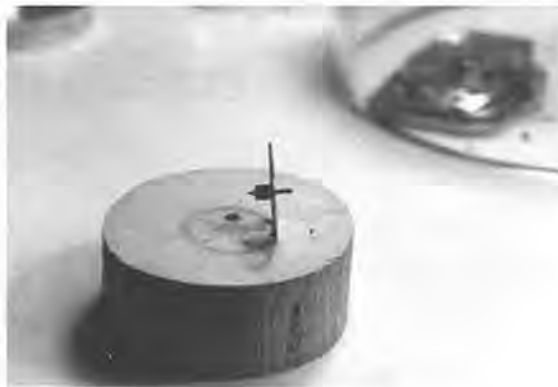


Figure 27



Figure 30



Figure 28



Figure 31



Figure 32

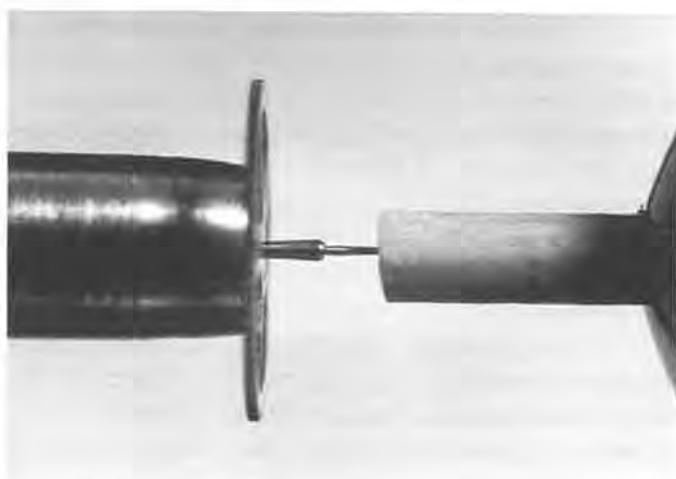


Figure 34



Figure 33



Figure 35

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A keenly sharpened carbide graver is cutting a center in the end of the 4th wheel in Figure 31 so the pivot drill will start exactly on center. Figure 32 pictures the carbide spade drill at work drilling the arbor to a depth of about four drill diameters. A better view of the drill at work is shown in Figure 33.

The seconds bit has been secured with adhesive, and is being held in place with pegwood until the adhesive sets in Figure 34.

An Elgin sapphire pivot polisher was used to finish the second hand bit to size as pictured in Figure 35. The cement brass was again heated with the alcohol lamp just enough to release the fourth wheel, which was then plunged into alcohol soaked pithwood to remove any residual shellac.

A Support Attachment for Repivoting

Figure 36 illustrates an easy to make support attachment (featured in the May, 1995 issue of *Horological Times*) that takes the place of the dust cover on the lathe

spindle. We have used a center in the lathe headstock to prick punch the brass support before drilling it the same size as the end of the duplex balance staff we are going to



Figure 38



Figure 36



Figure 39



Figure 37

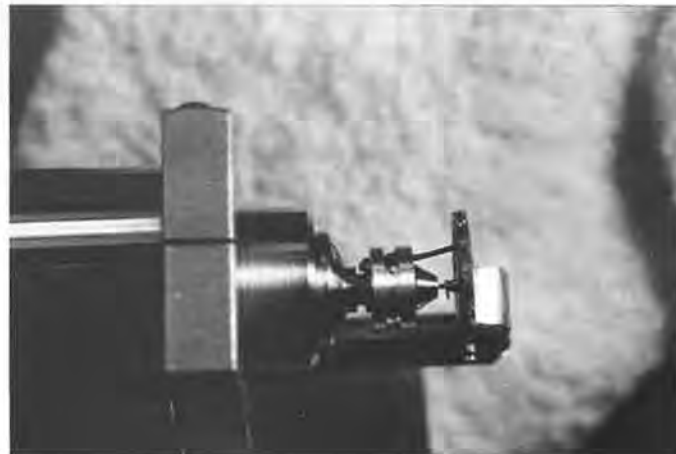


Figure 40



Figure 41



Figure 42

repivot, shown being drilled in Figure 37, and aligned with the tailstock center in Figure 38.

Figure 39 also pictures a homemade driver that runs on a 3/16" (.1875") drill rod post that has been center drilled in a manner similar to a Jacot lathe pivot support, and then hardened. The brass pulley is driven with the

monofilament line we used to drive the Jacot lathe. The end of the elastic cord is attached to the ceiling in my shop.

The driving pulley is held in place by the bend in the "U" shaped .38 mm (.015") diameter music wire driver, running free in a groove, as shown in Figure 40. A starting center is being turned in Figure 41.

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Technically Watches

Pocket Watches and Their Maintenance Part 38

The Assembly of the English Fusee Lever Watch (Continued)

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

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After the fusee unit, the mainspring unit, and the cap jewels have been assembled and oiled, we then proceed to assemble the watch movement.

Figure 1 shows the plates and wheels grouped for the assembly procedure. While the movement is being assembled, the lower plate is supported on a movement rest as shown.

When assembling the wheels onto the lower plate, the lowest wheels are assembled first, as shown in Figure 2. In this particular case, the third wheel is put into place first. Next, the center wheel is placed into position, and then the fusee assembly is placed into position.

Next, the fourth wheel is placed into position with the long pivot downward as shown in Figure 3.

Figure 4 shows the maintaining click being placed into position on the lower plate with its tip resting on the maintaining ratchet wheel.

Next, the escape wheel and pallet fork are assembled onto the underside of the upper plate. Then, the clip is placed into position to hold the escape wheel and pallet fork into position on the plate. This is shown in Figure 5.

After the escape wheel and pallet fork have been clamped into position on the upper plate, the upper plate is turned over and placed onto the pillars of the lower plate in the process of assembling the watch movement. This is shown in Figure 6.

Next, the clip is removed so the lower pivots of the escape wheel and pallet fork can be guided into their pivot holes in the lower plate.



Figure 1



Figure 2



Figure 3



Figure 4

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572.653C	3C	4-1/2"	\$29.95
572.655	5	4-1/2"	\$31.25

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Figure 5



Figure 7



Figure 6



Figure 8

When this is being done, the movement is held in the cotted fingers as shown in Figure 7. After this, the upper pivots are guided into their holes in the upper plate, starting with the fusee, then the maintaining click, center wheel, third wheel, fourth wheel, escape wheel, and pallet fork.

After all of the pivots have been guided into their pivot holes, the taper pins are replaced into the cross holes of the pillars of the lower plate to hold the plates together. This is shown in Figure 8. Sometimes the old pins can be reused, but in most cases, new pins should be used. If the proper taper pins are not available, then new taper pins can be made for this purpose. The following methods can be used for making taper pins.

One Style of Filing Device

Figure 9 shows a method of making taper pins that can be used as pillar pins, regulator pins, or hairspring pins. This figure shows a filing device which is held in the bench

vise when being used. The filing head is mounted onto a base or stem which fits in the bench vise. The head is held onto the stem with a spring loaded screw. This allows the filing head to be indexed to any one of the ten tapered "V" slots. The indexing is achieved by having a short index pin planted on the underside of the filing head which works in shallow holes in the end of the stem. There are ten holes, one for each index position.

To use the filing rest for making a taper pin, the proper size slot is selected. Then, the filing head is indexed to that position. The wire is selected and chucked into a small pin vise. The file used should be a number 6 cut burnish back file. A burnish back file is one that has had the teeth removed from one side of the file by surface grinding. The surface grinding leaves the surface flat with fine cross lines. When this surface of the file is used on the brass pin, it will smooth the surface of the pin and harden the pin.

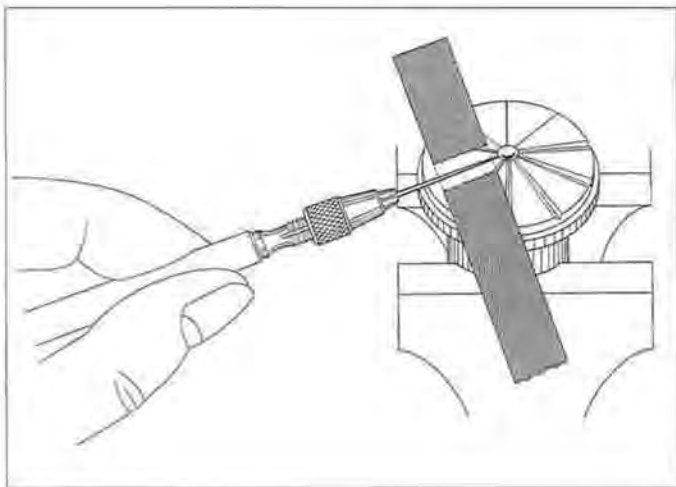


Figure 9

To make a taper pin, the wire is fastened in the pin vise and rested in the proper "V" groove of the filing rest as shown in Figure 9. First the side of the file which has the teeth is used to file the shape of the pin. As the pin is being filed, the pin vise is rotated back and forth between the thumb and forefinger. *Note: The rotation must be for more than a complete turn to prevent the taper pin from becoming out of round.* As the file is being

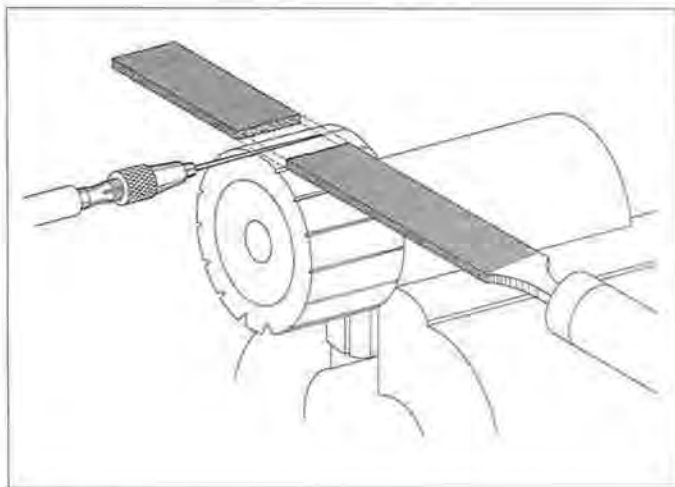


Figure 10

pushed, the pin vise should be rotated toward the operator so the surface on the pin will resist the teeth of the file. As the file is pulled back, the pin vise should be rotated away from the operator.

When the pin has been filed to shape and almost to size, the burnish side of the file is used on the pin in the same manner to smooth the pin and bring it to the proper size.



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Another Style of Filing Device

Figure 10 shows another style of filing rest used to make taper pins. The filing head is a cylinder which has a solid center pin that goes through a hole in the base of the device. The pin is free to turn in the hole in the base. The part of the base that fits between the jaws of the bench vise has been divided with a saw all the way to the hole in the base. This slot allows the base to tighten up on the pin of the filing head when the base is tightened between the jaws of the vise. To index the filing head, the vise is opened enough to turn the head; then, the head is indexed and the vise jaws are retightened. A taper pin is made on this filing rest in the same manner as in the first example.

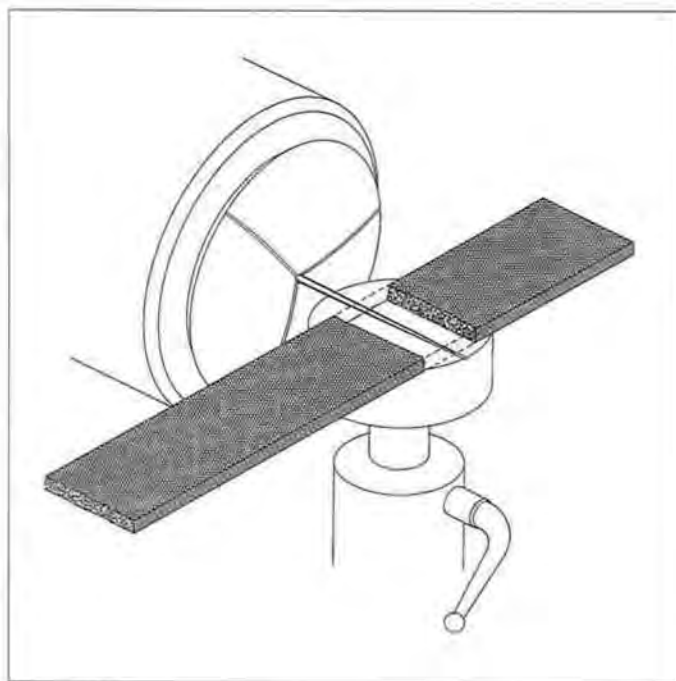


Figure 11

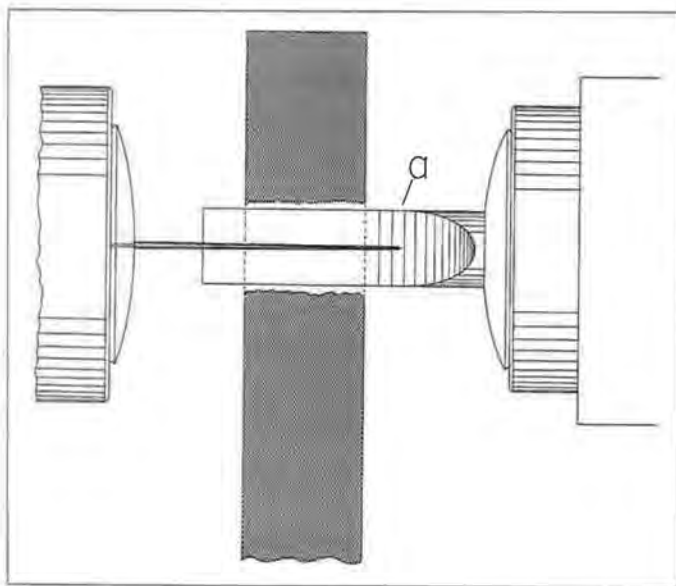


Figure 12

Using a Boxwood Filing Block

Another device that can be used for making taper pins is a boxwood block that is used in the bench vise. Different sized "V" grooves are made in the block to support the wire while the pin is being formed from the wire. The same method is used to form the taper pin as shown before.

Using the Lathe to Make Taper Pins

Figure 11 shows a method of making taper pins on the lathe. The wire is held in a chuck in the lathe headstock and is supported in a "V" groove made across the end of the hardwood peg. The peg fits into the hand rest of the lathe. The hand rest should be of the solid non-tipover type. If the head of the support is made large enough, then different sized grooves could be made on the support similar to that which is shown in Figures 9 and 10.

Figure 12 shows another method of making a taper pin by using the lathe. The wire for making the pin is chucked



Figure 13



Figure 14

in the lathe headstock. The support "a" is made from a piece of round rod and is held in the lathe tailstock. The support can be tapered to fit a tailstock spindle and taper chuck. The support can be left straight to fit a chuck in a chuck holding tailstock. A set of these supports can be made up to cover a wide range of pin sizes. It is best if these supports are made from high carbon steel rod so they can be hardened and tempered after they have been shaped. The slot in the support is a tapered "V" slot. To make the support, the rod is cut away almost to the center of the rod leaving enough extra material so that when the slot is milled, it will be exactly on center with the lathe center. *Note: Minor height adjustments can be made with paper shims under the tailstock.* When making a pin, the lathe headstock can be turned back and forth by hand or it can be turned with the motor in a counterclockwise direction only. The pin is first filed to shape and then burnished to smooth it.

After the taper pins have been inserted into the holes in the pillars, they are then pressed tightly into the holes in the pillars. This is done with special strong blunt tweezers that have had a slot sawed through the center of one jaw of the tweezers. This allows the slotted jaw to straddle the pin on one side of the pillar while the solid jaw of the tweezers is used to press the taper pin tightly into the hole. This style of tweezers is shown in Figure 13.



Figure 15

These tweezers can also be used for pressing a taper pin out of its hole.

Figure 14 shows these special tweezers being used to press a taper pin into its hole. After the taper pins have been pressed tightly into their holes, the pins are cut off on each side of the pillars so they extend out from the pillars about 0.50 mm to 0.75 mm. There is one exception to the length of the taper pin. The taper pin in the pillar that goes

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Figure 16

through the barrel bridge needs to be cut shorter in order to clear the countersunk hole on the underside of the barrel bridge. Cutting tweezers can be used to cut off the ends of the pins. This is shown in Figure 15. The pins can be nicked with the tweezers and then broken off as shown in Figure 16.

Next in the assembly process is to replace the mainspring barrel. Figure 17 shows the tweezers being used to place the barrel into position in the watch movement. Figure 18 shows the barrel bridge being placed into position over the mainspring barrel. Next, the barrel bridge screws are placed into position in their holes in the barrel bridge. This is shown being done in Figure 19. Then, the screws are tightened as shown in Figure 20.

Next month, we will discuss setting up the fusee and its power.



Figure 17



Figure 19



Figure 18



Figure 20

AWI Movement Bank/Material Search Network

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.

- 1P3** Vacheron Constantin 0s, serial #321388 balance staff
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- 1P8** Seth Thomas mantle clock 48J, winding arbor assembly (needs arbor, great wheel, click spring and click)
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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.

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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*.



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J.M. Huckabee,
CMC, FAWI, FBHI

As a Clockmaker Turns

Staking Tools and Techniques Part 2

Forward

The second part of this series will relate to problems in working brass. Brass used in clockmaking is very ductile, meaning that it is easily drawn and shaped. It is also very malleable, meaning that it can be formed or shaped by pressure or by hammer. This means that brass clock parts lend well to being shaped or returned to original shape. It gives great latitude to adjust for wear, damage, or errors in workmanship.

I will show numerous brass working techniques that you may, or may never use. Some are controversial in nature. However, they may add to your scope of skills.

Bullets, Swages, and Bearings

The tools in our first illustration are called "bullets" and "swages." All are shop built. These are used for brass working jobs.

The small pieces are called "bullets." These items are about an inch long. The central section is cylindrical, of a precision diameter, and taper slightly to each end. These are sized in close steps from about 0.1180-0.126 inch in the mid

section. They are used to "up-size" holes in brass, and give a precision inside diameter and polished internal surface. I use these, and others to adjust and finish holes in brass plates.

The larger pieces are called "swages." They are like punches, but have a conical tip in an included angle of about 110-140 degrees. They are used to "downsize" holes in brass.

For limited use by the clockmaker, these can be made of cold rolled steel. In the production industry they are made of heat treated steel.

Figure 2 shows how I grind the bullet taper. The swages are also ground by the same method.

Study Figure 3. This bullet is either pressed, or driven through a hole to produce a precision size and finish. The sizes shown here can "up-size" a hole about 0.002 inch per bullet and leave a polished internal finish. I use a small bench top arbor press, or a hammer.

Let's look at the swage of Figure 4. It has an included angle of about 130 degrees.

Let's look at the bullet in Figure 3. Imagine that it "up-sized" the plate hole so that the



Figure 1. Shop-built staking tools: a ball punch, two swages, and a half-dozen bullets. These are tools for working brass.



Figure 2. Bullets are made from short lengths of steel rod, of a precision size, cylindrical in the mid-section, and tapered to each end. I grind them to size as illustrated.



Figure 3. A bullet is either pressed or driven through a hole to form a precision diameter and internal finish.



Figure 4. This swage has an included angle of about 130 degrees. It can reduce the hole size in our plate. The hole near the loose bushing is oversize.

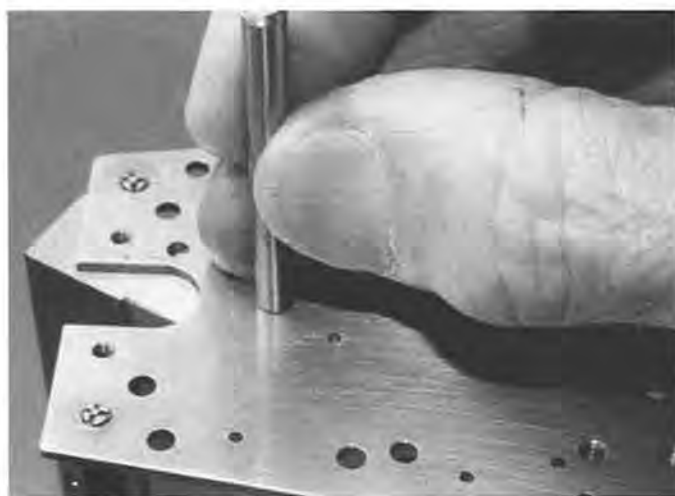


Figure 5. A hammer stroke on this swage will slightly close the plate hole. A bullet through the hole will resize and refinish the hole.

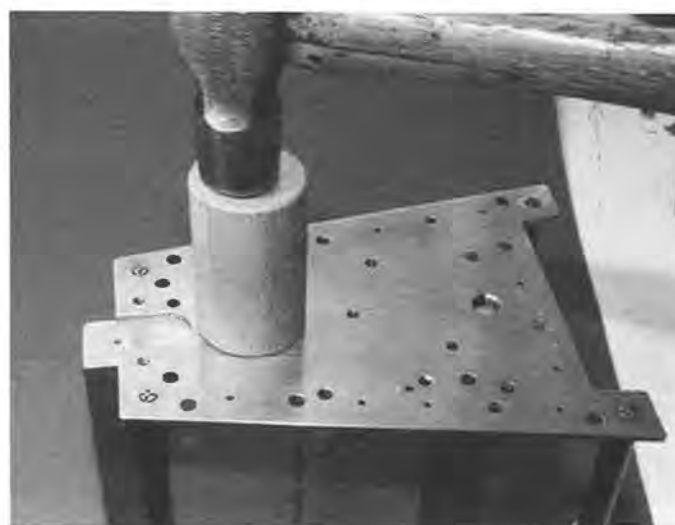


Figure 6. Friction bushing length should exactly equal plate thickness. A hammer and wood dowel will adjust your bushing inside-end flush with the plate.

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Figure 7. I broach the holes from both sides of the plate. That gives the hole a slight hourglass shape.



Figure 8. Overzealous broaching can end up like this. In some cases the hole can be swage-closed and rebroached. Use extreme discretion.

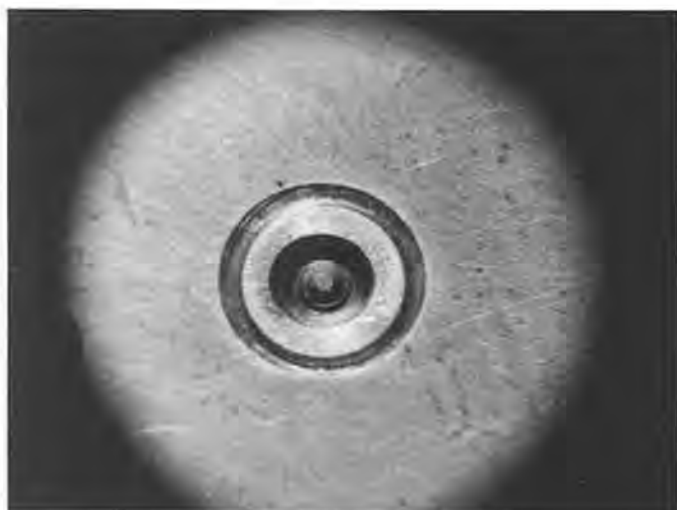


Figure 9. This is the hole in Figure 8. It was swage-closed, rebroached and viewed through a 15x eye loupe. Pivot diameter is $\frac{3}{4}$ mm.

bushing of Figure 4 falls through the hole. Now, the swage of Figure 5 will slightly close the hole. Use a smaller bullet to set the hole size correct. A caution—a punch with a smaller included angle will open the hole even more.

A wood dowel is “the clockmaker’s friend.” I use them for many things. In Figure 6, I set the inside end of a friction-fit bushing to be flush to the inside plate surface. Try this, and run a finger over the plate inside. You will like it.

Let’s broach the bushing of Figure 7 from both sides of the plate. Just overdo the job, and then study Figure 8. Try your swage in the bushing, and rebroach the hole. What do you think the result will be? Pull out your double eye loupe and take a look. Figure 9 is the same hole, opened and closed; same bushing, loose and tight; same pivot hole, too big and normal. The Figure 9 pivot has a diameter of $\frac{3}{4}$ mm (about 0.030 inch) and was photographed through a 15x eye loupe.

Ask your peers to look over your clock pivot jobs with a fifteen power glass—you may no longer be friends.

Let’s try another swage job. Figure 10 is an over-broached hole that was swage-closed and rebroached. It is also shown through the double loupe.

The Tools

Figures 11 and 12 show the tools I used for this article. They are indeed simple.

Admonishment

The techniques used in this article are very controversial. They are not a fit all, fix all technique. However, the next time you broach a friction-fit bushing and it falls out in your hand, this article is sure to flash into your mind.



Figure 10. This original plate hole was opened, and then swage-closed and rebroached. It was photographed through a 15x eye loupe. Use discretion with this technique. Pivot diameter is $\frac{3}{4}$ mm.



Figure 11. Bullet and swage used in this article. Bullets in Figure 1 are from about 0.118 to 0.126 inch diameter in increments of about 0.001 inch.



Figure 12. The tools used are a number 129 bench block by the L.S. Starrett Co., a piece of industrial scrap, and a Stanley #291B 2-ounce steel hammer.

Conclusion

This concludes the two-part series on staking techniques. I strongly recommend you use the material in Part 1. I also recommend that the items in Part 2 be used with judgment and discretion.





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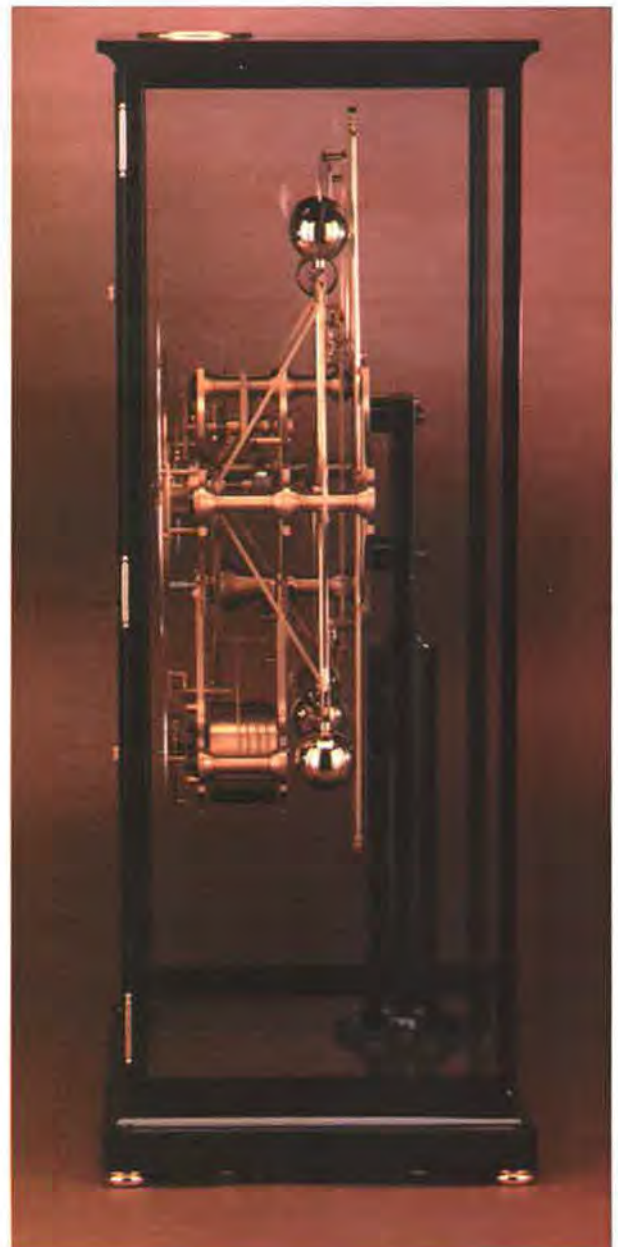
A Harrison Clock

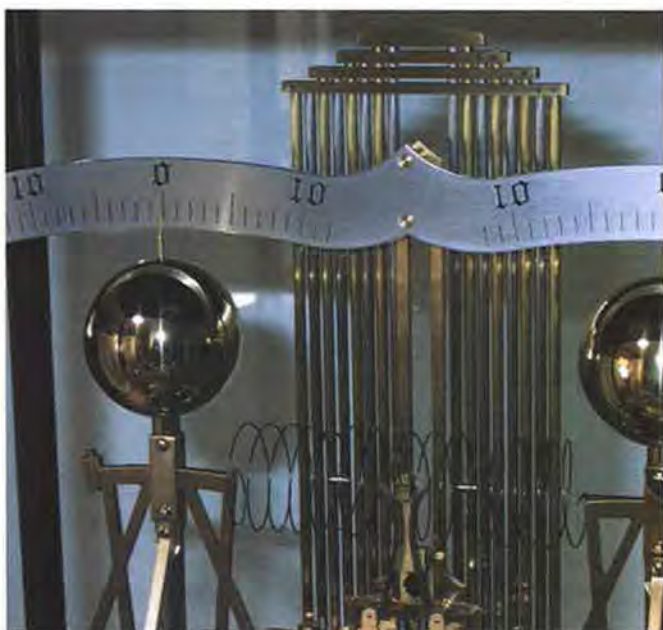
By Robert P. Doris

This unique clock was designed and constructed to illustrate the fascinating mechanisms invented and used by Englishman John Harrison on his large marine timekeepers, H1 and H2. These timekeepers were

built between the years 1729 and 1739 for the purpose of determining the longitude at sea. Harrison, a mechanical genius, eventually produced a watch (H4) accurate enough to win the great longitude prize of £20,000 offered by

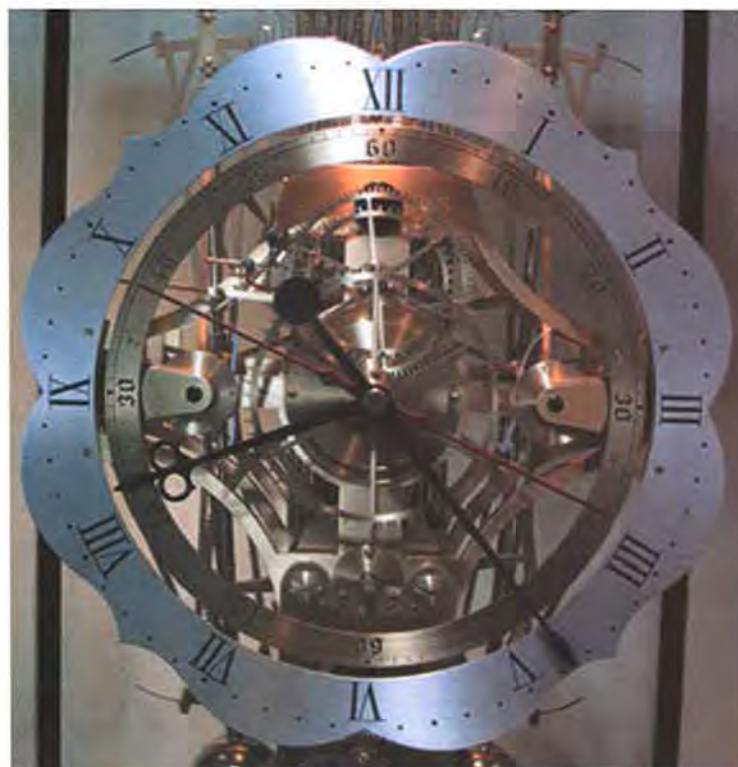
the British Government (worth several million dollars in today's currency). He achieved this through a lifetime of hard work, along with several setbacks and disappointments.





My intent was to enable the onlooker to view Harrison's devices with ease. Namely, the grasshopper escapement, bar balances, helical balance springs, gridiron temperature compensation, and maintaining power. This was achieved by using a skeletonized frame and by placing the escapement in the front. In the originals, these devices are often behind or between plates.

There is little information on how to construct a Harrison clock. I relied mainly on photographs, scant drawings, and articles in books and magazines. The clock was initially set up to be weight driven, in order to determine the force necessary to power the movement. This turned out to be a force of 3.5 pounds, which is sufficient to drive the heavy (5 pound) balances through a combined arc of 20 degrees, once per second. A suitable mainspring was found and fusee made to match to give a run time of 8 days. To further minimize any force variations, a 12 second remontoire is employed between the center and third wheels. This is a spring device which is rewound by the mainspring at 12 second intervals in order to provide a constant force to the escapement. One concession to modernity is the use of anti-friction ball bearings throughout.



The most challenging parts to make were the balance springs. These unique helical springs which Harrison termed "worm springs" are wound in one direction, then reversed in an "S" and wound in the opposite direction. (Figure 1.) This allows for fitting of the temperature compensation check pieces within the springs. Several tools were made to wind these springs until a satisfactory result was achieved. This involved making a split mandrel winding tool, with the appropriate right- and left-hand threads upon which music wire is wound. Once wound, the entire assembly is heat treated. This procedure enables the spring to retain the

diameter and shape of the tool once it is released.

The design and construction of the gridiron temperature compensation was another challenge. Without temperature compensation, a clock or watch will slow down as they get warmer and speed up as they get colder. In this clock, heat causes the balance springs to weaken. Harrison discovered that brass expands more than steel, and arranged brass and steel rods in such a way as to utilize the difference between their coefficients of expansion to create movement upon a rise or fall in temperature. This small movement, being only a few thou-

sandths of an inch, is magnified through a lever system which effectively alters the length of the balance springs in heat or cold. The ratio of magnification is fully adjustable. When the clock warms up, the balance springs begin to weaken. However, the compensation levers begin to extend which causes the balance springs to become shorter and maintain their stiffness. When properly adjusted, this cancels out the effect of heat or cold and the clock's rate remains the same.

The dial at the top indicates the balance arcs in degrees of a circle, being similar to a pendulum clock's beat scale. It is useful for setting up the clock and in determining its performance. Below the main dials, a simple calendar work indicating the day of month is fitted. It is driven off the great wheel and advances between midnight and 2:00 a.m.

To give an idea of the size of the clock, the main dial measures 10.8 inches in diameter, while the case measures 15 inches wide by 12 inches deep by 31 inches in height and weighs a total of 53 pounds. It involved over 900 hours of work through a 2-year period from March 1999 to April 2001. It was the most challenging timepiece I have made to date. The overall experience has been an insightful lesson on the early development of precision time-keeping. Another is planned for construction.

References

1. Dava Sobel and William J. H. Andrews, *The Illustrated Longitude*, Walker Publishing Co. Inc., 1998, p. 9.

Further Reading: *The Illustrated Longitude*, Dava Sobel and William J.H. Andrews; *The Quest for Longitude*, Edited by William J. H. Andrews.

On Video: *Lost at Sea, The Search for Longitude*, NOVA (PBS); *Longitude*, A&E, Jeremy Irons and Michael Gambon star in the story of a lone genius who solved the greatest scientific problem of his time.

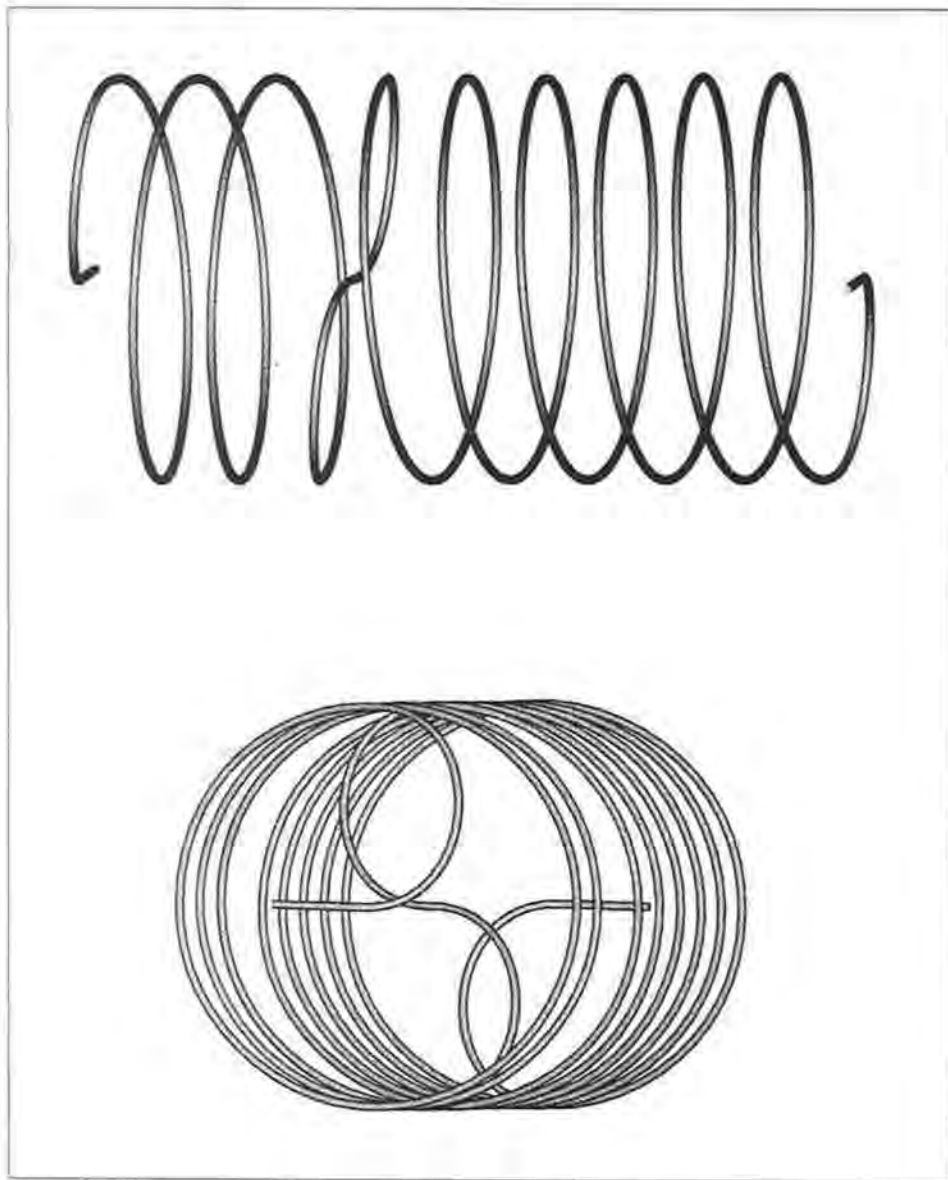


Figure 1. Two views of a balance spring (extended).

2001 Voting Results

The tabulation of ballots in AWI's 2001 Board of Directors Election, Proposed Amendment to the AWI Constitution, and AWI's New Logo Contest is complete. Five directors were chosen from a slate of 14 candidates. Those elected to serve three-year terms are: Mark A. Butterworth, Henry Frystak, Jack Kurdzionak, Robert D. Porter, and Frank Poye.



Mark A. Butterworth
Muscatine, IA



Henry Frystak
Linden, NJ



Jack Kurdzionak
Stoneham, MA



Robert D. Porter
Florissant, MO



Frank Poye
Paris, TX

Proposed Amendment to the AWI Constitution

The Proposed Amendment to the AWI Constitution was approved during the annual voting process. AWI's Constitutional Amendment goes into effect immediately. Article VII, Section 3 now reads: *Any member, after serving two (2) consecutive terms on the Board of Directors, shall be ineligible for re-election for two (2) years. A fraction of a term served over one (1) year shall be considered as one (1) full term.*

	For	Against	Total	Percentage
Amend Article VII, Sec. 3	1017	164	1181	86%

AWI New Logo Contest

Voting in the AWI New Logo Contest has been completed. We would like to congratulate James K. Zimmerman, CMW, CMC, CMEW of York, PA on having his AWI logo design chosen as the new official AWI Logo.



We would like to thank all the AWI members who took time to cast their ballot. AWI is your organization. Please be concerned enough to take part in all elections, surveys, etc. AWI members can access AWI's Constitution and Bylaws on line. Please visit AWI's website: www.awi-net.org. If you have questions, comments, concerns, etc., please send them to AWI, 701 Enterprise Drive, Harrison, OH 45030-1696, fax: (513) 367-1414, e-mail: awi@awi-net.org or call toll-free 1-866-367-2924.



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Want to know who won the Battery Contest? Be present as the awards for 2001 are announced and new and returning board members are sworn in. Congratulate **Frank Poye, Henry Frystak, Mark Butterworth, Jack Kurdzionak and Robert Porter**. Be present to thank **Tamara Houk, William O. Smith, Jr. and Milt Stevens** for their dedication and years of service to your association as members of the Board of Directors.

The batteries you use need to keep up with changing technology.



This year the AWI Affiliate Chapters welcome **Mark A. Butterworth** as their **Keynote Speaker**. Mark is best known for his company Butterworth Clocks, Inc. and his monthly *Horological Times* articles, "The Modern German Clock Movement."

Earn up to four CEU credits by attending lectures presented by **Dr. Matthew Clark; Jerry Faier, CMC; Mark Baker, CMW; Bob Ockenden, CMC; August Cornell and Charlie Cleves**

A special thanks to PAT CASSEDY, RICK FOSTER, and SCOTT SCHWARTZ, **CAS-KER COMPANY**; TONY VOIGHT, **WITSCHI ELECTRONICS USA**; and GERALD WILSON, **WM. S. McCAW CO.** for their early vendor registration. Plan to visit with them at their display tables.

Call the hotel before the **DEADLINE of July 13**—Hotel Reservations 859-371-3361, 800-HILTONS—to insure you receive the AWI rate of \$84. Registration with AWI after July 2 is \$225 for the weekend package; \$120 for guests and \$55 for children under 12 years of age.

SATURDAY TECHNICAL PRESENTATIONS

8:00 a.m. – 9:30 a.m.	<i>Servicing Wooden Works Clocks</i> <i>Isochronism & Positional Adjustments</i> <i>Organize Your Work Habits for Success</i>	Mark Baker, CMW Dr. Matthew Clark Bob Ockenden, CMC
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9:45 a.m. – 11:15 a.m.	<i>Diagnosing Poor Balance Motion</i> <i>Clock Restoration Practices</i> <i>Rolux Fakes</i>	August Cornell Jerry Faier, CMC Charlie Cleves
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1:30 p.m. – 3:00 p.m.	<i>Diagnosing Poor Balance Motion</i> <i>Clock Restoration Practices</i> <i>Organize Your Work Habits for Success</i>	August Cornell Jerry Faier, CMC Bob Ockenden, CMC
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3:15 p.m. – 4:45 p.m.	<i>Servicing Wooden Works Clocks</i> <i>Isochronism & Positional Adjustments</i> <i>Rolux Fakes</i>	Mark Baker, CMW Dr. Matthew Clark Charlie Cleves
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Stanley McMahan

Affiliate Chapter Report

In the Spotlight: John Kurdzionak

Many people are involved in the care and feeding of AWI. Everyone who holds an office in our organization plays a vital role in keeping the wheels turning.

One office that performs a vital function but receives little fanfare is the vice-chairman of the affiliate chapters.

I have had the privilege of working with John Kurdzionak over the past two years and have been impressed with his ambition, motivation, knowledge, and professionalism. He has a bright future ahead of him and I thought it would be nice to share an article with you that he recently wrote. It says a lot about John and his hard work.

This is an exciting time to be in the horological profession. Today, there are more watches and clocks of all styles, ages, and price levels needing quality repairs than there have been, perhaps ever before. There have been advances in timepiece technology and repair techniques that were unheard of 20 years ago, and there are fantastic opportunities for you to improve your skills in the horological field.

Horology, although changing with the times, is a fantastic career opportunity for the 21st century. AWI is here for you and for your local chapters and is ready, willing, and able to provide education and training, as well as having on hand a wealth of historical and technical information for past, present, and future technologies. All you have to do is ask for its services and they're available to you.

As the Affiliate Chapter Vice-Chairman, I would like to request that more local chapters send delegates to the annual meeting of AWI. Why? Well, I could easily say "because you can't afford not to" and leave it at that. But I'm not going to. Sending someone once a year to the AWI annual meeting provides the opportunity for your local chapter to have direct contact with both AWI and with delegates from other

chapters across the USA. You can meet the names and faces from *Horological Times*; you can find out about changes in the watch and clock industry; you can make valuable business contacts; you can meet suppliers and many manufacturers of the products you use; or you can find out how to solve a problem you're having at the local level just by talking to other delegates who may have had that problem, and solved it, before you! You can begin lifelong associations and friendships with others from around the world who are in the same business as yourself. It is here that you can voice your local chapters' questions and concerns to the AWI management and directors, as well as to others in the watch and clock repair business. Most importantly you can provide input that guides the direction AWI moves toward in the 21st century. It is an opportunity not to be missed. When you do not send someone to the annual meeting, the management of AWI and those of us who do attend end up making decisions without your valuable input. Please, we need to hear what you have to say, so if you have never sent a delegate, send someone to meet with us in August of 2001.

John F. Kurdzionak



AMERICAN WATCHMAKERS-CLOCKMAKERS INSTITUTE

SEEKING COMMITTEE VOLUNTEERS

Immediately following the AWI Board of Directors annual meeting in August, the President of AWI will appoint committee members for fiscal year 2001-2002. AWI relies heavily on its committees to establish and implement goals for the year. If you have time and talent to spare, consider volunteering to serve.

The committees and subcommittees listed below are those which are currently established in either the AWI Constitution or Bylaws. Please indicate the committee(s) for which you are qualified. Please number them in the order of preference.

- | | |
|--|---|
| ☐ Constitution & Bylaws | ☐ Membership |
| ☐ Finance | ☐ Publicity |
| ☐ Nominating Committee for AWI Board of Directors | ☐ Honor Awards |
| ☐ Education | ☐ Oversight Commission |
| ☐ Certification | ☐ Strategic Action |
| ☐ Media | ☐ Strategic Planning |
| ☐ <i>Horological Times</i> | ☐ Strategic Implementation |
| ☐ Book Review | |
| ☐ Technology | |

PLEASE COPY THIS FORM AND RETURN IT NO LATER THAN JULY 31, 2001. THANK YOU.

Name _____ AWI Membership No. _____

Address _____

City _____ State _____ Postal Code _____

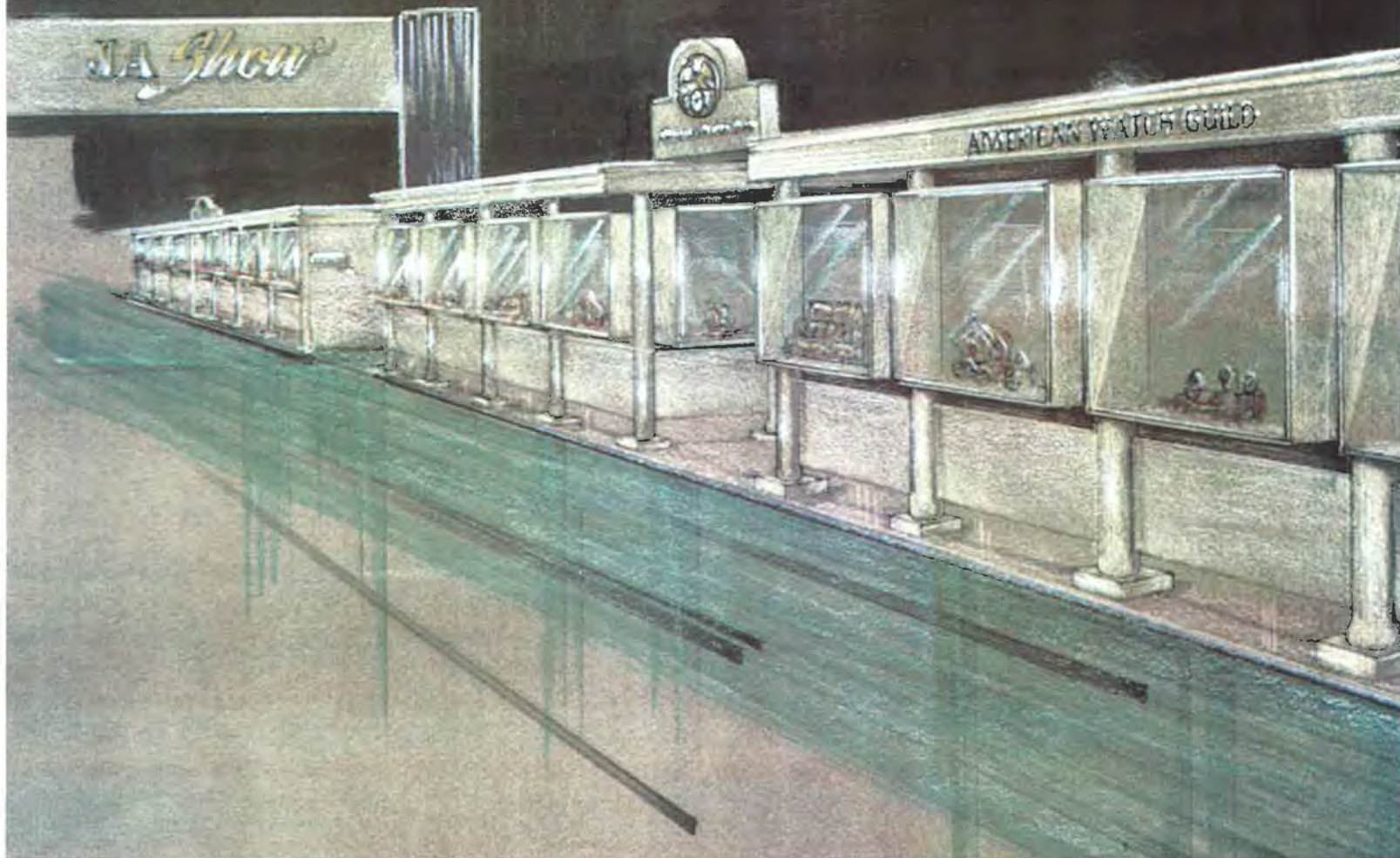
Phone (home) _____ (business) _____

Fax _____ E-mail _____

Please give a brief explanation of your qualifications to serve on the committee(s) selected

AWI Committee Volunteers 701 Enterprise Drive Harrison, OH 45030-1696
Fax: (513) 367-1414 E-mail: lfuleki@awi-net.org

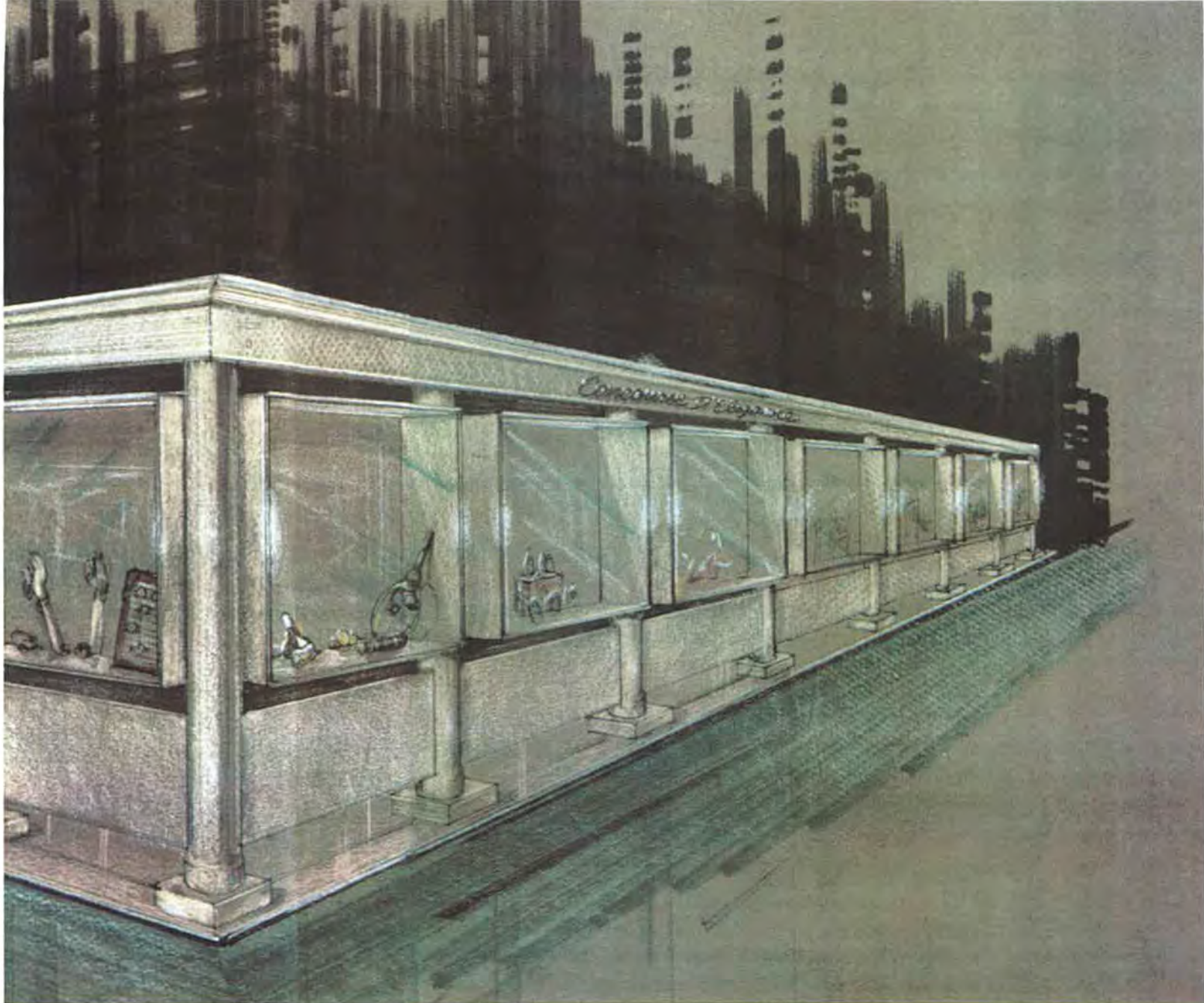
Concours d'Elegance



The AMERICAN WATCH GUILD presents JA New York Show, July 29 - August 1, 2001

Imagine over 12,000 watch and jewelry retailers from the continental United States, Canada, the Caribbean and South America arriving at the JA International Jewelry Show. They will all pass through the Grand Lobby of the New York Javits Convention Center where our 100 foot X 35 foot American Watch Guild Pavilion will be located.

On the outside for all to view will be 33 exhibition windows each 48" wide. They will exhibit the very latest watches in a window display contest to be judged by over 50 of the most prestigious watch retailers. Inside the pavilion will be additional floor cases with even more watches, clocks, watch straps, winding boxes and a demonstration of watch testing equipment. As an added feature, there will be 15 "By Appointment Only" private offices.



The World's Finest Timepieces

The Concours d'Elegance will be sponsored and promoted by the American Watch Guild, *American Time and Watch & Clock Review*. A portion of each exhibitor's fee will be donated directly to Memorial Sloan-Kettering Cancer Center.

This is your invitation to be a part of what promises to be the largest and most exciting Concours d'Elegance of the world's finest watches, clocks and winding boxes.

For additional information, contact Bert Kalisher at 516-295-2516.





Jack Kurdzionak

From the Workshop

You Are Invited

Do you have a solution to a watch or clock repair problem that you want to share with our membership? Do you have a question about a repair problem you would like to ask? I invite you to participate in this column with your suggestions, questions, and comments. It'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.

Battery Without Assault

"Anything worth doing is worth doing well." I don't know who said it first, but as a teenager I heard it plenty of times from my first employer. His name was Myer Itzkowitz and he owned a neighborhood automobile service station in my hometown. You might remember those stations. They were the ones where the attendant came out to the customer's car, pumped the gasoline, washed the windows, checked the vital fluids under the hood, and checked the air in the tires, including the spare. All this was done cheerfully and the bill for gasoline and needed oil was usually \$5 or less. From time to time I might have grumbled to Myer about the routine nature of waiting on customers when there were many other important things to be done in the service department. He was very patient with me and with his other employees as he explained that not every job was glamorous, but every job was important, especially to the customer.

Myer has long passed on, but his wisdom remains and is just as important to the watchmaker today as it was to the service station

attendant forty years ago. Today's watchmaker has many tasks to perform, which to him might seem to be routine and uninteresting, but are very important to his customer and his customer's watch. Watch battery replacement is one of them. No matter how mundane watch battery replacement may seem, it is so basic and so important to the functioning of a watch, that it cannot be overlooked. In fact, it often requires the care and knowledge only possessed by an experienced watchmaker.

The manufacturers of quality watches recognize the importance of proper techniques for replacing batteries. Their owners' manuals advise the customer to bring the watch to an authorized service center to have the battery changed, inspect the gaskets, and test the watchcase for water resistance. This advice does not imply having a sales clerk with minimal skills, standing at a counter, using the lowest quality equipment that can be found, changing the battery. Therefore, watchmakers who possess the necessary skills and equipment to properly replace batteries should take the manufacturers' recommendations seriously.

The results of poor quality work during battery replacement are obvious to the watchmaker and the owner of the watch. Gouges and scratches on the case back tell their own story of how the watch was not properly opened. Although many cases can be safely opened with only a case blade, others require specialized equipment and skill to avoid damage to the case. One owner of a Movado once asked me if a case back had to be scratched when it was opened. A clerk at another store told her that the design of the watch caused them all to be scratched each time they are opened. Wisely, she left that shop without having the battery

changed and came to me for a second opinion. There is no reason to scratch a watchcase if proper equipment is used to open the case.

The battery changer's fingerprint across the back of the movement indicates more abuse. Instead of using a clean buff stick to push the battery into place, it was shoved in with an unclean finger covered with who knows what. No watch battery can deliver its power to the watch through a film left from a fingerprint. Neither can it be delivered via a scraped connection to a circuit board. Battery connectors are gold plated to assure a good power flow from the battery. Instead of gently wiping the connector with Rodico or clean pegwood, some try to improve this connection by scraping away the plating allowing the base metal to corrode, thus preventing any current flow at all.

Battery replacements for quality watches deserve more than just the basics of good case opening and closing along with the proper installation of the battery itself. Their movements should be tested with a meter for current consumption and low voltage running. Current consumption that is too high will cause premature battery failure. Movements not running on a low voltage test may fail shortly after a battery is installed. These watches need more than batteries. They are candidates for complete service by a competent watchmaker.

A clean watchcase looks good and eliminates a source of foreign material that can get into a movement when the case is closed, possibly causing future problems. Clean the watchcase when changing the battery and replace the gaskets at the time the battery is replaced. Don't overlook the crystal gasket. Follow the manufacturer's recommendation and replace it with a genuine one.

Test all water resistant cases to make sure they are as water resistant as they were when new. Then you can deliver a watch to its owner with the confidence that the battery has been properly replaced. The owner can then expect another period of reliable service from that watch because it was not assaulted when your shop properly installed the battery using the right equipment.

A Few Tools for Battery Changing

Bergeon of Switzerland is selling a new tool (ref. 5700-BP) to open snap back watchcases as shown in the accompanying photos. It is mounted on a hardwood base that can be elevated to three different angles to accommodate your bench top. It has three nylon supports to hold the watchcase in place and three blades of differing angles mounted on a rotary turret to enter the joint between bezel and case back. To open the case the watch is mounted on a nylon support and held in place by a spring-loaded clamp.

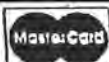
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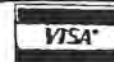
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A lead screw provides lateral movement of the case to position the case joint just below one of the three blades on the rotary turret. The hand wheel on the top is turned until the blade penetrates the case joint forcing the back off with an audible snap. No scratches are made in the case and there is no slipping case blade to gouge internal parts of the movement. They also supply a very old-fashioned tool called a leather buff stick (ref. 1282-A) to assist with gently pushing a battery into position in a watch movement as shown in the photo. ETA of Switzerland recommends this method of using the buff stick instead of a fingertip.

Thanks to Joel in the tool department of Cas-Ker Company. Even though they no longer stock the leather buff sticks, he will special order them and the case opening tool for anyone requesting them.

Jack Kurdzionak



Bergeon tool Ref. 5700-BP for opening watchcases



opening the watchcase
with the Bergeon tool
Ref. 5700-BP



pushing a cell into position
using a Bergeon leather
buff stick Ref. # 1282-A

Questions & Answers

(Continued from page 4.)

photographs, you can see that the piercing (sawing) has not been filed smooth as one would expect.

4. The rather whimsical renaissance figure does not fit with the generic 19th century coastal town scene engraved on the case. This kind of scenery, by the way, was common on Swiss watch cases made for import in the mid to late 19th century.

5. It was common for English makers to note patents and improvements that they made to the watch on their dials

and/or inside case covers (cuvettes). Unfortunately, the "Improved Skeleton Lever" noted on the dial and case tells us nothing. The watch has a lever escapement and the watch bridges have been skeletonized, but neither is an improvement to brag about.

From the movement and the case, I would place your watch as of Swiss make around 1850, destined for the American market, and relying heavily on the reputation of Robert Roskell and its wistful, somewhat romantic scenes to sell the watch to an unsuspecting client.

David A. Christianson,
Technical Editor



The Art of American Horology

Antiquorum is pleased to announce its first U.S. thematic sale, focused on an American theme, *The Art of American Horology*. The Auction will be held in New York City on November 28, 2001 and will be the first ever auction concentrating on the fascinating world of American made pocket watches, wristwatches and clocks.

The thematic auction, a sale devoted to a single subject, was first developed by Antiquorum in order to offer collectors an exceptional occasion to complete their collections and, by means of a specialized catalogue, acquire invaluable reference material on a variety of subjects. The first thematic auction was held in 1989, "The Art of Patek Philippe". Since then these types of sales, which canvass entire segments of the history of horology, in addition to individual makers, have become an Antiquorum tradition.

Continued on page 2.



*Bartens & Rice, New York:
Made expressly for Robert
Graves, circa 1885. Very fine
18K gold, keyless, minute-
repeating watch with split
second chronograph and
special dial.*



*E. Howard Watch Co., Boston,
USA: No. 1066946, circa 1910.
Very fine and rare 14 and 24K
gold hunting cased, keyless, made
for special order, accompanied by
a nugget link chain.*

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The Art of American Horology

Antiquorum's team of experts is currently working together to assemble a unique and highly specialized auction of timepieces and clocks, representative of the American marketplace.

We will produce a fully illustrated auction catalogue for this sale, complete with technical information, biographies of the various makers and information, when available, from the archives. Our goal is to put together a museum collection, tracing the history of American watch and clock production from its beginning, thereby creating a true reference book for American horology.

We would like to invite you to join us to take part in this innovative auction, and contact us to discuss pocket watches, wristwatches or clocks for consignment.

Recent World Record Prices!
New York, April 25, 2001

—(lot154): Breguet, No. 4288. Very fine, important, 18K gold, slim, early keyless half quarter repeating calendar watch, constructed on the principle of the "garde-temps", realized an outstanding price when it sold for US\$ 277,500 (SFr. 471'750) to the Breguet Museum. This very important result, more than three times the estimate, was fetched for the earliest keyless watch ever made and still in existence.



—(lot153): An extremely important and rare, gold, quarter-repeating, self-winding Breguet watch, constructed on the principle of the "garde-temps", with phases and ages of the moon and power reserve indication, was sold for US\$ 662,500 (SFr. 1'126'250) to the Breguet Museum, achieving a world record price for one of the earliest Breguet self-winding watches ever made and the highest price ever paid for a Breguet pocket watch at auction.

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2001 Auction Calendar

Auction in

New York: September 19

Collector's Pocket Watches,
Wristwatches & Clocks

Auction in

Geneva: October 13-14

Important Watches, Collector's
Wristwatches & Clocks

Auction in

Geneva: November 11

Prestigious Thematic Sale (Watches)

Auction in

New York: November 28-29

Collector's Pocket Watches,
Wristwatches & Clocks (Nov. 28)

The Art of American Horology
(Thematic Sale - Nov. 28)

For the Love of Diamonds
(Thematic Sale - Nov. 29)

*Breguet, No. 46, sold to
Count Ferson for 3,390 francs
on June 16, 1837.*

*Very fine and rare gilded brass
halfquarter repeating carriage
clock with alarm, calendar,
subsidiary seconds, and
special provenance. Estimate:
US \$100,000-\$120,000.*

*To be auctioned
September 19, New York.*



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Restoration of a Patti VP Clock Movement

By William Gilbert

Edited & Illustrated by David A. Christianson, CMW, CMEW, Technical Editor

Editor's note: Although Mr. Gilbert's article relates specifically to the first model of the Patti VP movement, the information and techniques he used will be of interest to all clockmakers.

The Patti VP movement was in itself an interesting movement, designed with double mainsprings in boxes to give an 8-day power supply in a smaller package; a club tooth escape wheel driving a pendulum, more reminiscent of a watch lever escapement, unusual in most clocks but not to the Welch, Spring and Company and its successor, the E.N. Welch Company; and it used a clevis suspension system as found in most cuckoo clocks. The two companies made three generations of the Patti movement.

For more historical and developmental information, you are referred to The Welch, Spring and Company, Supplement #12 to the Bulletin of the National Association of Watch and Clock Collectors, Columbia, PA, February 1978, pp.51-95. Available on loan from the AWI Library.



Figure 1

"My husband, William Gilbert, passed away in October, 1998. In going through his files, I found this draft article. I know he worked long and hard on it and I thought it would be such a waste if it were not put to good use." - Mary C. Gilbert

The following article deals with the trials and tribulations of restoring a Patti VP movement. The clock case also received considerable attention, but this article concerns only the movement. Although the movement had no markings, it was made between 1879 and 1884. The following characteristics clearly prove its vintage: i.e., a club toothed escape wheel, a double spring carried in a floating box on both the time and strike trains, special click springs attached to the front plate, the clevis pendulum suspension, the "X" cross band on both front and rear plates, and straight faced repose-style pallets (Figures 2A & 2B).

Initial Examination

Further examination revealed the following: lantern style pinions instead of solid steel cut pinions. Both time train and strike train mainsprings measured 5/16" side, 0.013" thick and 72"

long. Straight faced, bent steel strip pallets called repose-style, are slightly offset on the pallet arbor with the longest portion towards the bottom of the movement. The pallets span 5 teeth and are spanned by 6 teeth (Figure 3). The length of the pendulum from clevis pin post to the rating screw tip is 11½". The overall swing of the pendulum at the tip of the rating screw is approximately 2", or about 5° either side of the center.

When I first examined the clock, I was at once surprised to see loose brass filings clinging to the insides of the plates. It didn't take long to see that those filings were once the hook portions of the club toothed escape wheel. The escape wheel teeth were now sharp pointed stubs of a once proud club toothed wheel. Evidently a previous repairman did not understand the objective of the club teeth or he attempted to change the club toothed action into a dead beat or a recoil

escapement. When that failed, he attempted changes in the repose pallets by bending them into curved faces. In any event the attempt proved futile as the movement stubbornly resisted the changes and refused to run.

Basic Repairs

After dismantling the movement, removing rust from arbors and steel parts, cleaning all the parts and carefully checking for bent wheel teeth, arbors and pivots, I set about the restoration. First I had to replace the trundles in three lantern pinions because of considerable wear. Several pivots were bent but luckily the pivots were not worn beyond repair and they were straightened. I use a method of straightening bent pivots which I have found fairly safe and allows the pivot itself to remain straight. Using a piece of drill rod approximately 2½" long and 1/8" in diameter, I drill a hole in one end to fit

snugly over the pivot. I then chamfer this end by filing or cutting so the end face of the drill rod will not butt against the pivot shoulder. The length of the rod is also an assist in ascertaining how much the pivot is to be bent. This operation requires a certain amount of expertise and the straightening is accomplished by "feel." By carefully bending the pivot you are moving the pivot at its root, not along its length. If the pivot is badly bent you must anneal the arbor tip and pivot before bending to avoid breaking off the pivot. All of the arbor pivots were then refinished and highly polished. There are several ways to tackle the job of refinishing pivots but suffice in this article to note that I use a homemade Jacot attachment on my Cowells lathe.

The next items for attention were the bushings. My KWM bushing tool was pressed into service to replace several bushings that were worn

beyond recommended tolerances. All bushings were then pegged out clean. I used rounding broaches to further clean, polish and burnish the insides of the bushings, working from both sides of the plates.

I pay particular attention to the great wheel arbor bushings. In this case the bushings were badly worn and had to be replaced. I find that about forty percent of all movements in for repair require replacement of these larger bushings. Perhaps the great wheel arbor bushings, being in the lower echelon of the train, are not the culprits usually responsible for stoppage (due to wear). This does not mean that they are not important in the total functioning of the movement. When the power of the tightly wound springs are exerted against these surfaces, there is considerable friction. If the arbor holes are ovate, or scored, much power is lost that would otherwise go into the trains to

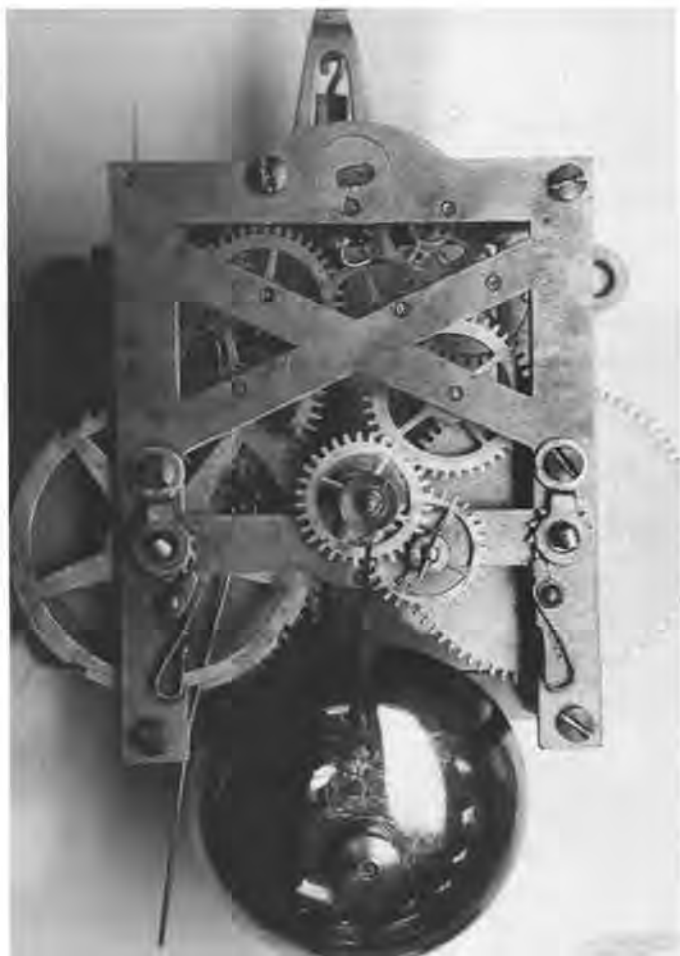


Figure 2A

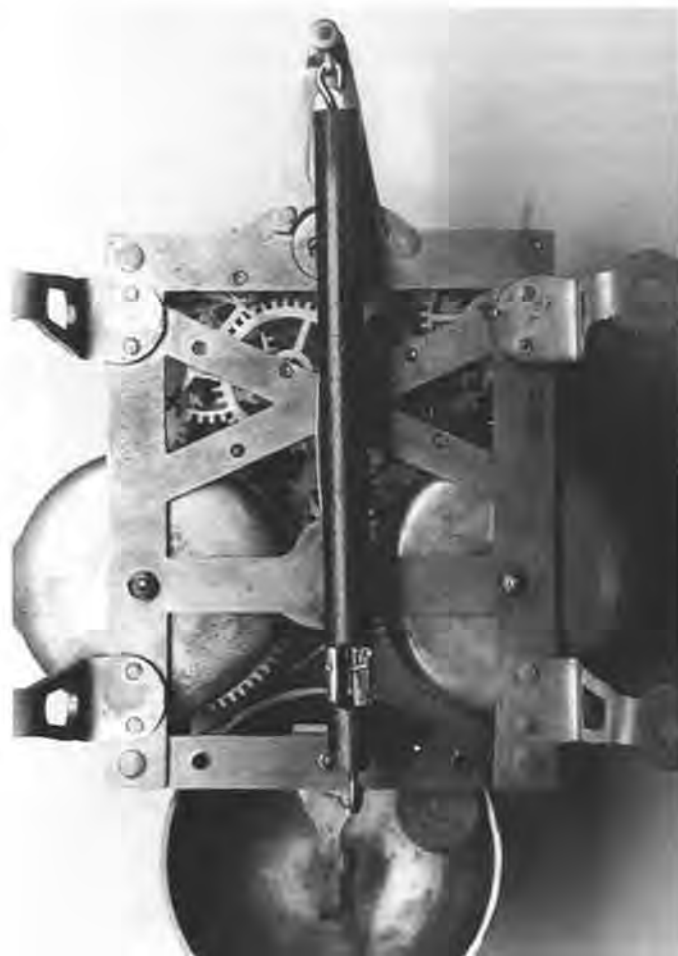


Figure 2B

keep the movement running for its full intended time. I think these bushings are often either overlooked or purposely bypassed due to the time consuming task of replacement. Very seldom is it possible to use commercially available bushings in these holes and they must be hand made. In preparing the holes for these bushings, I find it advisable to use a large broach. I have found it is extremely difficult to use a twist drill to increase the size of the plate holes to receive the bushings. Almost without exception the drill will run off to some extent and create a misalignment between front and rear plates and a depthing problem with the adjacent wheel.

In manufacturing the new bushings, particular attention must be exercised so that the bearing surfaces are truly concentric with the outside diameter of the bushings. If this is not carefully done, the great wheel arbors will almost certainly bind to some extent. To relieve the binding, you will have to broach the holes oversize, negating all your efforts to free the friction component and you will end up with a sloppy fitting hole, perhaps worse than that with which you started.

The Club Toothed Escape Wheel

At this point in my experience in restoring clocks, I had never had to make a club toothed escape wheel (Figure 4). I searched through all my literature, which is fairly extensive, but much to my anguish, there was a paucity of information. There was absolutely no information as to the angles of the teeth and especially the most important part of the tooth, the tip angle. It is this portion of the tooth that is responsible for the pallet lifting action and of course the swing of the pendulum. Without definitive information about the tooth tip angle, cutting a new wheel would be an exercise in futility to say the least and a time consuming trial and error experience. Luckily, within the AWI, there is a group of professional horologists who are willing and able to assist those of us who have never pried into the dark unknown of certain technical aspects. My appeal for assistance led me to Mr. Archie B. Perkins of Denver, Colorado, who helped me out of the shadows of ignorance and into the sunshine of knowledge regarding this unique problem.

This particular escape wheel measured 23.90 mm in diameter and carried 32 teeth on its circumference.

The thickness of the wheel was 0.80 mm and the center hole to match the arbor hub was 5.45 mm.

My first objective was to fashion fly cutters that would produce the proper width as well as the shape of the teeth required. Luckily there was just enough of the unaltered teeth remaining in the butchered wheel to guide me in the shaping of the new teeth. Without going into the mechanics of forming the cutters, I was able to grind and hand file suitable cutters. In this case I made three separate cutters: one to shape and undercut the radial or leading tooth edge, one to shape the tooth tip angle, and one to shape the curved backside of the tooth.

Using my lathe, I drilled the wheel blanks and then bored the center hole to match the diameter of one of the wheel holding shafts supplied with my Chronos wheel cutting engine. The shaft diameter chosen was slightly smaller than the wheel arbor hub. The blank was then placed on the shaft and locked in position. The shaft is drilled dead center on each end so it can be placed in the lathe and the outside diameter of the wheel blank can be turned in situ, between centers to exact dimension. Using this method the outside diameter and the center hole are truly concentric.

The Wheel Cutting Operation

Prior to drilling and boring the center hole of the wheel blank, I scored

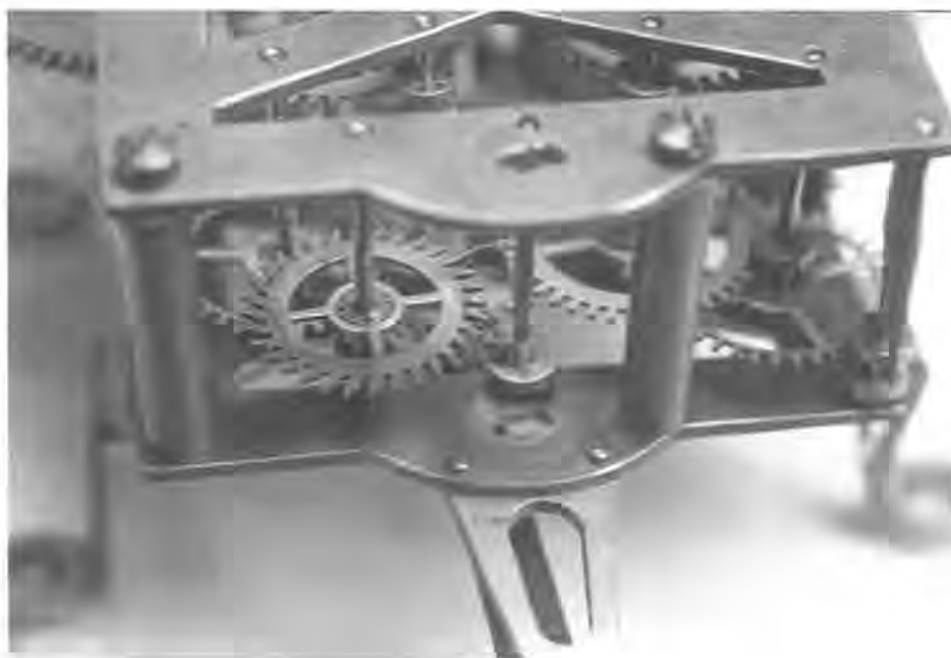


Figure 3



Figure 4

the blank into quarters so that I had 4 equidistant points along the circumference. These 4 points give you a certain amount of latitude in the original setting up of the fly cutters so you don't have to rotate the blank any more than 90° to find your starting point. You may find it advantageous at this time to mark off a 12° offset at one or more of these points to assure the proper amount of tooth undercut (Figure 5).

As in all wheel cutting operations, I use an identical back-up blank to minimize the brass curl that occurs on the underside of the blank. By using a back-up blank the cutting may require a slightly slower cutting feed, but it is worth the extra time as it minimizes tooth distortion as well as the clean-up operation after removal from the cutting engine. This is especially true when cutting small escape wheels as they are usually quite thin, to keep them as light as possible. Another plus in cutting two wheels together is you end up with two wheels, one of which you can possibly

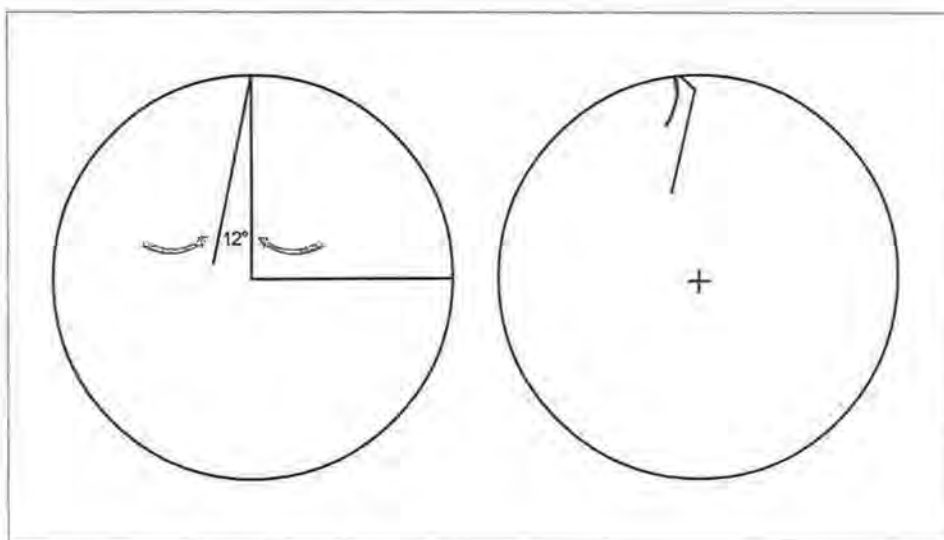


Figure 5

use at a later date or at least have a spare in case you have a catastrophe in finishing the first one.

I began the cutting operation by aligning the radial cutter (the cutter that removes the material between each tooth) so that it would undercut each

tooth at a 12° angle. This exercise is mathematical and depends in part on your expertise as well as the division plates you have in your inventory. In this instance, the cutter was moved off-center 2 mm. The ten to twelve degree undercut in the tooth's leading edge is

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important. If the undercut was, say, six or eight degrees, the leading edge of the tooth tip may not be the only part of the tooth to contact the pallet and this would cause far more friction than is desirable (Figure 7). In other works if the full radial edge of the tooth contacts the pallet face there is indeed too much contact between the tooth and the pallet creating undue friction and in extreme cases the leading edge of the tooth could cause severe recoil action and actually cause the movement to stop.

If the undercut were, say, sixteen to eighteen degrees, the leading edge of the tooth tip would most certainly be the only part of the tooth to contact the pallet, but the back side of the tooth now becomes the vulnerable part of the action where the pallet would

most certainly dig in or scrape, causing the same problem of increased friction. If the back side were cut with a deeper curve to avoid this pitfall, the tooth would be so thin it may not withstand the pressure exerted against it by the pallet faces and would probably bend.

The next step in the cutting operation was the cutting of the tooth tip angle. The angle can be measured in two ways. One way is to cut the tip using the radial undercut edge as a base and measure the angle from front to rear. This angle should measure 100° or 105° (Figure 6). Another way to measure this angle is to measure the angle using the rear top point of the tooth and a line passing through the center of the wheel. Measuring in this way the angle would be 30° or 35° with the apex

of the angle at the rear of the tooth. This second method requires that you must have the width of the tooth scribed on the blank. The cutting of the tip angle was accomplished by off-setting the cutter to match the angle scribed on the wheel blank. In cutting the tooth tip you must keep in mind that the rear of the tooth tip will be at the exact circumference of the wheel. This is important because when you cut the curved back-side of the tooth, the tooth tip thickness, toe to heel, must be 0.80 mm. If you were to err in this operation the tooth tip may not be the correct thickness and end up too thick. If the tooth tip is too thick, say 85 mm or more, the pallet may not fully clear the tooth and dig into the rear of the tooth even with a correct curved back side.

Assuming the tooth tip angle is cut and the angle is within tolerances, we now proceed to the cutting of the back side curve. When you made your fly cutter, this curve was already predicted and the result of that prediction was pretty well set. There is still a slight leeway in the cutting of this curve. The cutter can be off-set slightly and the wheel can be turned about its center slightly to arrive at the proper indentation of the cut. The important part of this cut is that the curve begins at the top (heel) of the tooth at the exact point of the scribed line so that the tooth tip measures exactly 0.80 mm. The lower part of the curve must not reach the tooth root. This is important to give the tooth as much strength as possible. When I cut the wheel, I erred slightly in this cut and the tooth tip was slightly more than 0.80 mm. By keeping the cutter in its position, I rotated the wheel ever so slightly and re-cut the back side curve taking a sliver cut to make the tooth tip exactly 0.80 mm thick.

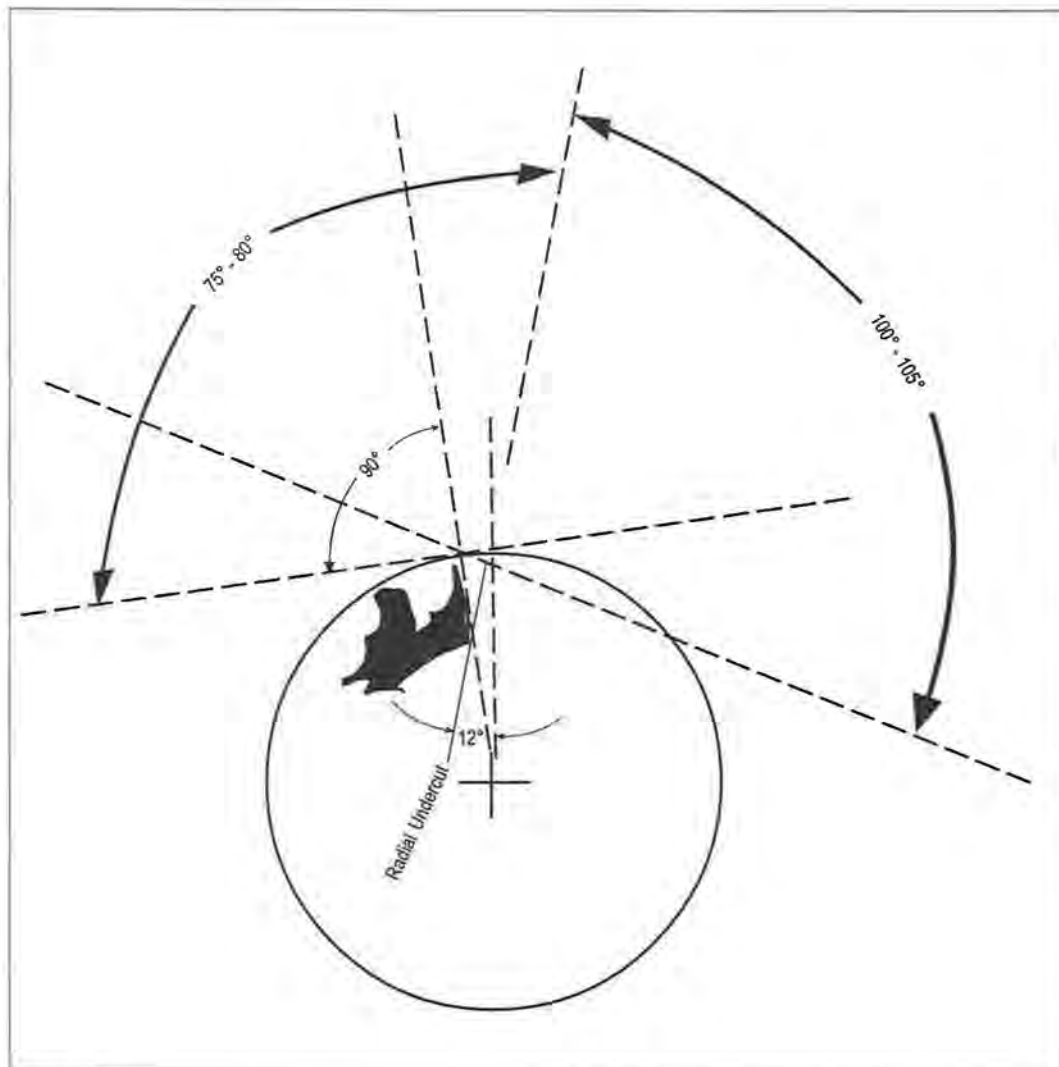


Figure 6

Now that the wheel is cut and you are proud of the task you have performed, all that is left is to put the wheel on its arbor hub and the job is complete. Not so fast. First the wheel must be cleaned of any brass curl and swarf, the material between the spokes must be removed (crossed out with a piercing saw), then polished. How is this done? Very carefully. Because the wheel arbor was tapered towards both pivots from the arbor hub, and the arbor hub was so small, I decided against reducing the arbor hub further to fit the hole in the wheel. Instead, I took only a sliver cut to make sure the hub was concentric with the pivots. I then attached a piece of soft wood to the lathe face plate and bored an indentation into the trued wood piece slightly smaller than the outside diameter of the wheel. After pressing the wheel into the soft wood (being very careful not to distort the teeth), I bored the wheel center hole to match the arbor hub. I was then able to hand press the wheel on the hub and rivet it in place.

Adjusting the Pallets

Hopefully when you encounter this situation the pallet faces, both locking and acting, will not have been toyed with and they are both straight or in their original repose configuration. As stated earlier, in this case the pallet faces were bent in an attempt to make the movement operate. The strip pallets must be flat and adjusted as nearly as possible so the locking portion of the pallets contact the escape wheel at the tip edge (Figure 8). Due to the position of the strip pallet on its arbor, the entrance pallet may have a slightly higher lift angle than the exit pallet. This phenomenon is acceptable and perhaps desirable. It will be noted that the tips of the pallets do not come to a knife edge, but rather have a slight witness edge at a 90° angle to the locking face. This allows a smoother glide on the escape wheel tooth tip without undue wear on the tooth. It is highly important then, that

the tooth tip is as highly polished as possible. I burnished the tooth tips with a flat burnisher to produce the mirror finish that is quite necessary to reduce friction to an absolute minimum.

As stated earlier, this is the point in truth with regards to the tooth thickness. In this case the 32-tooth wheel required that the tooth tips be exactly 0.80 mm. The problem of having the tips oversize is that the pallets will not clear the tooth tip heel. If you move the

centers farther apart, so that the pallets clear the heels, you cannot get an even drop on each pallet locking face. The result could be an exercise in bending the pallets a little on entry, a little on exit to a point that the angle of the pallet-to-tooth tip is wrong. Wrong in that the exit pallet no longer rests on the corner of the tooth tip but rests on the radial portion of the tooth. Naturally this will set up additional friction and will probably stop the movement.

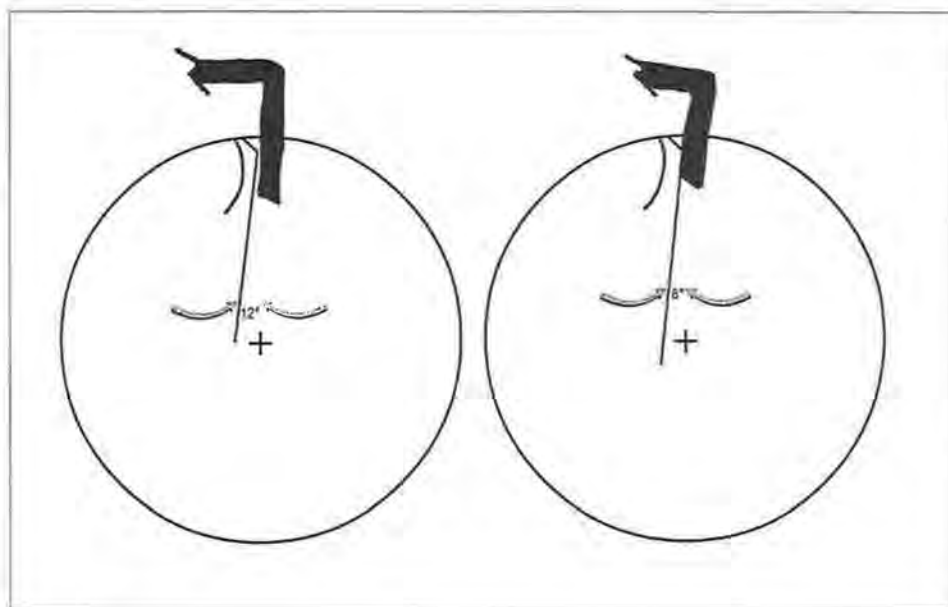


Figure 7



Figure 8

The Clevis Suspension

With the clevis suspension, you must pay strict attention to every point of friction. Unlike the kitchen variety type of movement, there is no suspension spring to assist in giving the pendulum an assist in its action to overcome slight irregularities (although it is generally agreed that the suspension spring adds only slight assistance to the vibration of the pendulum). This method of suspension is just another way of securing the pendulum and supplying a pivot point.

The clevis pin becomes the pendulum weight bearing surface and therefore must be as true and as highly polished as is possible. There cannot be any bends, twists or plier marks. The pin must be perpendicular to the movement so that the pendulum hangs as straight as possible.

The "U" shaped piece that hangs on the clevis pin is unique in that it does not have a small hole to fit closely over the clevis pin but has a large hole with a flat upper portion that contacts the clevis pin (Figure 2B). The flat upper portion most certainly has some wear and must be made flat and square again. The finish of this "flat" on each of the holes must be as highly polished as the clevis pin itself. If this suspension system is not given particular attention to render it as friction free as possible, an otherwise correctly adjusted and restored movement may fail to run.

The crutch wire reaches through a slot in the short wooden pendulum extension and is another friction point that could be improved. I found in this instance the slot had worn badly and the crutch wire was very sloppy in its fit and action. I slotted a thin piece of brass to fit the crutch wire, burnished the sides of the slot and fitted it over the existing slot and screwed it to the pendulum extension. This may upset some purists, but it gives the pendulum wire a smooth action in the slot and helps in reducing another point of friction (Figure 2B).



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Saturday Afternoon, July 28th

Basic Atmos Clock Repair

Jack Kurdzionak will give us a slide presentation of the basic repair methods he uses to repair Atmos clocks in his shop.

Those Fascinating Timelocks:

What They Are, Where They Come From and How To Service Them

C. David Pierce will tell us about those old timelocks used in bank vaults and safes in the past century, many of which were made by watch companies.

Vendors

Vendors will be on hand throughout the morning and early afternoon for you to visit their tables and look over their wares. We are grateful to the Wm. S. McCaw Company and Gaber & Company for being with us this year.

Saturday Evening, July 28th

Banquet

Door Prizes

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Information and Registration

Contact Mark A. Baker, P.O. Box 292, Damascus, OH 44619

Phone (330) 537-3939 or E-mail bakerclock@voyager.net

Book Review

The History And Development of the Quartz Watch, by Benjamin Matz. First Edition, published 2001, ISBN 0-9653053-0-9, Chronos Magazine, 2403 Champa St., Denver, CO 80205. Tel: 303-296-1600, Fax: 303-295-2159. \$14.95.

This 6" x 9", 57-page, soft cover book offers the reader a fascinating study of the history and development of the quartz watch. Master Watchmaker Ben Matz shares his story with us about the difficult and winding path he had to follow to trace 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.



Chapter 1—In Search of Origins

You feel as if you are sitting across the table from Mr. Matz as he relates the little known facts he discovered during his search for information about the invention of the light-emitting diode (LED), quartz clocks, and miniature batteries.

Chapter 2—Early Timepieces

This chapter presents a brief review of the 3,000-year history of timekeepers in general by tracing the history of timekeeping from ancient shadow clocks to the first mechanical clocks and portable timepieces.

Chapter 3—The Quartz Revolution

The differences and similarities between mechanical and electric timekeepers as they evolved from mechanical, to electric, to electronic, to solid state are discussed in this chapter.

Chapter 4—Battery Power

Chapter 4 narrates the development of the battery from early experiments by Luigi Galvani in 1791 to the invention of the first miniaturized cell by Samuel Rubin in the early 1940s and onward to 1957 when the first cell was used in the Hamilton electric watch.

Chapter 5—Motors & Movements

The pioneering work in electricity that led to the invention and development of the world's first electric watch by the Hamilton Watch Company, and the electronic tuning fork watch by the Bulova Watch Company, is traced in this chapter.

Chapter 6—The Quartz Watch

The revolutionary principles and components that make the quartz watch possible are clearly explained in this chapter. The piezo-electrical effect, the quartz oscillator, integrated circuits, and the inventors behind them are discussed in detail.

Chapter 7—Quartz Analog to Solid State

Fascinating information is presented in this chapter about the development of early (1960s) stepping motor quartz watches that displayed the time by conventional means, leading up to the introduction in the 1970s of the solid state light-emitting diode (LED) digital display and the liquid crystal display (LCD) and beyond.

Chapter 8—New Energy Sources

Improved batteries and alternate energy sources such as solar, heat, water, motion and capacitors are discussed in this chapter.

Chapter 9—Fantastic Features

This last chapter is an overview of quartz timepieces that not only tell time, but also provide a myriad of useful features. Watches that glow in the dark, that calculate, that measure altitude, depth, barometric and blood pressure, and provide data links to computers and other devices are some of the amazing watches detailed in this chapter.

References

The many books, encyclopedias, patents, periodicals, technical bulletins, and newsletters listed in the reference section of this book are an indication of the vast amount of research that went into its writing.

This book provides a wealth of information in a small package—anyone who repairs, sells, or collects quartz watches should have a copy. It is highly recommended.

Reviewed by Robert D. Porter, CMW





Mark Butterworth

The Modern German Clock Movement

Part 15

Falling Weights

Sometimes articles simply come by inspiration, and this one has been inspired by the many questions on the subject since last writing. To summarize them, the question is "Why don't the weights fall evenly in my grandfather clock?" or "Why don't they fall at the same rate as the old movement?" One's sense of proportion tells us that at the end of the week, when all the weights started at the top of the case, they should all end up even at the bottom. For that matter, it seems reasonable that they should also descend evenly and be at the same height in the middle of the week also.

In some cases, when the weights are uneven or descending at a different rate, the movement is indeed malfunctioning. But there are many situations in which this is perfectly normal for the movement.

I think it makes sense to first describe those situations in which a new replacement movement may act differently than the old one or even the existing movement to seem to act differently:

1. If the customer decides to shut the chimes off at night (usually for guests), the chime and strike weight do not descend because the chime train is locked. This is also true if the auto night shut-off is used. Most of the new clocks have this auto night off feature and if the chime and strike are not operating for 8 hours, that is one-third of the time and the weight will fall one-third less. The exception: in the Kieninger H, K, and R series if the chimes are manually shut off the chime drum is moved to a position where it turns but does not lift any pins. As a result, the strike does work and the weights still fall evenly. If the strike is also shut off in the Kieninger, a lever pulls back the strike hammers so they do not engage the rods and the striking continues but the hammers do not strike the rods. If the auto night

off feature in the Kieninger is activated, however, that weight does not descend evenly but by a third less as in the other German movements.

2. If one is trying to be precise, the strike weight will not fall evenly with the chime and time weights if the measurements are not taken at the same time of day over a period of several days or a week. This is true to a lesser extent with the chime weight. We know that the time weight falls evenly and continuously. This is not true with the other two weights. As an example, if one winds the clock at 1 o'clock p.m. on Monday and decides to check the weights at 7 a.m. on Saturday, the strike weight will not have fallen as far as the other two. The reason is that the strike is a building cycle over a period of twelve hours. At 1 o'clock the weight falls far enough to strike only once while at 12 o'clock it must fall far enough to strike 12 times. From 8 o'clock to 12 o'clock the strike must occur 50 times ($8+9+10+11+12$) during those 4 hours. From 1 o'clock to 7 o'clock, the strike occurs only 28 times even though it is $7/12$ ths of the total time. We received a call this week about a very particular person who stated that the rate of fall differed by $1/4$! In fact, it is possible for the difference to be more than that. To a lesser extent this is also true with the chime weight although its cycle is much shorter—one hour. The first quarter needs enough drop to play only 4 notes on the Westminster, while it needs 16 notes on the hour. Of course, all this assumes that one wound the weights to the same weight to begin with as exactly as possible, which is not always the case. Keep in mind also that it is not possible to wind the weights exactly together by more than one-half click of the winding wheel. In addition, if the unit has stopworks, chances are that the weights will not wind exactly to the same height due to the stopping position. Alas, life is not perfect.

3. Sometimes internal changes are made in the movements which cause a difference in fall of the weights occurring between the new and the old unit. The new Hermle cable wound BS and BSK series will have a drop which is greater because the internal gearing was changed to deliver greater force or torque to the gear train. In order to accomplish this, a greater amount of fall per day of the weights will take place. This is rarely a problem, but occasionally a short clock case may develop a problem in which the weights hit the floor before a complete 7 days. The solution is to wind the clock twice a week—we suggest Wednesday and Sunday. Kieninger made a limited number of two-week movements in the K series during the period of 1978-1979 which were most common in the cable drive triple chime ones. Unfortunately these were not marked other than the numbers “78” or “79”, but the chime weight is VERY heavy—about 16 pounds. As a result, the weights will drop twice as fast with a new movement than the old but the case is sufficient for a complete one week run.

Of course it is also true that the weights will not fall evenly if either the chime or strike is not functioning properly. What are the possibilities?

1. The chime and strike weights fall together, but a lesser distance than the time weight. This is due to the chime not working on each quarter. Since the strike is activated by the chime, when the chime is not functioning, neither will the strike. This problem can be either intermittent or systematic. If systematic, the most likely culprit is the 4th quarter in which the chime correction does not allow a complete unlocking of the chime train. The exception: the Urgos uw03 series will allow the strike to release each hour whether the chime works or not.

2. The chime and strike weights fall together, but a greater distance than the time weight. This occurs when the chime fails to stop at one or more of the quarters, sometimes intermittently.

3. The strike weight falls a greater distance than the chime weight. It can be normal as discussed for the Kieninger unit, but most likely it is the result of the strike not always locking when it should and producing an extra strike. It can also occur if the rack hook falls behind the snail. This results usually in a strike of 12 o'clock. It is not common, but it is possible that faulty rack teeth or a bent gathering pallet pin is also the problem. A worn bushing for the gathering pallet is a common cause as it changes the distance between the gathering pallet pin and the rack teeth.

4. The strike weight falls a lesser distance than the chime weight. This is a result of the strike either intermittently not working or not doing a full strike when it does. The most common problem is to strike one o'clock at both twelve and one. The solution is to set the strike for twelve when setting up the strike sequence.

I hope that these ideas will help you solve some of your “weighty” problems.

Final thought: *“When you have eliminated the impossible, whatever remains, however improbable, must be the truth.”*—Sir Arthur Conan Doyle in *The Sign of Four*



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

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There were no new requests at press time.

RESPONSES

Ladder Chains

Ron Saboe, West Union, IA, was able to assist Daniel T. Moore, Kansas City, MO, in his search for 144" worth of strong (11 lb.) ladder chains that have 40 links per foot

ITEMS STILL NEEDED

Hamilton Pocket Watch Case

D. A. Bilger, Jr., Mifflinburg, PA, is looking to buy a 14 karat yellow gold or gold-filled case for a Hamilton pocket watch model #921.

Do you have information regarding this month's requests? Do you need information about one of this month's responses?

If so, send your information or requests to:

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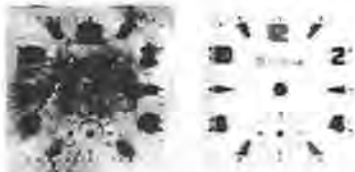
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