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HOROLOGICAL TIMES

CONTENTS

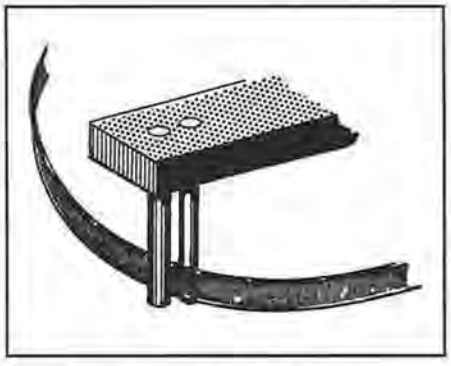
VOLUME 20, NUMBER 5
MAY 1996

CLOCKS & WATCHES

DEPARTMENTS

EDUCATION

SPECIAL INTEREST



Regulator pins should be only long enough to extend slightly below the bottom of the overcoil. Replacing Reulator Pins begins on page 44.

ON THE COVER: Photo by Dale LaDue from Rochester, New York.

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IN MEMORIAL

HENRY B. FRIED

January 8, 1907 - March 11, 1996

Henry B. Fried died in his sleep on March 11, 1996 at his home in Larchmont, New York at the age of 89. Henry Fried leaves his wife Tina, daughter Caryl and her husband Joseph, a brother Max, a sister Ettie Ritterman, four grandchildren, and five great-grandchildren. His son Robert died 22 years ago.

Memorials, if desired, may be made to the Henry B. Fried Memorial Scholarship Fund in care of AWI-ELM Trust.

A family history as told by Henry B. Fried appears on page 18.

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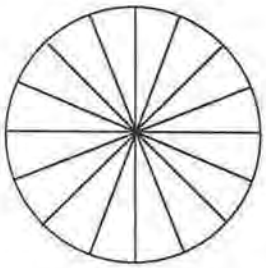

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Questions & Answers

By Henry B. Fried, CMW, CMC, FAWI, FBHI, ★FNAWCC

Question

I am sending along some pictures of a watch that came to me for service. I polished the outside of the case to reveal the actual color of metal. It appears to be silver, as does the inside case. The dial is void of any name and blank. The case back was engraved with the name VACHERON, which we all recognize. Is this a watch correctly identified, and valuable? Your help in this matter is much appreciated.

Ken Lingenfelder,
Santa Maria, California

Answer

I have examined your photos and I am familiar with this type of watch and somewhat familiar with its history. This was an older model of the firm, Constantin, later to be called Vacheron. The watch was probably made by Jacques Barthelemy (Vacheron) of Geneva who was born in 1787, died in 1865, and was active until 1844. The basic movement appears to have been supplied by the Fontainemelon ebauche factory.

The watch appears to be a demi-hunter, silver with cylinder escapement. The view under the dial shows that important parts are missing. While the item is moderately rare, it has no real value unless it is complete. Still then, if you are thinking of an expensive restoration, in my opinion it does not warrant that expense.

Henry B. Fried

Figure 1. Inside case back showing numbers 52042, also movement and badly damaged hairspring.

Figure 2. Backside of case opened showing inside of cover, also outside of inner back case with various engravings: Cylinder, 8 Rubis, Vacheron, Geneve.

Figure 3. Backside of watch case opened showing tip, center, and in oval the letters "HHH."

Figure 4. Inside case showing bezel opened.

Figure 5. Watch now revealed; dial removed. Note missing hour wheel and minute wheel. Note stop works missing on mainspring barrel.

Figure 6. Picture of watch showing outside case.

ASK HUCK

By J.M. Huckabee, CMC, FBHI

Gut Weight Line

Q. I would like to replace the weight line on an antique clock. Where can "gut line," a material similar to the original line, be obtained?

A. The material you described has disappeared from most catalogs. I'm not currently aware of a source.

Let's discuss some substitutes. Most suppliers offer a metallic cable and some form of woven material. Linen cord is also difficult to obtain; at one-time a substitute for gut.

My employment at IBM is filled with memories of metallic cables on their top-of-the-line Mod 35 Master Time Control. If one of those cables ever got slack, you had a memorable mess on your hands! So, I'm not really fond of metallic cables.

I frequently see Nylon Monofilament fishing line used. This material is elastic and as it stretches it weakens, crazes, and is subject to breaking. I don't like the thought of a heavy weight falling and damaging a clock case.

Twisted Nylon fishing line is often used. It is also somewhat elastic, and weights on a single line will spin, unwinding the twist which reduces strength. There is an "ironing effect" of the weight pulleys that moves the twist along the line causing thick and thin areas.

Still another choice is a woven salt-water fishing line made of Dacron. This material is very strong for its size and has less negative qualities than many other materials. Cord sizes for Grandfather clocks have test strength of one hundred pounds or more.

If you cannot find a gut line, some other substitute will be necessary, but beware of potential problems from a twisted material, or one that is elastic. Also be advised that metal cable is not easy to handle.

Winding Keys

Q. How do you determine key size to fit a clock? Is a key gauge recommended?

A. I'm sure a key-size gauge is a convenient item in every shop. However, I've never owned one. Most catalogs have conversion tables of size to metric measurement, or keys listed by size and dimension. I've never really thought money is well spent on some of the specialized gauges that are available. We have wire gauges, key, pivot, mainspring, bushing, crystal, drill, and many other gauges. I personally prefer a good dial caliper and a nice micrometer, which will do most of these measurements quickly. For example, on wire, drills, and pivots a dial caliper is the fastest tool available.

Use care in selection of key socket size. Most any clock, well cared for, will have a hundred-year life expectancy. What a shame it is to find one with the winding arbor torn up for the need of a proper key.

Use special care when selecting a key for winding a barreled mainspring. The wings of the key should never be larger than necessary for the spring size. A larger key augments greater stress on the gear train as the spring reaches full-wind. This is extremely important with small French Carriage clocks with a platform escapement. These little clocks wind so easily, and the gearing is delicate.

Double-end keys are a problem. Often we cannot locate a key with the dual-end sizes correct. In some cases an end may be transferred from another key, but this problem has no apparent solution.

If you have any questions, please write:
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Cynthia Colvin's "battle station" is on the Packaging Assembly Line. Here she maintains a careful and constant vigil to assure that Eveready® watch batteries are properly positioned as they move along the line. Keeping batteries on the right track prevents mispacking and down time and, consequently, assures a better value to customers. Cynthia's shift recently received an award for setting a new production record.

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ROCK QUARRY

By Fred S. Burckhardt

Like most people, I'm always looking for a way to make an easy dollar, easier that is than making a living fixing watches and clocks, Then one day it happened. A television show promised to make me filthy rich without using any of my own money. This was perfect, as I didn't have any of my own money to use.

Of course, in order to find out how this is done, I would have to send in a certified check for which in turn I would receive a book containing ideas which would change my life. There was no time to waste. I immediately rushed to the bank to get the certified check. On the way out of the bank, the president passed by and I said, "Save a lot of space for me in the vault because I'm going to have plenty of money to put in my account!" For some reason I don't think he believed me as he laughed and twirled his finger in a circular motion around his ear.

I waited with bated breath for several weeks. Repair jobs were set aside as I couldn't concentrate on any work. The only thing I could think about was how to spend all the money I was going to make.

The day finally arrived. When the postman brought the book I could hardly wait to tear off the wrapping and start reading. There was no doubt that everything the book said made sense. This was to be the beginning of my new life. No more worrying whether or not all the repairs were ready on time. No more irate customers. No more pinching pennies to make ends meet. No more being "Mr. Nice Guy" to those who rubbed me the wrong way. From now on it would be nothing but wine, women and song!

There was only one small obstacle in the way. This was the part about using other people's money. According to the book, getting other people's money to use was no problem. Bankers were always happy to lend money on such a deal. Friends and relatives would gladly supply all the money you needed. It sounded good to me so I decided to go see the friendly loan officer at the bank, Harvey Frattlemeyer. Harvey was born with a smile on his face. They say he was even smiling when his house burned down even though it wasn't supposed to happen until the following week.

After being shown into Harvey's office, I sat down and got all my papers and the speech I copied directly from the book. When Harvey came in, I started to do everything as outlined in the book. After a few minutes Harvey said, "You ordered the book didn't you?" After I acknowledged he was right, I continued with my speech. Harvey cut me off and told me to forget it. He said that he had heard the speech so often, he had it memorized. "Try your relatives and friends," he said while showing me out of the office.

Not being discouraged, I started to call my relatives and both friends. I met with nothing but unkind words like "Drop dead," "You've got to be kidding," or "You're sick," and a few others not worth repeating. This was harder than trying to repivot a French clock wheel. I hate to admit it but my dreams were quickly fading. I got the same feeling you get when you slip across the coil on a quartz watch.

When I returned to work, the boss told me to get busy and forget about the get-rich-quick scheme. There's no need to tell you how I felt. I've felt better going down to the IRS for an audit.

A few days later, a customer came in and started to tell me how hard he works and wishes he could find something that would make him rich. I unloaded the book on him and even made a profit. My mind was made up, no more falling for schemes like that. From now on, watches and clocks would be it.

Everything was going along well until one day I was walking past a book store and there in the front window was a new book called *One Thousand and One Ways to Become Wealthy*. I'm not going to tell you whether or not I bought the book but how does a snowcone dealership in Labrador sound?

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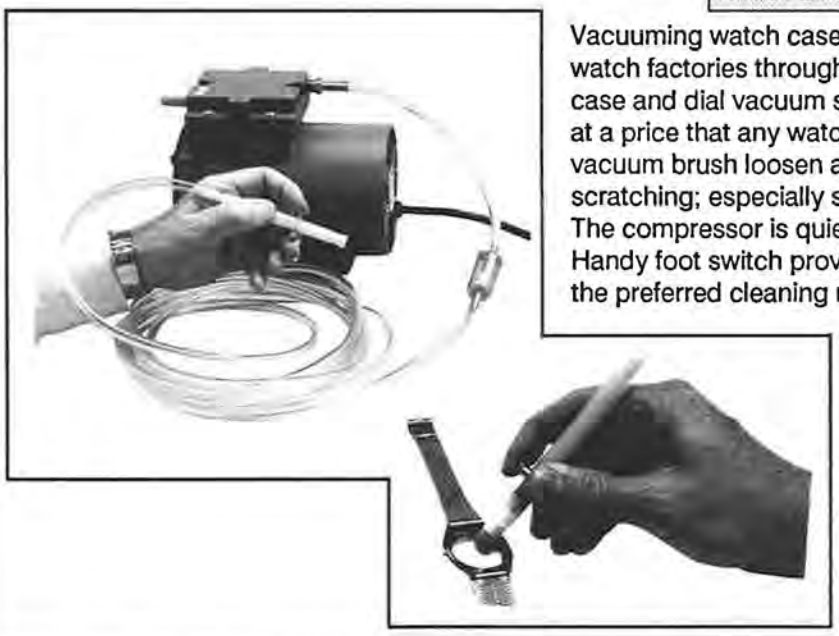

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BOOK REVIEW

By Gerhard M. Hutter*

Ludwig Strasser, Ein Uhrenfachman aus Glashütte, by Hans-Jochen Kummer. Hard cover, 12 x 8 1/2", 196 pages, 188 photos. Published by Callwey, München (Munich), Germany, 1994. German text.

Many books have been written about famous watchmakers. Daniels' *Art of Breguet*, Symonds' *Tompion, His Life and Work*, or *Riefler-Prazionspendeluhren* to name only a few. Callwey has now printed a biography of another well-known German watchmaker in precision timekeeping, Ludwig Strasser. This book gives a better understanding about an excellent watchmaker, inventor, and teacher who was perhaps, not the best businessman.

Hans Kummer, the author, is a board member of "The Friends of Old Timepieces," the German equivalent of the American N.A.W.C.C. Mr. Kummer has lectured extensively, written many articles, and has been a good friend of the American watch and clockmaker groups visiting Germany, by arranging many meetings with Germany's leading horologists and collectors. In this book, Mr. Kummer has done a commendable narration of an important maker and teacher in his country's past horological history.

The subject of this book, Ludwig Strasser, was born December 15, 1853. He ended his formal education at 13. He was then apprenticed to Sebastien Geist, famous watchmaker and a pioneer in electrical horology and clockmaking. One of the people that took notice of young Strasser was the very highly respected Moritz Grossmann who saw the hunger for knowledge in the young apprentice and recognized his ability to absorb the higher mathematics at an early age.

Grossmann, who was known for helping aspiring watchmakers, invited them to his factory for further study. He thus extended that invitation to young Strasser.

Joining Grossmann after completing his apprenticeship in 1871, Strasser learned the higher theory of watchmaking from the famed master. He remained with Grossmann at Glashütte for the next two years and then moved to nearby Leipzig for a very short stay at the tower clock factory of B. Zacheria.

After returning to Glashütte, at the urging of Grossmann, Strasser opened his own mechanical workshop under the name, "Strasser & Rhode" with an old friend and fellow watchmaker, Gustave Rhode. This was a very productive partnership which embraced a very large field of products, ranging from precision pendulum clocks to mechanical measuring instruments. His famous invention of the "Strasser Escapement" won him a gold medal at the Paris World's fair in 1900.

The company prospered and gained worldwide recognition with many more inventions which resulted in the expansion to thirty workmen. The production included chronoscopes which read 1/1000th of a second and were weight-driven short-time measuring instruments, and the tierce counters which are timing devices especially useful to observatories and give the seconds interval not only visually but also audibly. Little is known regarding his taxi meters and timers for cars, although many safe and vault time locks have survived. His devices that time the coincidence-system-clocks were very popular with the railroads. He sold his version of these to many countries. However, his largest production consisted of weight-driven pendulum clocks including wall-hanging to floor-standing models that contained various movement and pendulum types.

Many helped with the development of precision timekeeping in Germany but George von Neumayer, William Foerster, and Carl Marfels stood in the forefront. Because Germany had no ship's chronometer production to speak of, Strasser was approached to aid in the development of these instruments. He established an ebauche workshop and gave many refinishers a new challenge as did Prell, Jensen, Helwig, and Gerstenberger.

The nickel-steel balance by Guillaume was first imported from Switzerland and only years later manufactured in Germany. The company of A. Lange & Sons was closely involved with the development of the new alloy but yet it required many frustrating years to achieve the high accuracy of imported chronometers.

Strasser's association with the DUS (German Watchmaking School) started in 1877 as a board member and part-time teacher. His advancement to full-time status occurred in 1883. He reached his next appointment when the founding director, Lindemann, died in 1885. He succeeded him. In 1902 he gained the title of Professor. This famous school produced many who achieved fame. To name a few: Hugo Müller, Richard Gläser, Lauritz Jensen, Gustave Gerstenberger, and Alfred Helwig.

The final forty pages of this book are those written by Herbert Dittrich and deal with the history of Strasser's and Glashütter astronomical clocks. This section deals with the more technical

details, geared to the repairer and restorer of astronomical clocks. There are detailed photographs which supply an insight into the production of the famed Glashütte regulators. Four representative models are shown together with dimensions and tables for every wheel and pinion used during the period of 1878-1958.

In this latter section are drawings and tables which show both Graham and Strasser escapements together with conversion tables originally published by Strasser. These indicate methods of calculating missing wheels, pinions, and escapements. The six full pages supply every detail for the construction and functions of Strasser's escapements, which brought him the Paris Gold Medal.

The construction of the Strasser movement reveals the thoughts of a watchmaker and the differences in design, in comparison with those of an engineer named Sigmund Riefler. A completely detailed description of compensating pendulums follows with drawings and photographs which make it easier to comprehend. A segment about wall and floor cases used in the Glashütte models and other movement types complete this section.

Reading this book brings back very fond memories of my own four-year apprenticeship. Also as part of this educational package, was a nine-week stay every year at the watchmaking school in Karlstein. This time however, was well spent since the emphasis was toward the theory of watchmaking under the watchful eye of director Ludwig Lehotsky.

My second full-time position was in Vienna with the privilege of working under another pioneer of precision electronic timekeeping, Emil Schauer. It was this specialized training which made it possible to finish some of my following assignments in Norway and Denmark. It was a challenge to fulfill the war department's need for a missile-countdown clock when none were available. Later, to see it working on national TV repaid our efforts. Another assignment was to aid with the installation of a very large time system at the Oslo Airport, built by Telephonebau & Normalzeit in Germany.

Returning to the subject of this review, this book is about a person who learned from the best and then spread his accumulated knowledge through sharing and teaching in a professional school. Now look around you, isn't there another person we all know so well and take for granted? A person always leading us on to better understanding and no matter if it's a mechanical clock or a quartz watch. Mr. Henry Fried, "Mr. Watchmaker," has always tried to help and to guide us for a better understanding and knowledge of horology. He is a treasure amongst us and has a memory which knows no bounds. **(Editor's Note: Mr. Hutter wrote this before Henry Fried's death. We believe it appropriate to leave it as written.)**

*Gerhard Hutter was the first Dana Blackwell Clock Award Winner of the N.A.W.C.C.

PICKLE BARREL

JEWELRY REPAIR, PART 18

SOLDERING, BRAZING, AND WELDING

By Marshall F. Richmond, CMW

In doing jewelry crafting and repair, the bonding of metals with heat plays a very big part. In order to be able to do a better job and turn out high-quality work, a good understanding of soldering, brazing, and welding is necessary and can be the difference between success and failure. My source of knowledge comes from experiment, experience, reading, exchanging ideas with others, observing, and listening. This article is a follow-up of the last two on fluxing, shielding, annealing and pickling so an explanation of soldering, brazing, and welding is the starting point.

Soldering is a term used when a metal with a lower melting point than the metals to which it is being bonded are joined together with the use of heat. The metal with the lower melting point is called "solder." There are two general terms used with solder: they are soft solder and hard solder. *Brazing* is a term used in hard soldering when using brass as the solder for metals, such as ferrous metals, with a higher melting temperature than brass. *Welding* is the term used when fusing, with heat, one metal into another with equal or a slightly lower melting point. This usually requires heating the metals white hot.

Soft soldering is usually done using a lead base solder that melts at a low temperature somewhere between 250° and 450° Fahrenheit. There are many formulas for soft solder because lead is alloyed with other metals to give it greater strength and a higher or lower melting point as the use demands. Soft solder can be applied with a soldering iron, torch, electric soldering machine, or a carbon arc. In soft soldering, the metal to be soldered should be heated. This heat will melt the solder. My first experience with soft solder was using what was called a soldering iron, which was actually a copper piece with a pyramid-shaped point mounted on a steel rod with a wooden handle. It was heated with a gasoline blow torch. The point was "tinned" which is a term used for flowing solder on the four sides of the point. Copper is such a good conductor of heat that when exposed to a hot flame or bed of coals, it quickly absorbs enough heat that it can then transfer the heat to the article being soldered. Thus when solder is added at just the right time, it will melt and flow following the heat wherever the iron is moved. With practice, neat solder joints can be made this way, however the strength is not nearly as good as it is with hard soldering, brazing or welding.

With progress came the electric soldering iron which used the same principle, except with electric current the heat is continuous and uniform. After the electric iron the soldering gun came along. It used a small tip and was in the shape of a pistol for easy handling. With the coming of the electric watches and the miniature circuits using solder joints, a small battery-operated electric soldering pencil was developed. Since soft solder makes good electrical connections many electrical circuits have soldered connections using soft solder.

In soldering electrical connections never use an acid-based flux, instead use a resin-based paste flux or resin core solder. Acid flux on electrical connections will let the solder flow, but since most are copper connections, in time, something happens and current will not pass this connection. This is a really difficult problem to find, so if you can prevent it you will not have to fix it.

When applying soft solder with a torch, heat the metal and apply the solder to it. Then by moving the torch heat you can pull the solder to where you want it because it will follow the heat. Many inexpensive charms are die cast of a metal with a low melting point. When customers want the jump rings attaching charms soldered, do not use a torch because the charm can melt. Attaching jump rings can be done with care using a soldering gun and soft solder. Years ago the tin smiths fastened many things made of tin with soft solder. Joints needing to be water-tight could be sealed by soldering. Jewelry items made of pewter are lead and tin and should never be repaired with a torch. Repairs can be made by using a soldering iron or gun which lessens the danger of damaging the piece. A good soft solder for repairing jewelry is "Tix" sol-

In order to do a better job and turn out high quality work, a good understanding of soldering, brazing and welding is necessary and can be the difference between success and failure.

der which, along with other solders, is available from most jewelers suppliers. Acid core, resin core, and plain solder can also be found at most any hardware store or hardware section of department stores, as well as automotive parts suppliers.

Hard soldering requires much more heat than soft soldering because the metals being soldered usually need to be heated red hot. Hard soldering can be done with an electric soldering machine or a torch. Hard solders are available in silver, karat gold, and platinum. Silver solder is available in 1/4-ounce troy(5 dwt) sheets, or wire usually about 20-gauge in diameter. It comes in four different melting temperatures, extra soft, soft, medium, and hard. I have found the extra soft or easy flow works better for repairs than the harder, higher melting temperature solders. Gold solder is available in plumb gold in colors of yellow, white, pink, or green in 10 karat and 14 karat. White gold plumb is also available in 20 karat. Repair gold solders are available in low karat white and yellow, 10 karat white or yellow, 14 karat, white or yellow, and 18 karat white or yellow. Usually higher karat solders are harder and melt at a higher temperature than lower karat solders. Eighteen karat hard solders are often referred to as welding solder. Gold solder in 10 karat, 14 karat, and 18 karat, yellow and white is available in a hypo-syringe in paste form containing one dwt of solder. It can also be obtained with flux and with two sizes of tips. This works well for small solder joints such as fine chains. Platinum solders are also available in one-dwt sheets in nine different hardnesses with melting temperatures ranging from 1,832° to 3,224° Fahrenheit.

To do extensive hard soldering, which is a must when doing jewelry crafting and repair, an adequate torch or torches are needed. The "Little Torch" has, in recent years, become so popular that it is now considered the standard torch for doing jewelry work. It comes with five tips which will cover most needs encountered in doing jewelry work. I rarely use anything but the #3 tip, but #4 and #5 will deliver more heat. This torch will operate on acetylene and oxygen. It will also work with propane or natural gas, although these will not supply as much heat as acetylene. When doing hard soldering on larger and heavier rings or other jewelry pieces, a larger torch is probably better. Using the little torch with the larger tips (#4 or #5) gives such a concentrated hot heat that it is easy to melt the metal you are trying to solder. The old reliable "Hoke" torch was considered for many years to be the standard jeweler's torch and comes with three sizes of tips. I have both torches on my bench and keep the "Hoke" torch lit, burning on a small propane flame, and use it as a pilot light for the "Little Torch." My "Hoke" torch burns propane and oxygen and the "Little Torch," acetylene and oxygen. There is another torch comparable to the "Hoke." It is also available to burn either acetylene, or propane or natural gas but these torches must be ordered to either burn acetylene or to burn propane

or natural gas. The "Little Torch" will burn any of the three with oxygen.

The May 1995 issue of *Horological Times* carried an article from this series on the "Ten Main Steps to Soldering" so this article will not give a step by step instruction for soldering. The ten main steps were the important steps to soldering but due to the variation of the objects to be soldered some of these steps are not necessary while other objects may require some treatment not mentioned. I will try to devote the remaining part of this article to different metals, what solders to use, how to apply heat, how to flux, how to make the solder flow where you want it. Also, I will point out some of the troublesome problems that require caution.

Starting with metals, there are usually two general terms that will cover most metals encountered in jewelry work and they are "Ferrous" and "Nonferrous" metals. Ferrous metals are metals that are alloys of iron such as steel or stainless steel. Nonferrous metals are metals that contain no iron such as copper, nickel, brass, aluminum, gold, platinum, or alloys such as karat gold. Brass is also an alloy of copper and zinc.

Karat gold is an alloy of gold with other metals to produce such properties as hardness, toughness, or color. Pure gold is 24 karat so 12 karat would be half gold and half alloy. Ten-karat gold is 10 parts gold and 14 parts alloy, while 14-karat gold is 14 parts gold and 10 parts alloy.

Silver alloys are sterling silver: 925 parts silver and 75 parts copper. Coin silver has more alloy to obtain hardness and is about the same silver content as Mexican silver. German Silver, Silverode, nickel-silver, and Silveroid are names used to indicate the color of the alloy which is an alloy of nickel and copper and actually contains no silver. These nonferrous metals can be hard soldered with most any of the hard solders except platinum solder. This is because its melting point is higher than some of the nonferrous alloys. By fluxing with soft-solder flux, soft solder will flow on most metals either ferrous or nonferrous. Silver and gold solders will flow on any of the mentioned nonferrous metals using batterns, flouron, or even borax flux.

To hard solder ferrous metals such as iron, steel or stainless steel, a special flux is needed. In the past, I have recommended "Aircosil" but it has become hard to get from jewelry suppliers. Now I can recommend "Kwik Flux" as I have found it easier to get from my suppliers. "Kwik Flux" will allow hard solder to flow on ferrous metals, even stainless steel, and it will also allow the nonferrous metals to be soldered to ferrous metals or vice versa. For experiments and practice I have found that copper, brass, and nickel, or nickel alloys are an inexpensive substitute for gold and silver solder. It is inexpensive, so by using these metals and silver solder, I can practice and experiment before using certain methods on fine jewelry. Strange as it might seem, even though silver solder is a white metal, when it is flowed on brass and finished by filing or polishing the solder joint is not visible. The solder seems to have turned the same color as the metal being soldered. This applies to white metals such as nickel silver or silver and they are white metals. I cannot answer why this happens but I have observed it many times.

As the metals and solders compatibility have been fairly well covered, the next thing to be discussed should be the application of heat and general reactions of solder and metals when the heat is applied. Temperature listings for solders sometimes give the melt and flow temperatures of the solders. Such listings will give the flow many degrees higher than the melt temperatures, which explains why when the heat is applied the solder first forms a small ball at the melt temperature. As more heat is applied, and the metal being soldered gets to the flow temperature, the solder flows. At this point it is time to get off of it because a higher temperature can cause the solder to boil which can leave a weakened pitted joint. The heat should always be applied on the metal and not directly on the solder if possible because as the solder follows heat after it flows, it can be drawn away by moving the heat to where you want it within limitations. There no doubt is enough material on the subject of soldering to fill a large book but the best way to learn is use the basics that have been explained here and experiment. The inexpensive way is to use silver solder for hard soldering and to use copper or brass for practice material.

Brazing is actually hard soldering, only brass is used for the solder and it is used on ferrous metals which have a much higher melting point than does brass. Brazing is done in much the same manner as any hard soldering, except in heavier brazing in which brass rod is used, the rod is melted on the end which is placed on the ferrous metal. Powdered borax can be used as flux in the powder form. For brazing small articles such as stainless steel watch cases, solder can be applied using "Aircosil" or "Kwik Flux."

Welding, as pertaining to jewelry work, is actually hard soldering using a high-temperature melt and flow solder which flows at almost the melting temperature of the metal being welded. This can be an advantage when repairing any point of extreme wear because it can build up the repair point with a metal harder than easy (low temperature) solder. It will wear longer. It can also be good when used in manufacturing such as putting heads in rings. This is because, later when hard soldering is needed, it can be done close to the original solder joints without causing them to become unsoldered.

The next article will be a discussion of miscellaneous repairs that are often referred to as nuisance repairs. Although they are often an interruption in daily routine they can be profitable because they are often necessary repairs the customers cannot do themselves and are willing to pay for.

FROM THE WORKSHOP

"From the Workshop" is a new feature in Horological Times. *Readers are invited to send in one or more of their favorite methods of solving a problem in the workshop.*

AWI has not tested any of the methods published. They are published for the reader's information and experimentation.

Send your suggestions to: "From the Workshop," Horological Times, *701 Enterprise Drive, Harrison, OH 45030.*

J.B. Green, Huntsville, AL, wrote to his Atmos clock course instructor about the success he had in replacing a defective bellows on a Model 519, or any other model where the drum and drum cover are soldered. Mr. Green made the repair in the following way.

Step 1. Make a clamp as detailed in Figure 1.

Step. 2. Assemble the clamp with the nuts and washers on the wood side. (See Figure 2.)

Step 3. Make a small index mark on the drum and drum cover at the twelve o'clock position. Place the drum in the clamp with the drum cover studs in the drilled holes and leave 1/4" clearance on each bolt on the wood side.

Step 4. Place the clamped drum, soldered side down, on a small cold eye of a kitchen stove.

Step 5. Turn on the eye and watch carefully and remove immediately when the drum and drum cover separate. This prevents the lacquer on the drum from becoming discolored. Note: Should the drum become discolored in this step, the lacquer can be removed with a water-based ammonia clock cleaning solution, then relacquered after reassembly.

Step 6. Unscrew the nuts evenly to release the spring pressure and separate the drum cover, spring, and old bellows from the drum.

Step 7. Remove the remaining solder from the inside of the drum and drum cover with a knife and file. The drum cover should now fit into the drum with little effort.

Step 8. Mark, and drill eight holes with a #44 drill, 45° apart around the open edge of the drum, 3/16" down from the top. Countersink these holes to fit a 2-56 flathead brass screw. (See Figure 3.)

Step 9. Align the index marks on the drum and drum cover. Mark, and drill eight holes with a #44 drill, 45° apart around the top outer edge of the drum cover to match the holes in the drum. (See Figure 4.) Countersink these holes to fit a 2-56 flathead screw.

Step 10. Cut eight pieces of brass 3/8" x 3/4" x .050". (See Figure 5.)

Step 11. Bend each piece, in a vise, at 90° at the pencil mark. (See Figure 6.)

Step 12. Center the scribe mark, on a bracket, under a hole near the index mark on the drum cover. Press the bracket firmly against the inside outer edge. (See Figure 7.) Scribe a circle on the bracket through the drum cover. Center punch the circle. Drill a hole with a #50 drill, and tap the hole in the bracket 2-56. Number this bracket and the hole in the drum cover. Number, scribe, drill, and tap the other seven brackets.

Step 13. Install all the numbered brackets on the drum cover. Don't "final tighten" the screws at this time but seat them firmly.

Step 14. Place the drum cover into the drum at the index marks and at the correct depth. Rotate the drum cover about 1/16" to offset and prevent a conflict with the drum cover screws. Scribe the brackets in the area shown through the drum holes (see Figure 5). Remove all the brackets, and drill and tap the brackets 2-56 for the drum screws.

Step 15. Re-install the numbered brackets in the drum cover, but not tight. Place the drum cover into the drum and align the drum cover bracket holes with the right drum holes. Install the drum screws and seat them, but not tight. Loosen the drum cover screws a slight amount and adjust or rotate the drum cover, if necessary, until all screws are seated. Tighten the drum cover screws and remove the drum screws.

Step 16. Remove the drum cover from the drum. Place the bellows, convex side up, and the spring into the drum.

Step 17. Reverse the four clamp bolts so the bolt heads are on the wood side and bolts are in the up position.

Step 18. Place the drum cover on the spring, aligning the index marks. Lay the drum unit in the clamp. Align the drum unit and clamp bars. Compress the clamp bars and start all four nuts on the bolts. (See Figure 8.)

Step 19. Rotate the drum to approximately align the index marks and screw holes in the drum and drum cover brackets. Take up any slack with the nuts on the bolts.

Step 20. Place an ice cube into the center of the bellows. Take up the slack evenly with the four nuts. Ad-

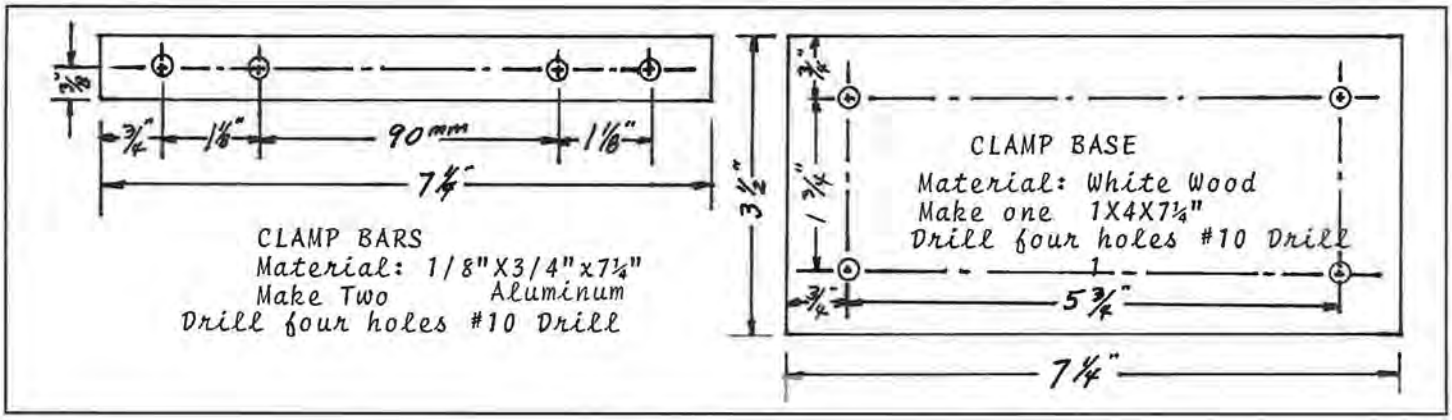

Figure 1.

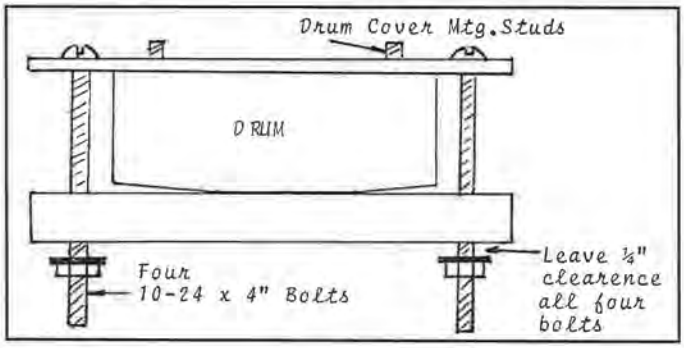

Figure 2.

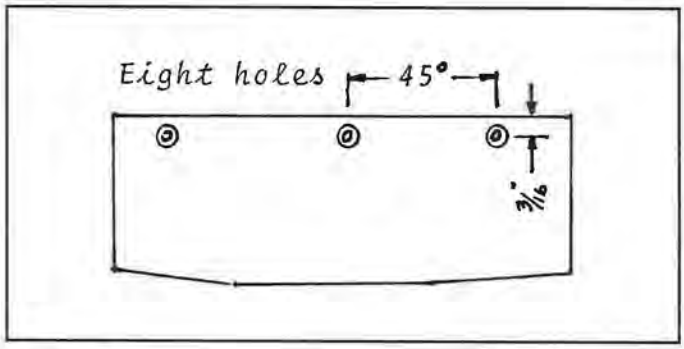

Figure 3.

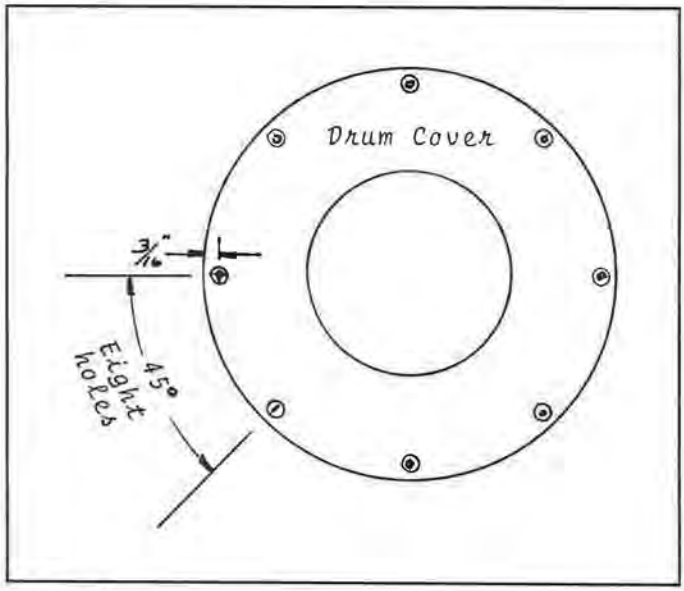

Figure 4.

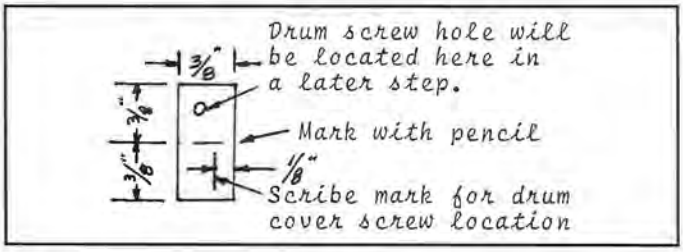

Figure 5.

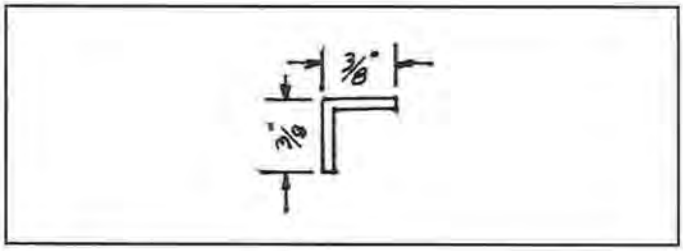

Figure 6.

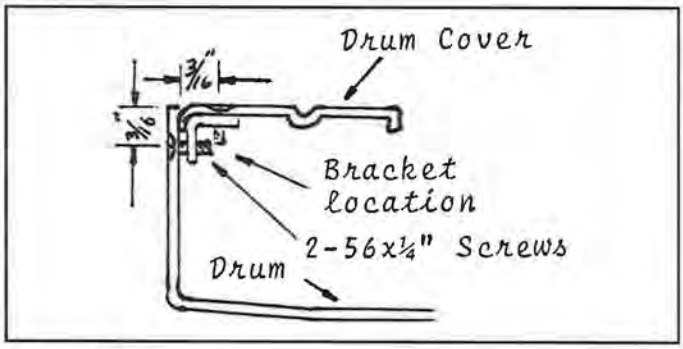

Figure 7.

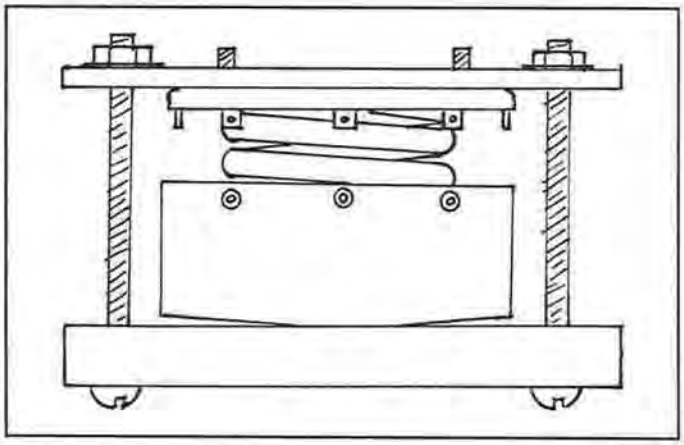

Figure 8.

just and rotate the drum to align the screw holes and install all drum screws. When all drum screws are properly seated give them a final tightening.

Step 21. Remove the nuts from the bolts and remove the drum unit from the clamp.

Step 22. If the drum needs to be lacquered, clean the surface and relacquer. Put the backing plate in place and install the drum on the Atmos clock.

Max Levine, Snoqualmie, WA, recommends the following method for dealing with an 18-size Elgin or similar watch movement having the balance and balance cock on top of the plate.

Materials/Tools Required

It is always a problem to assemble the train wheels and top plate of these watches because the pallet arbor is between the plates. I have seen several clamp devices to hold the pallet in position and have even made a couple myself. They haven't worked very well.

Try rolling a small piece of Rodico into a thin worm about 2 mm in diameter and use this to position the pallet against the top plate, with the pivot of its arbor in the hole or jewel. Place wheels in the lower plate as usual and carefully put the top plate in place. The lower pivot can be shifted to get it in its bearing after the upper wheel pivots are in place and without danger of the pallet falling out of the top plate.

Remove all Rodico from the pallet area and clean away any bits or smears using a fresh piece of Rodico. Place plate screws in the pillars and complete assembly.

AWI Executive Secretary Applicant Deadline

Deadline for applicants for the position of AWI Executive Secretary is May 31, 1996.

As announced in the March 1996 issue of *Horological Times*, AWI is seeking applicants for the position of AWI Executive Secretary. The start date will be between August 15 and September 30, 1996.

Qualifications: Successful management experience; knowledge and understanding of Horology preferred; academic degree desirable; demonstrated "people skills;" ability to analyze, reason and solve problems; creative and innovative. Final candidates may be required to complete a battery of aptitude/personality evaluation instruments. Some stated qualifications may be substituted with approved combinations of education and experience.

Interested persons should request an application before May 31, 1996 from the Personnel Committee, AWI Central, 701 Enterprise Drive, Harrison, Ohio 45030.

A Family History as Told By Henry B. Fried

In 1987, I convinced Henry Fried that because of his unique role in the history of our profession he should provide a record of from whence he came and how he achieved his legendary stature in the industry. He agreed, on the condition that it not be used until he "was no longer here."

Henry B. Fried's many accomplishments and the honors he enjoyed throughout his productive life have been chronicled many times. Please refer to "The Life and Times of Henry B. Fried," by Harry Blair, *NAWCC Bulletin*, October 1994. In this tribute I will endeavor to report the lesser known facet of this giant of a man as they were told to me in his own words.

Milt Stevens

Henry began his commentary by suggesting that it would be best to learn how it all got started: who his grandfather was, who his father was and how they got into watchmaking? Henry continued, "Let's say it started with Napoleon. No, he did not compromise one of my female forebearers. When Napoleon conquered the Austrian Empire back in the beginning years of the last century, he did some good in so far as our family is concerned. He franchised the Jews living in that empire if they would adopt a last, or family, name." Henry's great-grandfather and others of that time, and since time immemorial, who were of the Semitic races whether it be Aramaic, Egyptian, Arabic or Ethiopian did not have last names. Rather, Henry's great-grandfather was Shalom Ben which means the son of Ben. Thus Isaac, Ben; Jacob, Ben; Isaiah, Ben; etc. meant the son of Ben. When you went back with this system of geniality, you had some individuality rather than a nondescript John Smith, John Smith Jr., or John Smith III. When Shalom applied to the commissioner for a last name, he was asked what Shalom meant. It meant Peace in Hebrew. The commissioner translated peace into German, the Austrian language of that time, and said your last name from here on is Fried. So actually, his name was Peace. Hanging onto his first name, he became Shalom Fried. This had a bearing on the next generations and their practice of watchmaking, because with the taking of a last name also went the liberty to practice all trades. Such freedom was previously forbidden to Jews. When Shalom's son Isaac, who was born in 1827, came of age, Shalom apprenticed him to a watchmaker in an area that is now Poland. Then it was still part of the Austrian/Hungarian Empire—the Hapsburg Empire. Isaac also trained his son, Samuel (Henry's father), who was born in 1868, to be a watchmaker.

While things were more tolerant than before, a great deal of latent prejudices remained. Henry's father used to tell of the badgering that the Jews received from the natives of that area. Samuel related one lesser incident about the time he went across the border to buy parts for himself and his father. On his return through the Polish border they accused him of smuggling. When he protested that he was a watchmaker, as young as he was, they asked him to take apart and reassemble a watch. When he did this easily, they relented and allowed him to pass. Having heard about the land of freedom, Samuel started to save enough money to emigrate to the United States.

Meanwhile, Isaac had died. Samuel's mother then married a widower, Michael Wattle. At the time of the marriage Michael Wattle had a daughter, Rachel who was just two years younger than Samuel. Rachel and Samuel developed a deep affection for each other and later were destined to marry. They had one blood stepbrother in common, born to the union of Hannah Fried and Michael Wattle.

After saving enough money for his passage, Samuel Fried landed in New York in 1886. While in New York, he resided with relatives. He worked in a clothing factory, the first job open to him. He repaired watches in his bedroom on the lower east side

of Manhattan at night. When he had saved enough money, he sent for Rachel. She worked as a janitor's assistant in a public school. She also lived with relatives on the lower east side. Contemplating marriage, Rachel and Samuel saved up enough money to return to Poland so they could be with their parents for their wedding in 1891. They stayed in Poland until 1895 when they returned permanently to the United States with their children, Rose and Jack.

Samuel fathered five more sons and another daughter. Henry Bernard (Henry B. Fried) was born at 42 McKibben Street in the Williamsburg section of Brooklyn on January 8, 1907. Henry was born in the back bedroom of the ground floor apartment in a five-story wooden tenement. The building housed ten families. Samuel's watchmaking shop was the front street room and there were four more rooms, each connected by a door behind. There was was no running water.

Samuel had gifted hands and a good mind. He spoke English very well. He also spoke German, Hebrew, Polish, Russian and Italian that he learned from his newly immigrated customers. He, like Rachel, was musically inclined. When still a young man, Samuel made his own violin. His older brother related that Samuel was mildly admonished by his stepfather for cutting the horse's tail to complete the bow.

When electricity was brought up to, but not into, the building around the year 1912, Samuel completed the wiring into his shop and the apartment. He taught all of his sons watch and clock repairing up to the time of his death in 1920 at the age of 52. Samuel's death was a result of the returning doughboys who brought back various diseases, one being typhus—the disease of which Samuel died. At the time his father's death, Henry was away singing as a professional choir boy in one of the best Hebrew choirs in the city. They traveled from community to community to sing on weekends. Henry reported, "When I returned that weekend I was an orphan. When I left, he was in very good health. He had just passed an insurance examination only two weeks before." Rose, Samuel's daughter who preceded Samuel in death, died on Armistice Day two years before. Rose was one of the two-million fatalities of the Swine Flu epidemic. She was 22 years old. Henry's older brothers, Louis and Saul, carried on the watch repair business that by then included some jewelry.

Henry and his brothers had attended Public School #43 on nearby Bowne Street. Henry had already skipped a couple of grades and was in the fifth term of high school in Brooklyn's Eastern District High School in the Williamsburg section when his father died. The Williamsburg section of Brooklyn is in the middle of the area in which the novel *A Tree Grows in Brooklyn* was centered.

With seven remaining children, Henry's older brothers decided that he had enough schooling and should work to help support the family. The oldest child in the family was about 22, the youngest, Ettie, was six or seven. The brothers found a job for Henry as a continuing watchmaking apprentice with Irving M. Looker at 91113 Maiden Lane on the 13th floor of that building. There he ran errands to the material houses that were close by and often in the same building. He would run up and down the stairs. Henry said it was good for his legs. Henry also polished jewelry, cased watches, and sewed on the black cloth bands to women's watches. He also did some cleaning of watches and a couple of clocks. Henry reported, "It was terrific and I enjoyed it very much, and the boss was a wonderful person. He was very nice to me."

One day Mr. Looker called Louis and Saul in and told them that their brother had a very good brain and should have a formal education. The brothers inquired whether Mr. Looker was going to fire Henry. He said no. Henry should continue to help the family and go to night school. The brothers questioned when Henry would study and do his school work. Mr. Looker replied, "Right here, and I will make sure he does it." Henry said, "He was terrific. He was like a father to me."

It wasn't long before Henry discovered the "681" shelf in the public library. He recalls that he was like a young boy being turned loose in a candy store. The "681" shelf, of course, contained all of the horological literature of the day. Henry said he read them all and practically committed them to memory.

Henry proved to be a good student at the Brooklyn Evening High School and he had a zeal for learning. Most of those attending were much older then him. Many were already professionals and tradesmen who wanted to qualify to pass promotion examination at their employment. Henry states, "It was wonderful being exposed to these kinds of bright, ambitious individuals."

Mr. Looker had moved the business uptown to 366 Fifth avenue in the McCreery building. He was a factory representative and he sold to people from all over the world. One day he was showing merchandise to buyers from South America. Having learned Spanish in night school, Henry was able to pick up their conversation in Spanish. They were going to purchase as much as Mr. Looker would sell them because they did not intend to pay for it. Henry, of course, was concerned. He excused himself, and went down to a pay phone and called Mr. Looker. He related to Mr. Looker what he had heard. Mr. Looker was very calm and told Henry to return because he needed him to help these customers. When Henry returned, he continued to show them merchandise while Mr. Looker left and called the Jewelers Vigilance Association. They were very much aware of the individuals and told Mr. Looker to sell them anything they wanted. They would cover any of his losses. Later when those

individuals tried to leave the country, the police and agents of the Jewelers Vigilance Association apprehended them. Thus, Mr. Looker's kindness in helping Henry to go to school was in some way repaid by this incident.

Eventually, Mr. Looker retired and moved to California. Henry took a job working for a department store in the accounts payable department. He took the job because of an attractive salary but he longed to return to the trade. Mr. Looker found a job for him down on Maiden Lane again. By this time Henry reports that he was a pretty good watchmaker, "no big tricks, but pretty good." In 1925, he accepted a position as head watchmaker and head of the material department of KK Importing Corporation at 45 John Street, one block north of Maiden Lane. The owner was an Italian man by the name of Leopold Cutino. While working at KK Importing, he was exposed to the finest craftsmen in New York and learned much from them. He sat between a husband-and-wife team. The wife taught him hairspring vibrating, and the husband taught him how to make bridges and other specialty parts. He sat between them because they used to fight like cats and dogs.

Meanwhile, Henry's zeal for studies in night school continued. He became involved with scholarships, the school newspaper, yearbook, chess team, and played trumpet in the school orchestra. Henry revealed that he still had the trumpet. He also ran track and cross country and won many awards for his track ability along with a number of his teammates.

Henry's mother had a natural talent and love for music. She would attend musical shows and then with the help of her great memory would come home and go through the entire show with the family. Henry relates that they almost felt like they had seen the show themselves when she finished.

Brother Jack had a love and talent for bicycle racing and was at one time on the U.S. Olympic team. Jack inherited this love of bicycle racing from his father, who before his death, participated in bicycle races. Jack ran a bicycle shop. He encouraged Henry to become involved in bicycle racing, which he did. Henry loved it, and became Junior New York City Champion in 1922 and in 1923.

Meanwhile, a high-school friend was training in track for the Olympics and asked Henry to help him train by running with him. At times, Henry was able to beat his friend during the training sessions. His friend encouraged him to forget bike racing and to concentrate on track. Henry related that he had a natural talent for running because as a youth anti-Semitism was prevalent in the area in which he lived. Often he had to run home from gangs of boys of another recent immigrant ethnic persuasion who wanted to beat him up.

When high-school graduation neared Henry was offered scholarships for track and academics at Rice Institute, Georgetown, St. Bonaventure, and Syracuse University. He favored going to St. Bonaventure because his former high-school teammate was the coach. He realized the need to work so he opted to attend New York City College at night.

While he continued to work for Mr. Cutino at the KK Importing Corporation, Henry learned from specialists from all over the world who had brought their talents to the watch industry that was centered in New York City. While with KK Importing, Henry was exposed to all kinds of watches from Switzerland, and he soon became an expert on Swiss watch movements and material. With this background, he wrote and illustrated articles for Samuel and Louis Levin. They used them in their publication *Horology*. Henry recalls that the son, Louis Levin, was an excellent watchmaker, draftsman, and illustrator in his own right. He could produce excellent three-dimensional drawings.

Henry met his wife, Tina, while both were still children. Tina's cousin introduced them. When they married in 1931, the timing was not good because of the Depression. Tina and Henry had two children, Robert and Caryl. President Roosevelt wanted to keep high-school children in school because he did not want them to compete with adults for the few jobs that were available during that unfortunate time. He devised a plan to keep young people in school by establishing vocational training in the schools. Through this program young people could learn almost any trade available.

The New York City school system announced a competition for the position of watchmaking instructor. Over 200 people applied, including Henry Fried. He was interested in this position because of the uncertainty of the employment situation during the Depression. Working for the school system offered the security that he needed for his young family. Henry Fried finished first in the competition and got the job. Max Schwartz, who many will remember from his days with the Bulova Watch Company, finished second and was offered the position of substitute teacher.

In 1937, Henry opened the classroom for the New York Board of Education. That's all he had, a classroom—no desks, work benches, chairs, or tools. Times were still difficult and appropriations were slow in coming. He learned that in the basement of the school, buried under a pile of coal, there were a number of drafting tables. When he met with his 25 students on the first day he told them to all wear old clothes, bring soap and a towel, and clean clothes to school the next day. He advised them that they were going to move the coal pile and rescue the drawing tables buried under it.

The class was eager to get started so they all followed directions and came to school for a day of hard work. At the end of the day they had moved the coal pile, recovered 30 drafting tables, and returned the coal to its original position. When they all had showered and changed, their instructor took them to a local ice cream parlor. Henry reported that they actually

had fun that day. The class spent the next several days scrubbing the tables with brown soap supplied by the custodian.

Meanwhile, Henry went to his friends in industry and the material houses and begged for tools and supplies. Most were very generous. Henry also brought in some of his own tools. The students were encouraged to purchase their own tools when they could afford to do so. The drafting tables cleaned up nicely and had many drawers in them. Students were able to lock their tools in the drawers of their desk.

Many of the students were refugees of all nationalities; many were very bright and talented. In 1940 or 1941, twelve of the fifteen students taking the HIA Junior Watchmaker exam, passed it. The HIA Junior Watchmaker exam was the equivalent of AWI's Certified Watchmaker examination of today. The students did very well and the classes from the George Westinghouse turned out a number of graduates who became highly successful watchmakers in the United States watchmaking industry.

The Board of Education required 32 credit hours of education classes in order to qualify for a permanent teacher's license. Most of these credits, Henry took at New York State University Industrial Teacher Training College. He recalls that he was allowed to take the final 15 hours during one summer, provided he got nothing lower then a "B" in each class. Henry proudly relates that he achieved an "A" in all of the classes. The reason this was a special summer was that he took these final courses at Oswego College on Lake Ontario. The family spent a summer vacation at Lake Ontario while Henry attended classes every day. He recalls that he jogged to and from the classes daily; an exercise he enjoyed immensely.

Teaching provided the time for family vacations. Van Nostrand Reinhold Company asked Henry to write a textbook on watchmaking. This resulted in the *Watch Repairer's Manual* which Henry proudly credits for the family being able to take long and enjoyable vacations. The proceeds provided many other "extras" for the Fried family. We are all familiar with the many other books and articles Henry Fried has written since this first one.

Teaching also allowed Henry time to continue doing specialty watch repairing for customers. He also repaired cameras and helped resolve production problems both in the watch and camera industry. He specialized in making bridges, fashioning custom-sized jewels and fitting them into bezel settings, vibrating hairsprings, and working on all kinds of complicated watches and devices.

During the war he did defense work for Longines and other companies, devising ways that they could convert standard clocks and watches to meet the specific needs of the war effort. Eventually he was a regular consultant for such companies as The Self-Winding Clock Company, Longines, Waltham, Benrus, and the Swiss.

Henry Fried was consulted by the Federal Trade Commission, Customs, and patent lawyers. He was frequently called upon to be an expert witness in various court cases involving the watch industry. Needless to say he was also a much sought after lecturer, technical expert, and instructor by horological associations around the world. The tours he lead throughout the world are legendary.

Evidenced throughout Henry's taped commentary was his love for his family, the arts, sports, and his fellow man. He completed the commentary by noting that he took special pride in the respect his fellow craftsmen have paid him. Henry Fried concluded, "I owe them very much for the happy life they have given me."

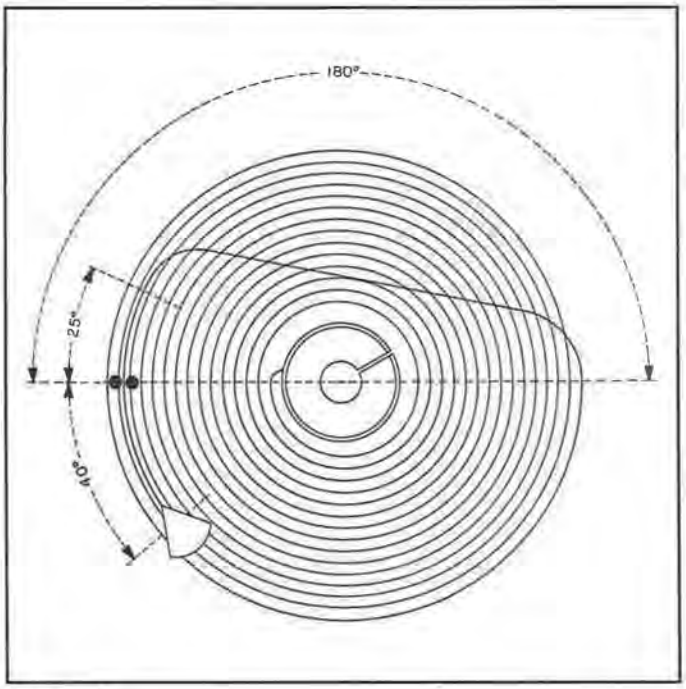

Figure 1.

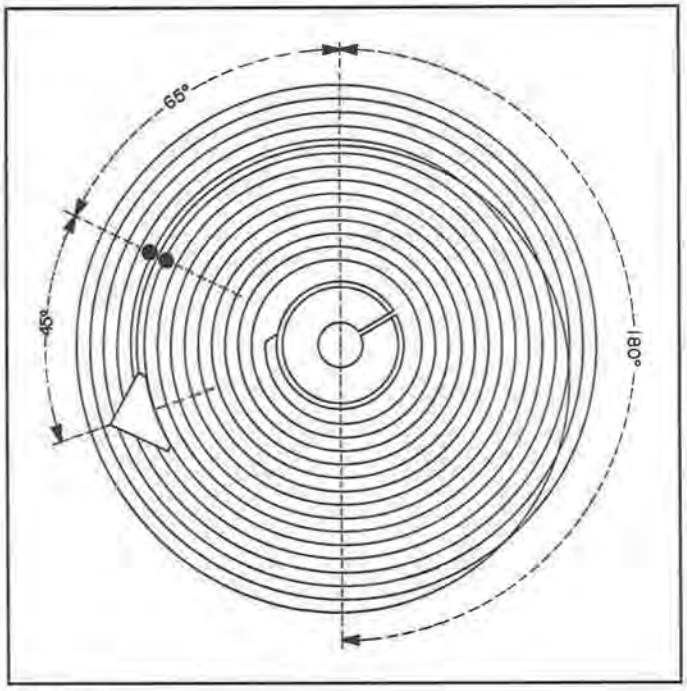

Figure 2.

TECHNICALLY WATCHES

ANTIQUE WATCH RESTORATION, PART CXXV

MAKING OVERCOILS ON HAIRSPRINGS

By Archie B. Perkins, CMW, FNAWCC, FBHI

Different watch companies have their own particular design of overcoil or overcoils. In many cases, these designs are chosen to fit their particular watch designs. Although some of these overcoil shapes do not match any of the patterns shown in the plates of patterns, they still fulfill the requirements of the Phillips theory on overcoils and can be made isochronous.

Some examples of overcoils used by some of the major watch companies follow. Figure 1 shows a style of overcoil that has been used by the Elgin Watch Company. This style of overcoil is sometimes referred to as a double-quadrant overcoil. This is because the two bends in the overcoil are the quarter part of a circle. This style of overcoil is sometimes used in watches when the center wheel is in a position that interferes with the overcoil. The straight part of the overcoil is placed so that it clears the edge of the center wheel.

The Elgin overcoil is designed with a gradual rise bend to raise the overcoil. The rise starts 90° back of the point where the overcoil starts over the body of the hairspring. The angular distance between where the overcoil starts across the body of the hairspring and the position of the regulator pins is 180°. The angular distance from the regulator pins to the stud is 40°. The angular distance from the regulator pins to the second curve in the overcoil is 25°.

Figure 2 shows a Waltham overcoil. This is a circular type of overcoil similar to the Lossier overcoil. The rise in this overcoil is in the form of a knee bend. The knee bend starts about 5° before the overcoil starts over the body of the hairspring. This overcoil is made of two radii. The first radius forms the overcoil for the first 180°. The second radius forms the regulator sweep. The angular distance from the 180° mark to the regulator pins is 65° and the angular distance from the regulator pins to the stud is 45°.

Figure 3 shows a Hamilton overcoil. This overcoil was used in their 950E, 992E, 998, and 999 models. The rise in this overcoil is a knee bend that starts about 30° before the overcoil starts over the body of the hairspring. It is 190° from the start of the overcoil to the regulator pins and 80° from the regulator pins to the stud. The stud is a collar button style of floating stud.

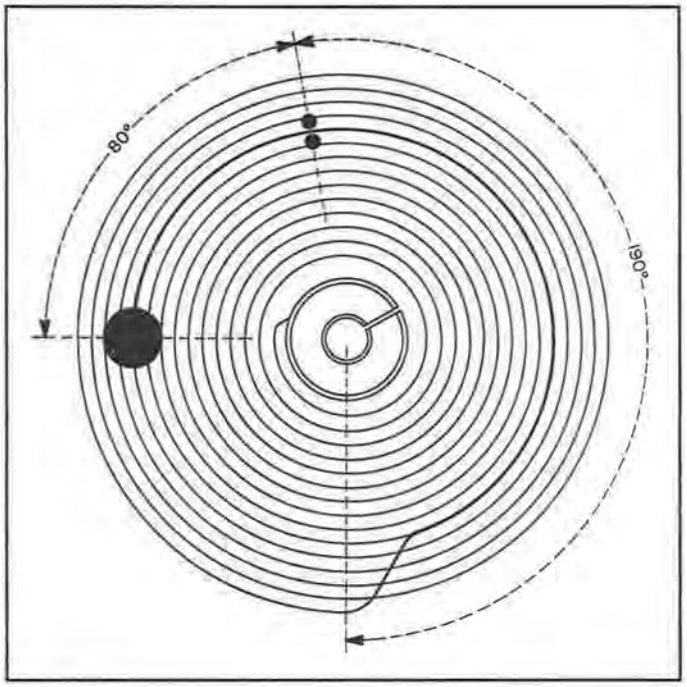

Figure 3.

Figure 4 shows three other Hamilton overcoils. These are all circular-type overcoils. View A shows the 992B overcoil. This overcoil has a knee bend rise which starts about 45° back of the point where the overcoil starts across the hairspring. The height of the knee bend is .43 mm. The angular distance between where the overcoil starts and the regulator pins is approximately 196°, and the angular distance between the regulator pins and the hairspring stud is approximately 54°. This overcoil is also used for models 950B, 998B, 999B, and 4992B. This hairspring has a counterpoised collet.

Figure 4, View B shows the overcoil for 10-size Model 923 Hamilton. The angular distance between the start of the overcoil and the regulator pins is 180°, and the angular distance between the regulator pins and the stud is 55°. This overcoil is raised with a gradual rise bend.

Figure 4, View C shows the 21/0-size Model 721 overcoil. The angular distance between the start of the overcoil and the regulator pins is approximately 134° and between the regulator pins and the stud is approximately 70°. This overcoil is raised with a gradual rise bend.

Figure 5 shows three additional Hamilton overcoils. These overcoils are of the double-quadrant style with very little radius to the bends at the ends of the straight part of the overcoil. View A shows the 6/0-size Model 987A overcoil. The angular distance between where the overcoil starts across the spring and the second bend is 113° and from this point to the stud is 108°. The distance from the stud to the regulator pins is 70°. This overcoil is raised with a gradual rise bend.

View B, Figure 5 shows the 14/0-size Model 980 overcoil. The angular distance between the start of the overcoil and the second bend is 120°, and between the second bend and the stud, the angular distance is 130°. The angular distance from the stud to the regulator pins is 80°. The overcoil has a gradual rise bend.

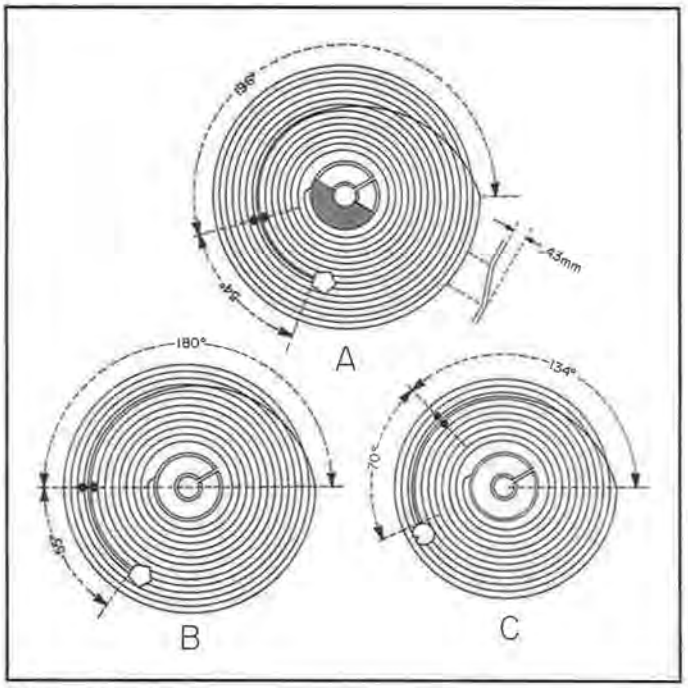

Figure 4.

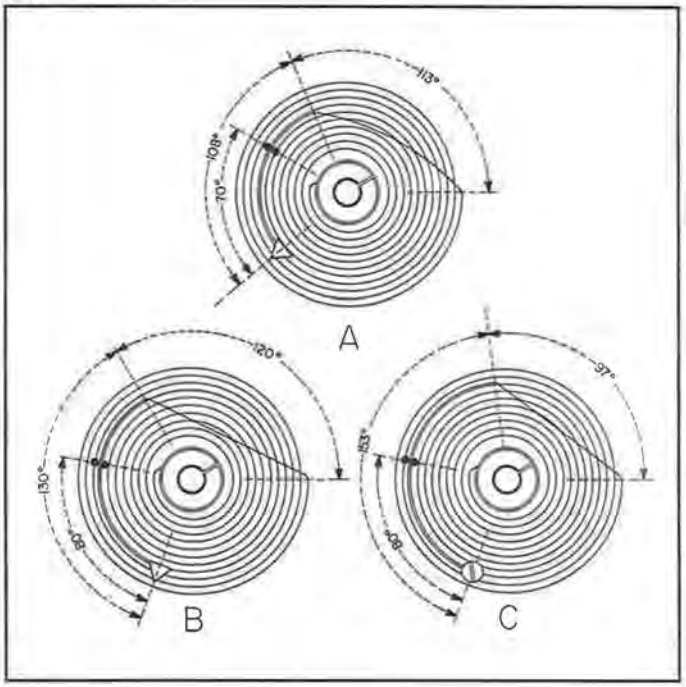

Figure 5.

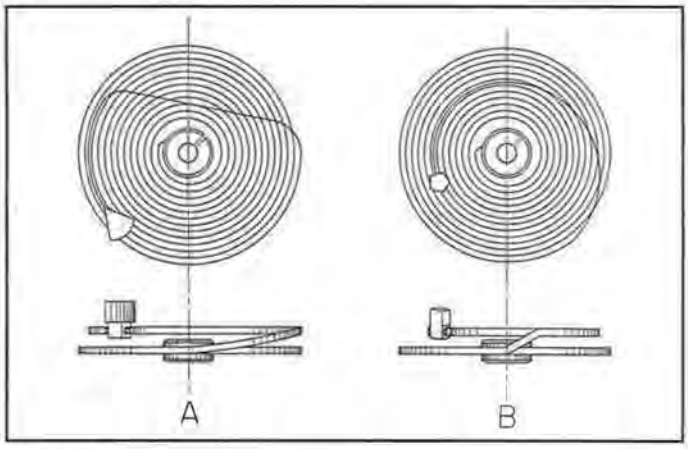

Figure 6.

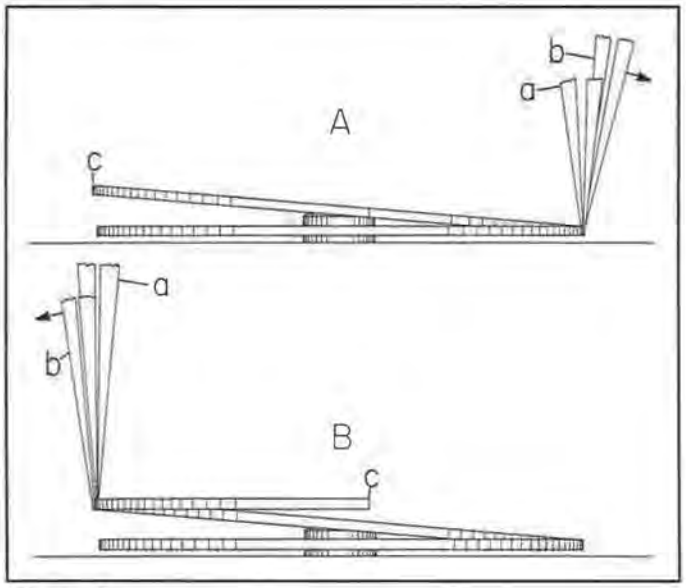

Figure 7.

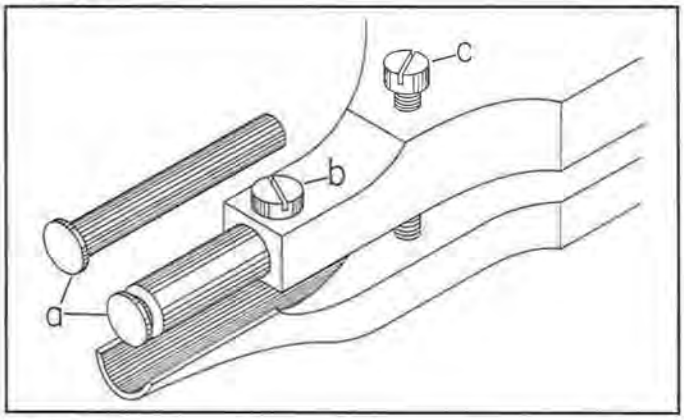

Figure 8.

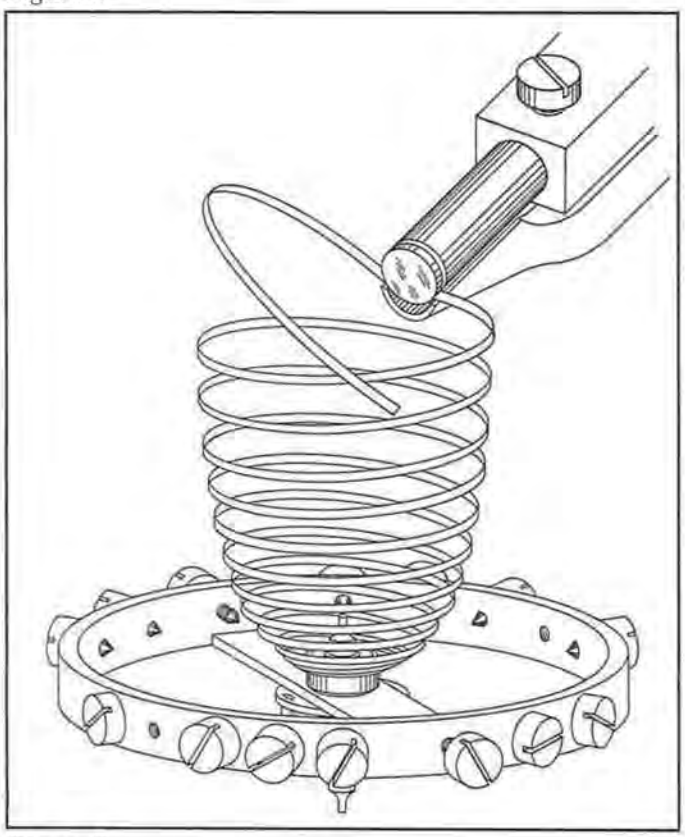

Figure 9.

View C, Figure 5 shows the 20/0-size 987 overcoil. The angular distance between the start of the overcoil and the second bend is 97° and between the second bend and the stud is 153°. The angular distance between the stud and the regulator pins is 80°. This overcoil has a gradual rise bend.

Two Styles of Overcoil Rise Bends

Figure 6 is used to show the two styles of bends for overcoils. View A shows the gradual rise bend. The gradual rise bend starts 90° back of where the overcoil starts across the body of the hairspring. This bend is made with two tweezers. The gradual rise bend is usually used when there is very little space for an overcoil.

View B, Figure 6 shows the knee bend rise. This bend is made within an area between where the overcoil starts across the hairspring and a point 45° back of this position. The knee bend is a double bend. The first bend raises the coil and the second bend levels the coil to the desired height. The knee bend rise is usually used when there is adequate to excess space for an overcoil.

Making the Gradual Rise Bend

Figure 7 shows how the gradual rise bend is made. View A shows the first bend being made to raise the overcoil. This is usually done with two tweezers. The outside coil is held at the proper place with tweezers "a" while tweezers "b" are leaned in the direction of the arrow to raise the coil. The coil is raised to the maximum height at "c" which is opposite the point where it is manipulated with the tweezers.

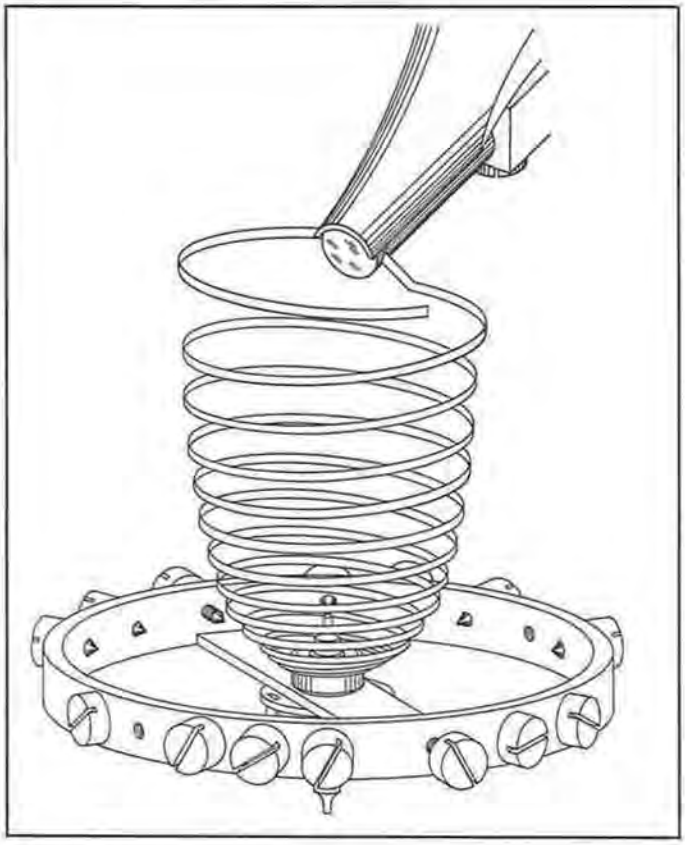

Figure 10.

View B, Figure 7 shows the second bend used in making a gradual rise bend for an overcoil. This bend is made opposite the first bend which raised the coil and is used to level the end of the coil. To make this second bend, the coil is held with tweezers "a" while tweezers "b" are used to level the end of the coil. Tweezers "b" are swung in the direction of the arrow.

Making the Knee Bend

Figure 8 shows special Dumont hairspring overcoiling tweezers. These have been made in four sizes. These sizes are: 0, 1, 2, and 3. Size 0 is the smallest and 3 is the largest. These tweezers are used to form the knee bend when raising the overcoil. Following is a description of the tweezers. The upper jaw of the tweezers has been machined down to form a cylinder at the end of the jaw. A hole has been drilled lengthwise through the center of the cylinder. This hole holds a headed pin "a" that is held in place with set screw "b." The lower jaw has been machined so it has a concave shape to match the shape of the cylinder and pin of the upper jaw. The stop screw "c" is used to control the distance between the two jaws when they are pressed toward each other. The headed pin can be adjusted in or out of the hole for different thicknesses of hairspring material. Once the pin is adjusted for the spring thickness, set screw "b" is tightened to hold the pin stationary.

Figure 9 shows how the tweezers are used to raise the overcoil. The balance and hairspring are suspended by the overcoiling tweezers, as shown, when the bend is made. It is advisable to first set the tweezers stop screw with a scrap piece of hairspring of the same size to avoid overbending the new hairspring.

Figure 10 shows how the overcoiling tweezers are used to level the overcoil after it has been raised. This operation

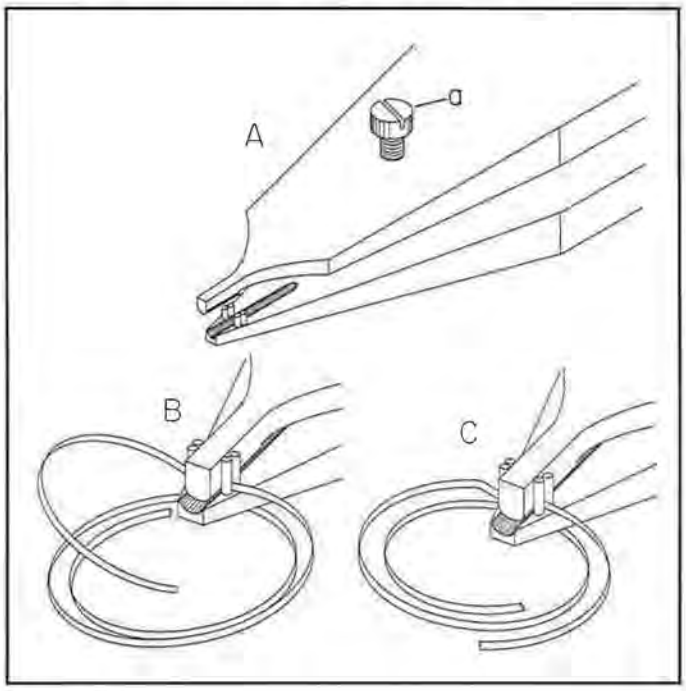

Figure 11.

completes the knee bend. For this operation, the tweezers are turned over so the round jaw is below the concave jaw as shown.

Second Method of Making the Knee Bend

Figure 11 shows a pair of tweezers that can be made by the watchmaker for making the knee bend in an overcoil. This tool can be made from an old pair of tweezers or it can be made from flat stock. View A shows the finished tweezers. The inside of the upper jaw has been rounded and the inside of the lower jaw has a rounded slot milled into the surface to match the rounded upper jaw. The lower jaw has four guide pins that are frictioned tightly into holes drilled through the lower jaw. These guide pins are located so they guide the upper jaw of the tweezers to keep it centered with the concave slot of the lower jaw. The guide pins are also spaced close enough so they hold the hairspring material upright while the raise is being made in the overcoil. Stop screw "a" determines the amount of rise given the overcoil.

View B, Figure 11 shows the tweezers being used to raise the overcoil. View C, Figure 11 shows the second bend being made to level the overcoil. When this bend is made, the hairspring is turned over with the top side down.

Third Method That Can Be Used to Make the Knee Bend

Figure 12 shows a simple method that can be used to make the knee bend to raise the overcoil. This method involves the use of a pair of regular tweezers that have been changed slightly for this purpose. View A shows one method of changing the tweezers for making the knee bend. In this case, a step is ground on the inside of one jaw of the tweezers. This step prevents the hairspring from sliding upward between the jaws of the tweezers when the points of the tweezers are pressed into wood to raise the overcoil. The inset in View A shows the hairspring material held between the jaws of the tweezers.

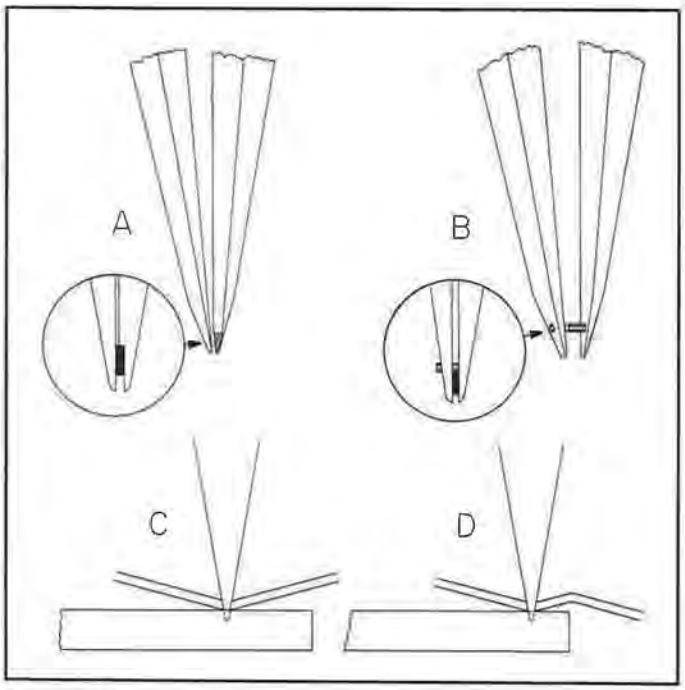

Figure 12.

View B, Figure 12 shows another method of changing the tweezers for making the knee bend. In this case, instead of making a step in the jaw, the jaws are drilled so a round pin can be frictioned into one of the jaws of the tweezers. The hole in the other jaw will guide the pin and support the pin when the tweezers are used. The hairspring will be supported by the pin and help form the curve of the knee bend when the tweezers are used. The inset in View B shows the hairspring material between the jaws of the tweezers.

View C, Figure 12 shows the tweezers being used to make the first bend to raise the overcoil. The points of the tweezers with the hairspring positioned between them are pressed into a block of soft wood to raise the overcoil.

View D shows the second bend being made to level the overcoil. The hairspring is turned over with top side down when making the second bend to level the coil. Caution: Care must be used to avoid overdoing these operations to prevent the hairspring from being damaged. Much practice work should be done on damaged hairsprings to perfect the method.

"Antique Watch Restoration" will continue next month.

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SCHOLASTICALLY SPEAKING

Pacific Northwest is Home to Premiere Watch and Clock Technology Program

North Seattle Community College in Seattle, Washington, is home to one of the premiere Watch and Clock Technology programs in the United States. Watch and Clock Technology has been a part of Seattle since the late 1950s. This unique program found a permanent home when North Seattle Community College opened its doors in 1970.

North's Watch and Clock Technology Program emphasizes hands-on lab work giving students an opportunity to learn by actually working on a variety of timepieces — from antique clocks and pocket watches to the latest in quartz technology. An elaborate video system allows each student to observe the intricate repair procedures performed by Instructor Tony Knorr.

In 1994, North's program became affiliated with WOSTEP, the Watchmakers of Switzerland Training and Education Program. Currently there are twenty WOSTEP programs in the world. Nearly three thousand hours of Swiss watchmaking is taught during the two-year program.

The Watch and Clock Technology Program at North has trained hundreds of students to go on to successful careers with major jewelry chains, independent jewelers, or to open trade shops to service jewelers in their communities. The program is known around the world and consistently has a waiting list of students wishing to enter.

In the fall of 1995, North Seattle Community College held an industry open house to acquaint national and local retailers, manufacturers, and community leaders with the Watch and Clock Technology Program. Guests were greeted by North's president, Dr. Constance W. Rice and heard from long-time program supporter and industry leader, Herb Bridge. A Ben Bridge Scholarship Endowment for Horology was recently established at the college by Herb and Shirley Bridge.

The Watch and Clock Technology Program at North Seattle Community College and its affiliation with WOSTEP II is "a winning combination for students and the watch industry," said Charles Berthiaume, Vice President After Sales Service, Rolex Watch U.S.A., Inc. The program succeeds because of the commitment of its faculty and students and the outstanding support it receives from industry leaders.

Students interested in enrolling in the Watch and Clock Technology Program should contact the registrar at (206) 527-3664. Those interested in hiring students or graduates of the program should contact Instructor Tony Knorr at (206) 526-0173.

Figure 1. Elaine Rolf, a graduate of North Seattle Community College's Watch and Clock Technology Program, works in watch repair for Ben Bridge Jewelers in Seattle.

Figure 2. Tony Knorr, Watch and Clock Technology Instructor at North Seattle Community College, explains the program curriculum to industry leaders, including Herb Bridge (front, center) from Ben Bridge Jewelers.

MUSIC BOX CLOCKS

TWELVE-TUNE MUSIC BOX WITH SIX BELLS, PART 10

By Leo A. Jaroslaw

Introduction

In the last part we completed the disassembly of the movement. In this part we will start the discussion of cleaning and servicing the movement.

Cleaning and Servicing

12. Clean and finish the bedplate.

NOTE: The bedplate is completed first, so that the other components can then be installed for safety as each is completed. Another factor, depending on the paint used, is the time required for drying between coats. If long drying, work can be initiated on the next component.

NOTE: Early music box movement bedplates were made of brass. The later ones are of cast iron.

12.1. Clean the brass bedplate in either detergent and hot water, or safe solvent, to remove old dirt and oil.

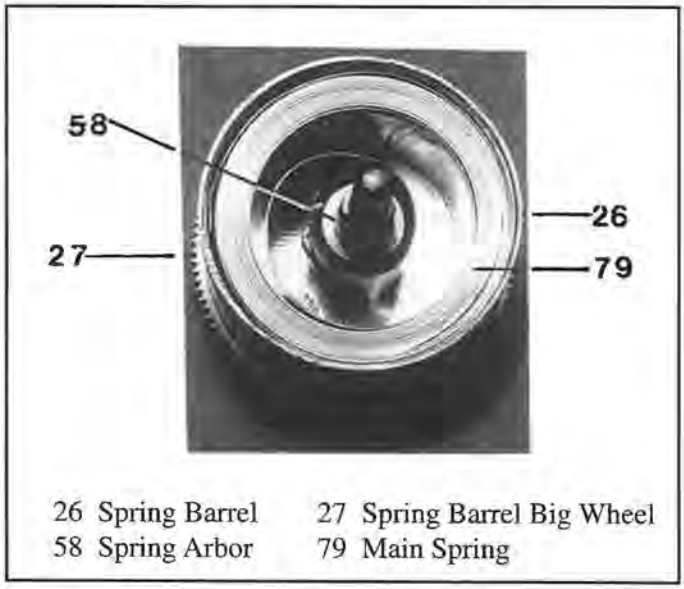
12.1.1. Polish with your normal brass polish.

NOTE: Always rub the bed lengthwise when polishing.

12.2. Wash or clean the cast iron as described above, then thoroughly dry.

NOTE: The top surface of the cast iron bedplate was machine finished on a shaper. This type of tool leaves a finished surface which is a series of fine grooves close together.

12.2.1. Use a wire brush on the bedplate to remove any loose or scaled paint.



26 Spring Barrel
27 Spring Barrel Big Wheel
58 Spring Arbor
79 Main Spring

Figure 10.1. Spring barrel with cap removed.

NOTE: Always brush in the direction of the shaper tool finish.

12.2.2. Paint bedplate.

NOTE: If old paint has been completely removed, use a primer for the first coat.

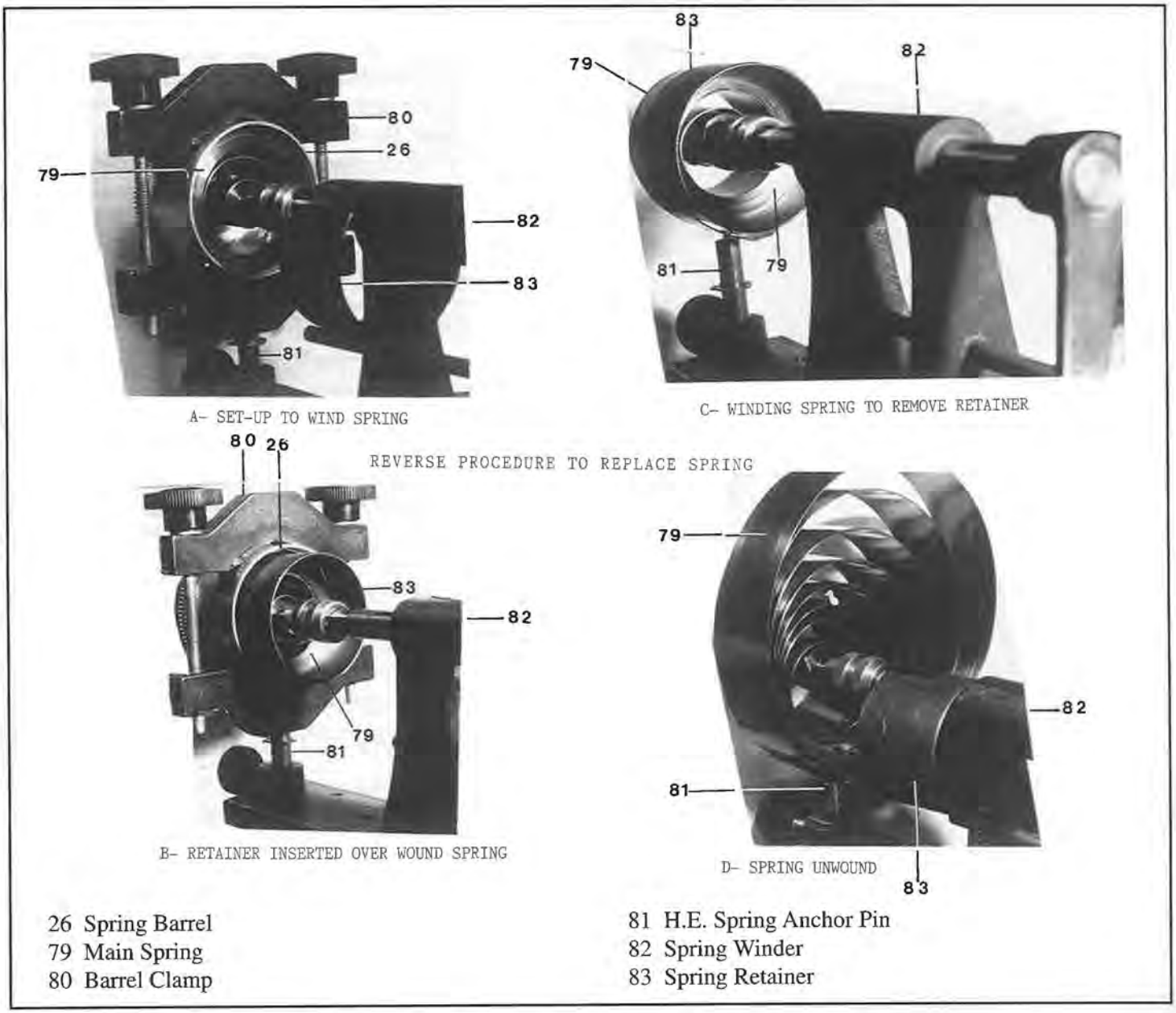
NOTE: If the movement is in brass, use an antique or old gold color of paint. Either brush or spray can be used.

A nickel-plated movement should have the bedplate painted silver. Both colors should have a minimum of two coats plus the primer if required.

NOTE: All the movement components except the bedplate, cylinder and the comb will be cleaned in ultrasonic baths. Exposed parts will then be polished with brass polish and rinsed. We will discuss cylinder and comb cleaning as we come to each specifically.

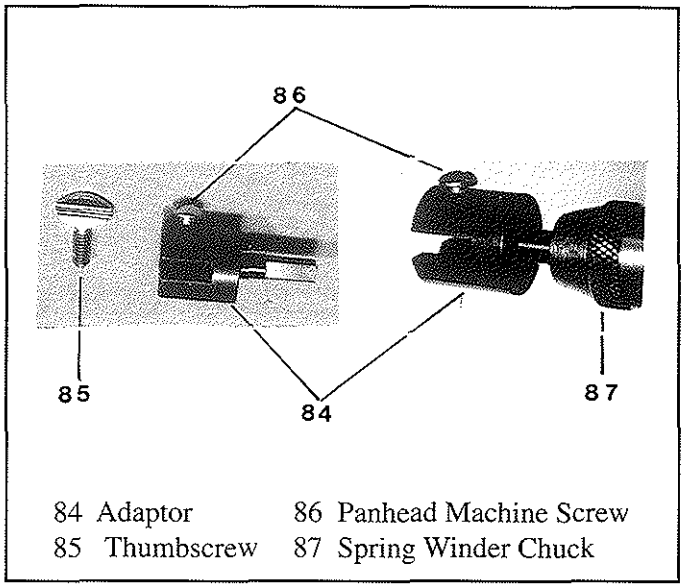
13. Disassemble spring barrel.

CAUTION: SPRING BARRELS ON MUSIC BOXES ARE SIMILAR TO GOING BARRELS IN CLOCKS. HOWEVER, IN MOST CASES THE SPRINGS ARE OF MUCH GREATER STRENGTH (COMPARABLE TO ENGLISH FUSEE SPRINGS). THESE SPRINGS REQUIRE GREAT CARE FOR SAFETY. DO NOT ATTEMPT TO REMOVE THIS



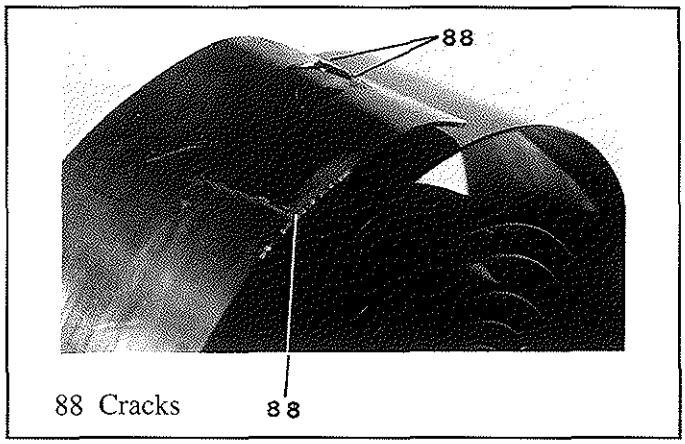
26 Spring Barrel
79 Main Spring
80 Barrel Clamp
81 H.E. Spring Anchor Pin
82 Spring Winder
83 Spring Retainer

Figure 10.2. Setup to remove spring.



84 Adaptor
85 Thumbscrew
86 Panhead Machine Screw
87 Spring Winder Chuck

Figure 10.3. Key drive adaptor converted to large winding arbor.



88 Cracks

Figure 10.4. Original spring.

SPRING WITHOUT AN ADEQUATE HEAVY-DUTY SPRING WINDER. (SEE FIGURE 10.1.)

NOTE: I use a Keystone KMW-1 winder. The model KMW-2 is heavier duty, but wasn't available when I purchased mine.

The music box mainspring arbor would not fit the chuck of my winder. The largest arbor which came with the tool had too small of a diameter to safely engage the spring. I had to invent a substitute.

A special arbor comes with the winder for use with the regular clock key. The outside diameter closely approximated the music box arbor diameter. I modified it by replacing the thumbscrew with a panhead screw. (See Figure 10.3.) The screw head was filed down to enter the inner coil hole. It acted as an arbor hook, and did the job well. (See Figure 10.2.)

NOTE: The spring in our movement is 1.285" x .025" x 80".

13.1. Remove cap in your usual manner.

NOTE: It can be pried off. However, I prefer to hold the barrel, cap down, in my hand with the arbor between my index and third finger. A sharp blow is struck on the arbor with a rawhide or plastic mallet. The cap usually pops right out.

Before popping the cap, check for a location mark. If none, make a mark. This way you can be certain that the cap will pop back in positively when reassembling.

13.2. Remove spring, if winder is available. (See Figure 10.2 for procedure with the Keystone winder.)

CAUTION: SPRING REMOVAL IS HIGHLY RECOMMENDED. OTHERWISE, HOW WOULD YOU KNOW THE CONDITION OF THE SPRING AT THE OUTER HOLE END?

NOTE: See Figure 10.4 for the condition of the spring removed from our movement. Besides the cracks and tears around the hole, the spring was barrel bound. These conditions were not visible while in the barrel. The spring was replaced. (See list of suppliers in an upcoming article in this series.)

Oddly, in the books I have dealing with music boxes, none discuss spring removal. If you are not removing spring from barrel skip to 13.4.

After spring removal, observe spring direction. If the barrel hook is not shaped to indicate direction, scratch an arrow in the barrel as an indication of the direction when reassembling.

13.2.1. Set aside spring barrel and cap with parts to be cleaned.

NOTE: If the cylinder is to be polished, the motor should also be polished. See Part 15 steps 20 - 20.3 in an upcoming article in this series for procedure.

13.3. Inspect removed spring for cracks, tears and general condition, including barrel bound.

NOTE: Barrel-bound springs can be stretched as you would with a clock spring. However, it is best to replace the spring.

WARNING: IF YOU INTEND TO TRY STRETCHING THE SPRING, WEAR A FULL FACE PROTECTOR, HEAVY GLOVES, AND A PADDED JACKET. THERE IS ALWAYS THE POSSIBILITY OF A BREAK. THIS SPRING IS POWERFUL.

13.3.1. If available, use an ultrasonic cleaning machine with a non-water-based ultrasonic cleaning solution for cleaning the spring. Proceed as you would with a clock barrel and spring.

CAUTION: WATER-BASED SOLUTIONS SHOULD NEVER BE USED TO CLEAN MAINSPRINGS. IT IS VERY DIFFICULT TO REMOVE THE RINSE WATER BEFORE IT HAS CORRODED THE STEEL, AND MAYBE OF MORE IMPORTANCE, THE SPRING MAY BECOME SEVERELY DAMAGED BY EXPOSURE TO WATER (A PHENOMENON CALLED HYDROGEN EMBRITTLEMENT WHICH CAUSES PREMATURE FATIGUING AND CRACKING OF SPRING METAL).

NOTE: The above caution is taken from the* Ultrasonic Horology Newsletter, *November 1981.

13.3.1.1. If ultrasonic is not available, use your normal cleaning procedure for cleaning clock barrels and springs. However, take cognizance of the above caution.

13.3.2. Lube mainspring using a good clock mainspring lubricant.

NOTE: I use Keystone Mainspring Lubricant-Medium applied lightly over the whole spring.

WARNING: WHEN PULLING THE SPRING APART TO LUBE, SEE WARNING 13.3.

13.3.2.1. To lube mainspring, insert ten-penny nail or other 1/4" diameter tool (screwdriver, etc.) through the end hole of the spring. Clamp the tool in a strong well-anchored vise.

13.3.2.2. Apply a small amount of the lubricant on a lint-free cloth, folded into a thin pad.

13.3.2.3. Insert a screwdriver or similar round tool through the center of the spring as a handle for pulling the spring to unwind for lubrication.

13.3.2.4. Work the pad along the spring as you pull to unwind. Add lube as required. Work the pad back and forth several times to assure complete coverage.

NOTE: It may not be practical to force the lube pad into the last few inner coils. After removing the spring from the vise, pour a few drops of the lubricant into the inner coils.

13.3.3. When barrel and cap are clean and the spring lubed, re-insert the spring into the barrel using the mainspring winder. Double-check the direction, using the arbor.

13.3.3.1. Insert arbor and seat the hook in the hole. Make certain that the spring is a snug fit around the arbor.

13.3.3.2. Replace cap in line with the markings.

NOTE: Some music box motors have a cardboard liner between the cap and the spring. If yours had one, re-insert it if in good condition. Otherwise make a replacement and insert that.

NOTE: Skip to 13.4.9.

13.4. Clean spring without removing from barrel.

13.4.1. Remove cap per 13.1, mentioned previously.

13.4.2. Remove arbor by rotating in reverse to winding.

13.4.3. Inspect spring for cracks or breaks, particularly around the hole which engages the arbor.

WARNING: IF ANY CRACKS OR BREAKS ARE VISIBLE - THE SPRING MUST BE REMOVED FOR REPAIR OR REPLACEMENT. IF YOU DON'T HAVE A PROPER SPRING WINDER, SEND THE MOVEMENT OUT TO A CLOCKMAKER WHO DOES. DO NOT TAKE A CHANCE TO REMOVE THE SPRING BY HAND. IT COULD PRACTICALLY EXPLODE.

13.4.4. Separate some of the coils so that the cleaning fluid will be able to penetrate.

13.4.4.1. Replace the arbor and hook it to the spring.

13.4.4.2. Hold geneva square in a vise. Then, using a clamp which has rubber or similar material cemented onto the clamp faces, clamp onto the gear.

13.4.4.3. Wind barrel three to four turns, and place spacers between several of the coils. The spacers should be brass or other soft material which would not be affected by the cleaning fluid you use.

13.4.4.4. Unwind spring leaving the spacers between the coils.

13.4.5. If available use an ultrasonic cleaning machine with a non-water-based cleaning solution. (See **CAUTION** 13.3.1.)

13.4.5.1- If ultrasonics are not available, soak barrel/spring in a non-water-based clock cleaning solution. Soak for several hours, preferably overnight. During soak, agitate the assembly several times in the solution to flush the fluid, removing dirt/dried oils, etc. Upon completion, rinse with a rinse designed for that cleaning solution.

13.4.5.2. After rinse, dry with hot air or your usual method.

13.4.6. Upon completion of the cleaning procedure, oil the spring with any heavy-duty clock spring oil. (I use Keystone Mainspring Lubricant-Medium.) Lay barrel down with the spring topside. Spread the lube over the top of the spring coils. Allow some time for the oil to seep between the coils, if possible. Then remove spacers following procedure 13.4.4.

13.4.7. Replace arbor.

CAUTION: MAKE SURE ARBOR TAB (HOOK) IS SEATED IN THE SPRING HOLE. ALSO, THE INNER END OF SPRING SHOULD WRAP AROUND THE ARBOR.

13.4.8. Replace cap.

13.4.9. At this time, determine whether the finish of the barrel assembly is clean and bright. Compare it to the pin cylinder. If the cylinder will be polished, then the barrel assembly should also be polished. Refer to Part 15, steps 20 - 20.3 in an upcoming article in this series for procedure.

13.4.10. Oil arbor at cap and barrel holes. Wrap completed spring assembly. Set aside until reassembly of the whole.

This completes Part 10. In Part 11, we will start with the governor.

AFFILIATE CHAPTER COLUMN

By Jack Kurdzionak

A Good Investment

This article is being written a day after the stock and bond market took a large plunge in value. By the time it appears in print the markets may have continued their fall, stabilized, or resumed their growth in value. The media have been focusing upon the drop in value for the past weekend with much speculation as to where the markets are going. One thing is certain with the investment market and that is no one knows where it is going but that doesn't keep people from investing their funds in the markets. There will be "bulls" and "bears" in the markets for the foreseeable future. Very few people will say that they shouldn't invest because they cannot predict the future.

Most of us will invest funds for our retirement in some investment vehicle or another. We invest in our homes by making improvements to keep them comfortable and marketable in the future. We invest in our children by providing them with a good home, a loving family, and a solid education. What we also need to do is invest in our own careers by taking care to see that our futures are solid. Many of us ignore our own professional development. We just can't assume that everything in our profession will remain as it has in the past. We have to take the initiative to see that we control the future as much as possible. Many things are beyond the control of the horologist, just as investments are beyond the control of the individual. We must make the best of the situations at hand and enhance those situations when possible. You can enhance your own future by furthering your education, stretching your abilities to their limits in your workplace, keeping abreast of the industry, and joining professional and business organizations. You will remain a valuable asset to your employer and protect your own job by being the best you can be in your career. Joining a professional or business organization by itself does not ensure dividends to your career. You must invest in those organizations as well.

Paying dues and attending meetings is the minimum you must do to join many organizations, but to make the organization do more for its members and prosper, you must invest in the organization. This is not a money investment. It is one which involves time and directed effort. AWI is your national professional organization and it needs you now.

The annual meeting will take place on June 28, and every affiliate chapter has a right to send a representative to that meeting. Every member of AWI has a right to attend all of the annual meeting as well as speak about any issue before the directors and the delegates. It does take time and money to attend, but it is an invaluable investment in the future of your chapter and your profession. The time involved is three days, from Friday through Sunday, and the place is near the Greater Cincinnati Airport. You might say to me that you can't find the time to get away for three days to attend. My answer to you is that you can't afford to miss the meeting. If you don't attend, you might be able to spend a few more hours at the bench doing work that can wait a few days longer before it is finished. If you don't go you may spend a day on the golf course or some other leisurely pursuit. It wouldn't be the end of the world if you took a few days off from work or play. Some folks say that their businesses cannot run well without them there. I can't speak for them but my own experience is that business is better without me there. My employees don't seem to mind my absences at all. They encourage me to go away more often.

Others might say that the cost of attending is a hardship. This can be overcome with AWI sharing some of the travel expenses and the affiliate chapter treasury making a contribution. The effort you make to attend the meeting is your investment in your future, the future of your profession, and the future of your affiliate chapter. When you meet with the leading horologists in the country you cannot go back to your chapter and your work without a sense of enrichment. One delegate from New Jersey once said that he comes to the annual meeting every year because he cannot afford missing the meeting. If you don't come, you can't participate.

If our children had an opportunity for professional and organizational growth, wouldn't we encourage them to seize each and every opportunity when it presents itself? Why don't we take our own good advice that we give to others? We are giving sound advice when we tell others to invest in their future. We should heed our own words.

Please make every effort to attend the meeting. Call the folks at AWI Central now for more information—time is running out. Just remember that you must provide for the future of your profession, otherwise you will have no future in your profession.

WORKING WITH MAINSPRINGS

By David J. Carlson

When a mainspring is the power source for a timepiece it is important that we understand proper maintenance and the options for repair and replacement. The time invested in working with mainsprings will result in fewer comebacks and the satisfaction of knowing the timepiece has been restored to proper operation.

History

The invention of the mainspring in 1500 by Peter Hele (Henlein a locksmith of Nürnberg, Germany) made truly portable timepieces possible. Early development of the mainspring was most probably based on the experience of metal smiths who produced swords and learned how to "work" steel to form a long elastic ribbon which we now call a mainspring. Hard brass ribbon has also been used for mainsprings, particularly in some early American clocks. The mainsprings considered here will be those of steel although the same general concepts apply to both brass and steel.

Mainspring Characteristics

An edgewise view of a section of spring steel anchored on one end is shown in Figure 1. If a force "F" is applied, the spring is deflected downwards from its horizontal position. The force is distributed throughout the spring such that the metal surface on the top is stretched and the bottom surface is compressed. There is a "neutral plane" between the top and bottom surfaces that is under zero stress. In opposition to the external force F, the spring "pushes back" with an equal and opposite force F'. If the external force F is removed, the internal force of the spring F' returns the spring to its original horizontal position. On a larger scale, this is the same process that happens when a mainspring is wound. As the mainspring unwinds it supplies the energy which was stored during the winding process.

The amount of force required to bend a spring and the amount of energy that it can store depends on the stiffness of the steel. The stiffness can be calculated by means of an equation[1] which combines the mainspring dimensions and the elastic limit of the steel. Interpreting the equation is very valuable when considering mainspring substitution:

- The stiffness of a spring varies directly with its width and as the cube of its thickness. If it is necessary to substitute a mainspring, it is preferable to accept a 10% reduction in width rather than a 10% reduction in thickness because the change in thickness would reduce the power three times as much as the change in width.

- The elastic limit determines how much a spring can be stressed or bent before it will not return to its original shape. When a new mainspring is first wound, it is stressed beyond its elastic limit and is formed into the familiar spiral that we see in an unwound spring. The

"If it is necessary to substitute a mainspring, it is preferable to accept a 10% reduction in width rather than a 10% reduction in thickness because the change in thickness would reduce the power three times as much as the change in width."

cause of the deformation is the slippage of the material at the molecular level. Referring to Figure 1, the outer layers of the spring are permanently stretched and the inner levels compressed. After many windings, the subtle variations in stress will gradually cause the mainspring to become a smaller spiral in the unwound condition. When the unwound spiral becomes too small the amount of energy that it can store when it is wound will be reduced and the mainspring should be replaced.

- Reducing the length of a mainspring will reduce the running time of a timepiece. If for example, you require a 3/4" x .018" x 96" and substitute a spring of the same width and thickness but only 70" long, the number of turns will change by the square root of the ratio of the length.

$(96/70)^{1/2} = 1.2$ times reduction in turns

If the clock was designed to run seven days with the 96" spring, it would run 7/1.2 = 5.8 days.

Increasing the length of spring will generally not improve running time and in the case of a spring barrel may well reduce it.

Safety First

The power of a mainspring should never be underes-

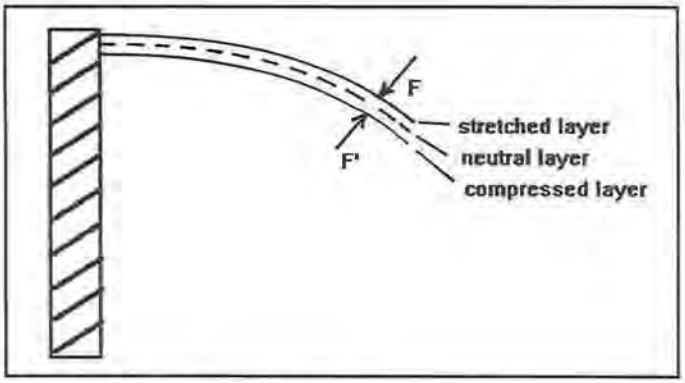


Figure 1. Stiffness of a spring.

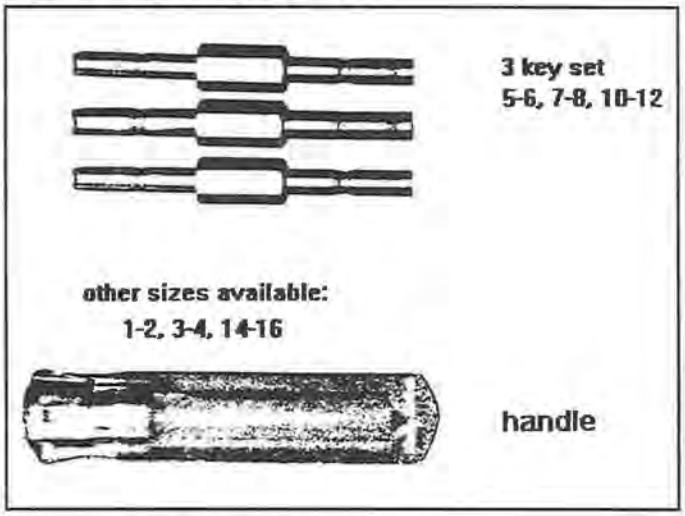


Figure 2. Let-down key set.

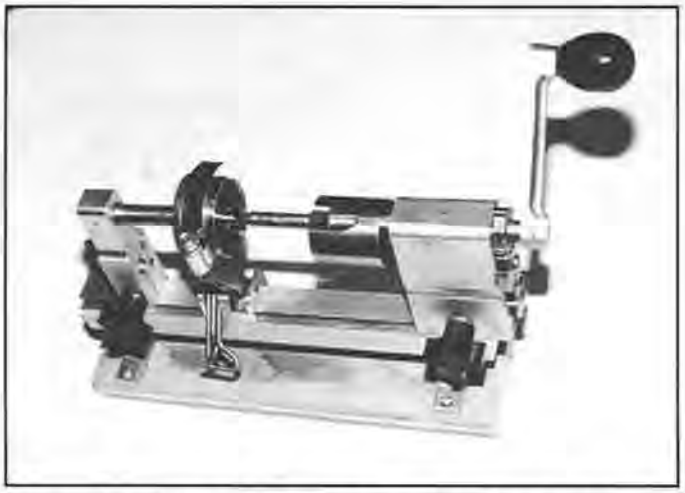


Figure 3A. "Olie Baker" winder with spring barrel.

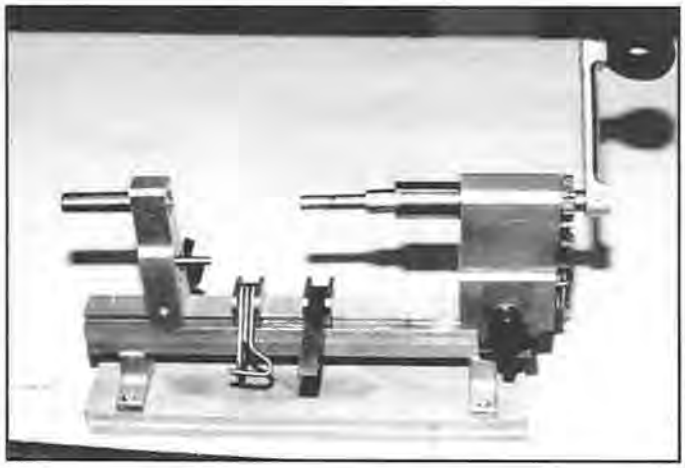


Figure 3B. Ready for hole-end spring.

Figure 4. Bergeon spring winder.

timated. The smallest mainspring in a ladies watch can flip parts into unprotected eyes. Mainsprings in the larger clocks can propel parts with potentially lethal consequences.

Letting the Power Down

Before attempting to take any timepiece apart, the power must be let down. This is customarily done with a let-down tool. A very useful let-down key set with interchangeable chucks is shown in Figure 2. To let the power down in a spring barrel, the let-down tool is placed on the winding arbor. While firmly holding the let-down tool, the winding ratchet click is released, and the let-down tool is allowed to gradually rotate in your hand using the friction of your hand to slow down the rotation of the winding arbor until the power is fully released. If the spring is of the open type, the spring should be wound and a mainspring clamp used to constrain the expansion of the spring when the power is let down so that it can be removed easily from the timepiece.

Removal Problem

In some cases where an unconstrained mainspring has broken or the ratchet assembly has failed, the mainspring will expand to such an extent that the movement cannot be removed without damage to itself or the case. If the click assembly has failed, you may be able to wind the spring and trap the great wheel. If winding is not convenient or the spring has broken, the outer coils of the spring can be cut off with a shears (a straight cut double-action aircraft type does a good job) until sufficient spring material has been removed.

Mainspring in a Barrel

The spring barrel is a widely used technique to limit the expansion of a mainspring. In most applications the barrel is combined with the first or great wheel. One of the questions that is most often asked is what is the correct length of a mainspring. It is fairly straightforward to develop an equation[2] to determine the mainspring length:

$$\text{Length} \quad \frac{Pi}{2\,t} \quad (B^2-A^2)$$

where Pi = 3.1416
B = barrel radius
A=arbor radius
t = mainspring thickness.

Removing a Mainspring from a Barrel

An important part of any timepiece overhaul is the inspection and servicing of its mainsprings. A mainspring in a barrel poses a special problem because even after the "power is let down" the spring is under tension. I strongly recommend a spring winder which will more than pay for itself in the long run. There are many types of spring winders available of which three are listed: "Olie Baker,"

Bergeon, and "Givler." (Note descriptions below.) Figure 6 shows an assortment of spring winders for watches.

Figure 3A — "Olie Baker"
Type: spring winding lathe
Arbor: Uses original arbor plus a let-down tool in the headstock.
Barrel Holding: hose clamp and stop
Spring Retainer: sleeve
Feature: Tailstock is reversible with a pin for winding loop-end springs. (See Figure 3B.)
Comment: Most useful of the presently available winders.

Figure 4 — Bergeon
Type: slotted sleeve and ram
Arbor: series of slotted sleeves and matching arbors
Barrel Holding: none
Spring Retainer: slotted sleeve
Comment: Very expensive system. Useful for inserting spring but not for removal from spring barrel. Special use has been found in making new springs from bulk spring stock. (See the text on "Making a Mainspring.")

Figure 5 — "Givler"
Type: "U" frame with detented winding handle
Arbor: series of interchangeable arbors supplied
Barrel Holding: none
Spring Retainer: special clamp, two sizes supplied
Comment: Difficult to hand hold the barrel while inserting and removing spring. Useful on occasion for rewinding loose springs.

Safety Note

When winding or unwinding mainsprings, *always* position yourself so that if something breaks or gets out of control you are not in the plane of the expanding spring!

Servicing a Mainspring

Inspection

Mainspring inspection is very important. Typical of the faults are those shown schematically in Figure 7. Another fault not shown are raised areas within the spring which our British friends call "knuckles."

Cleaning

Petroleum-based cleaners are the most effective. Carburetor cleaner, available from most auto supply houses, is very good. In some cases, particularly the older clock springs, a hard varnish-like residue may remain on the spring after cleaning. To remove this residue, a fine grade of steel wool may be used. With one end of the spring secured in a bench vise, the spring may be polished with the steel wool. In stubborn cases, the process can be repeated.

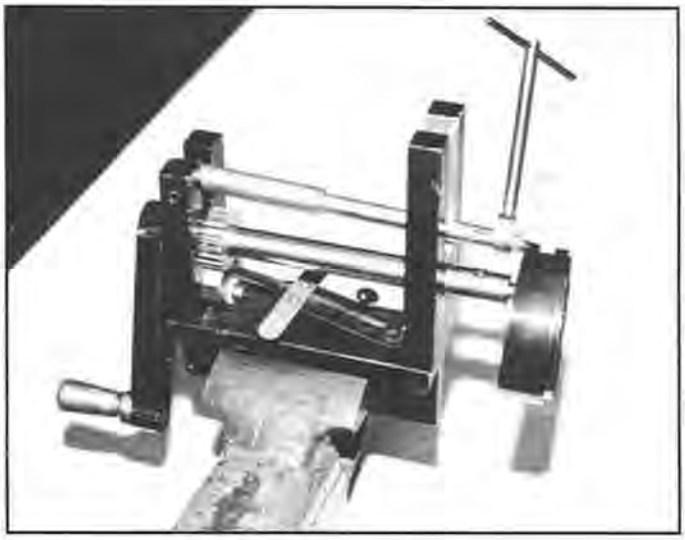


Figure 5. "Givler" spring winder.

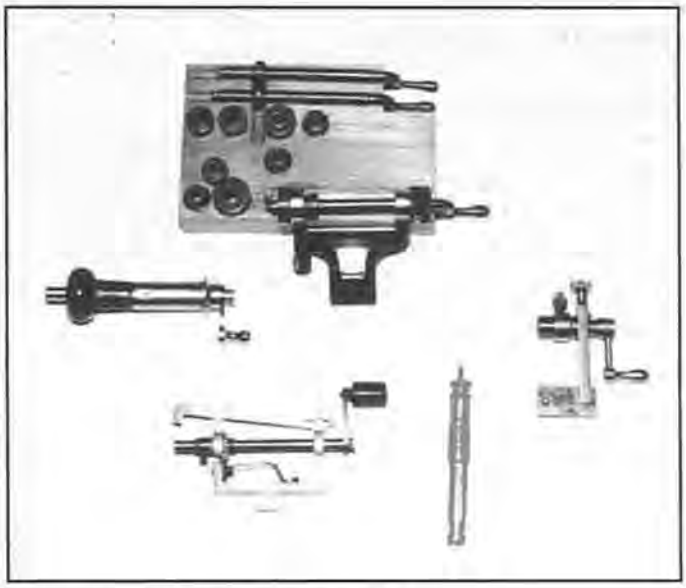


Figure 6. Watch mainspring winders.

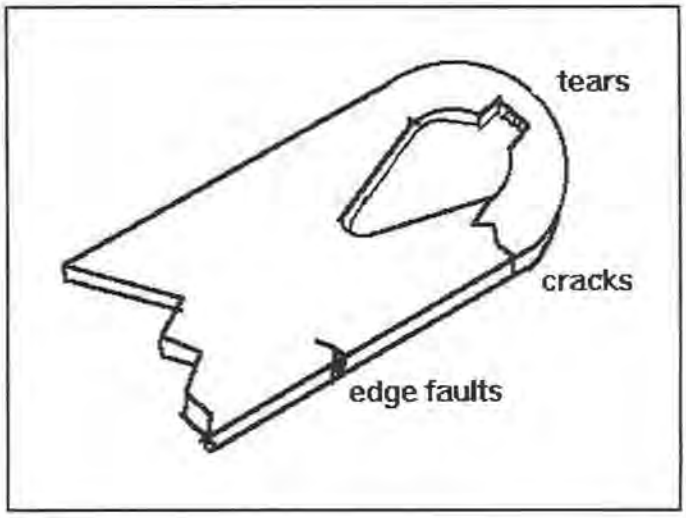


Figure 7. Mainspring faults.

Lubrication

During the winding and unwinding process, the surface to surface friction of a spring is very high. The job of the lubricant is to minimize the friction while not being squeezed out by the pressure. I recommend grease as the lubricant of choice. For most mainsprings a good-quality automobile gear grease has proven very satisfactory. For smaller timepieces use a lighter grease such as one of the Moebius products.

To apply the grease, trap the end of the spring in a bench vise and use a brass rod (a screwdriver will do) in the center loop to stretch out the spring. To apply the grease the old "bicycle chain" method is best. A small amount of grease is picked up between the thumb and forefinger and rubbed simultaneously into the front and rear surface of the spring. A fringe benefit of this method of application is that small flaws missed during the visual inspection of the mainspring can be sensed by "touch." For the inner coils of the spring that cannot be easily opened use a cotton swab or a pipe cleaner.

Repair or Modification of Mainsprings

The two principle types of mainspring ends for clocks are shown in Figure 8. These are the "hole end" or "loop end." The loop end has two sub varieties: single-piece or two-piece. Making an end on a spring is a reasonable task in the shop either for the purpose of repair or for changing from one type of end to the other.

Hole End

The procedure for making a new hole end for a 3/4" mainspring follows (smaller or larger springs can be scaled proportionately):

1. Cut the old end off the spring using a suitable shears or cut-off disk.
2. Hold the spring in a bench vise with 2-3" showing above the vise.
3. Draw the temper for 1 1/2".
4. Round the end of the spring using a file or sander.
5. Locate and center punch a mark in the center of the spring 3/8" from the end.
6. Drill or punch a 1/4" hole. (*Caution*: if drilling be sure to clamp the spring!)
7. Backfile the 1/4" hole to form a teardrop shape 1/2" long. (See Figure 8 - hole end.)
8. Finish the spring with fine emery paper to remove any rough spots which might become the site of future failures.
9. Use a large round nose or chain pliers to work the hole in the end of the spring so that it will more easily catch the barrel hook.

Loop End

To make a loop end for a 3/4" spring (scale other sizes proportionately):

1-3. Same as hole end.

4. Locate and center punch a mark in the center of the spring 1/4" from the end.
5. Drill or punch a hole for the rivet. Select the hole size for the available rivet diameter as shown Figure 9A.
6. Start forming the end of the spring around a 1/4" mandrill and captivate the assembly in the jaws of a vise (see Figure 9B).
7. With the pieces still in the vise, squeeze the spring in the area shown in Figure 9C with a pair of smooth jaw pliers. (A double-action type is best for the job.)
8. Transfer the rivet hole location while the assembly is still in the vise and drill or punch the hole.
9. With the mandrill in place, rivet the two-piece together. Care should be taken not to be overzealous with the hammer or the rivet holes can be torn.

An alternative to forming the hole is to save the loop ends from two-piece hole-end springs and simply transfer them. (See Figure 8.)

Forming a Hole at the Center of a Mainspring

At best, the work required to form a new center hole in a mainspring can be very tedious and is low payback for the time involved unless it is a special spring or an urgent repair situation.

With a pair of round nose (chain or loop-forming) pliers pull the center of the mainspring out of the center while at the same time unwinding it. The loop-forming pliers are used to prevent the possibility of a sharp bend which could be the site of a future failure. Continue to unwind and straighten the center section of spring until there is sufficient material to capture in a vise.(Save the old center section to use as pattern.) The steps that follow to form the hole are essentially the same as above for the "hole end" with the exception of the hole and shape of the spring which is usually tapered. After the hole is formed the chain-nose pliers are used to reform the spring and shape it around the arbor. Be careful in the forming process not to introduce any sharp bends.

Making a Mainspring

There are times when a mainspring is not available from the supplier. This happened to a friend of mine and myself. We both had need for a large Seth Thomas Sonora Chimes mainspring. The spring calculated out to be 1" x .018" x 119".

To solve the problem we purchased a roll of .018" spring stock from a materials vendor[3]. The roll was 110' long at a cost of $75. The stock was excellent quality with a high-gloss blue finish and a rolled edge. The economics of the purchase worked out well because we had the potential of making eleven springs from the stock. Actually we made five springs at a value of $20 each for the first batch.

Fabricating the Spring

(Using the Bergeon spring winder shown in Figure 4*.)

- Cut the spring to length, make the outside loop or hole-end.
- Make the inside hole for the winding arbor. (For the above spring, I pulled the temper for 2 1/2" to allow a longer section to form the initial loop for the winding arbor.)
- Wind the spring into the sleeve.
- Using the ram, eject the spring almost halfway from the sleeve and put a wire girdle or a spring keeper in place.
- Eject the spring the remainder of the way from the sleeve.
- If the spring is not to be used immediately, store in rust-free environment.

* The initial "winding" of a spring takes considerably more effort than subsequent windings. In the initial winding the spring is stressed beyond its elastic limit and forms the large spiral we are used to seeing. When using other spring winders or a lathe, *safety* should be a primary concern. I personally "chicken out" on large fusee springs and prefer to use one of the mainspring suppliers that advertise through AWI.

ENDNOTES

1. Stiffness Formula:
   Stiffness = $(C\ t^3\ w\ E) / L$

   C = measuring system constant
   t = thickness
   w = width
   E = modulus of elasticity
   L = length

2. The formula to calculate the length L of a spring can be easily derived in three steps:

   a) Volume of a spring barrel = $Pi\ (B^2-A^2)\ H$

   where Pi=3.1416
   B = barrel radius
   A = arbor radius
   H = arbor height

   b) Volume of a spring = LtH

   where L = spring length
   t = thickness or strength
   H = height of the spring

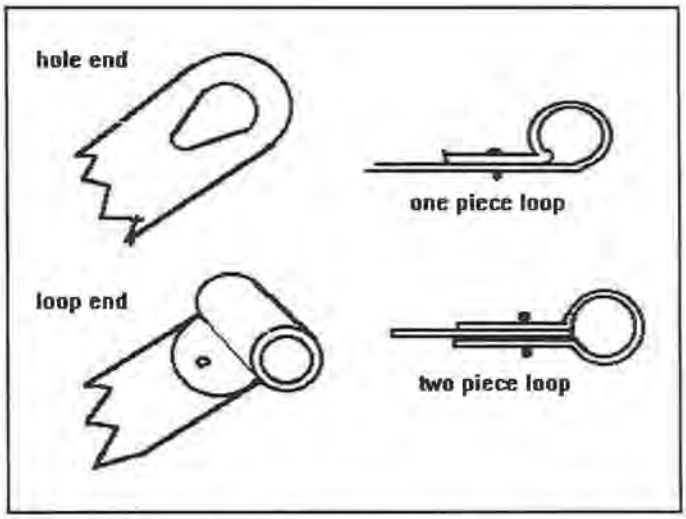


Figure 8. Hole-end and loop-end mainsprings.

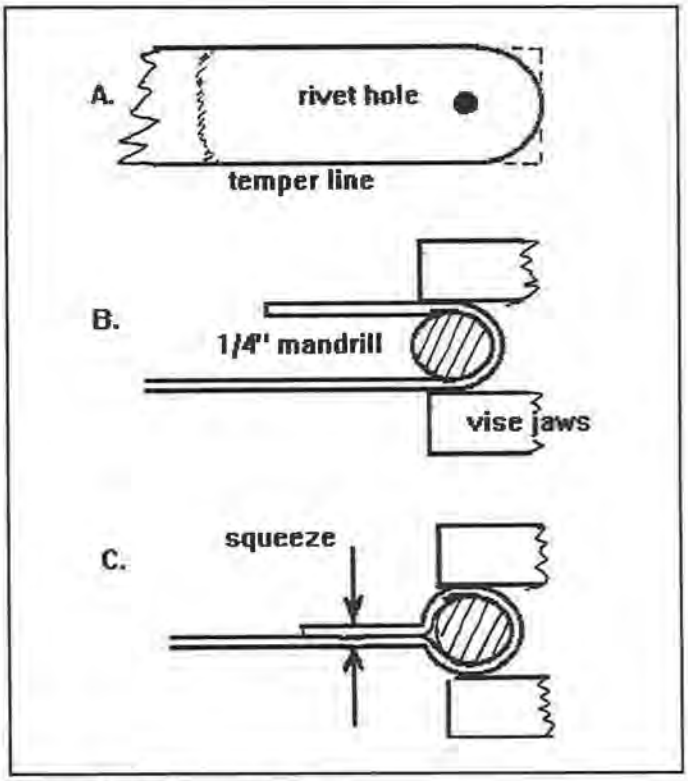


Figure 9. Making a loop-end.

c) Let the volume of the spring fill half the volume of the spring barrel:

$$LtH = 1/2 \times Pi\ (B^2-A^2)H$$

Simplify and solve for L:

$$L = \frac{Pi}{2t}\ (B^2-A^2)$$

3. Spring Material Supplier: McMaster-Carr Supply Company, P.O. Box 4355, Chicago, IL 60680-4355. Phone: (708) 833-0300.

A Practical Course In Clock Repair

Unit 1

Measuring Tools And Their Use

By John P. Kenyon, CMC

A clockmaker will discover early-on the significance of accurate and precise measuring instruments. Whether refurbishing an old part, fabricating a new one, ordering a replacement, repivoting, or doing bushing work, success in the final result is largely dependent upon the accuracy of measurements.

The most common measuring tools used in a clock shop are rules (scales), slide caliper rules, and micrometers. Each of these devices will be discussed. Specialty measuring instruments that are designed for specific purposes will be examined as we employ them later in the series.

Both metric and inch measurements are used in clock work, but most clockmakers prefer the metric system. In our discussion of the rule and slide caliper rule, we will use the metric system. (I am assuming that our "circle" is familiar with the inch scale on these instruments.) With respect to micrometers, we will cover both metric and inch scales.

It is possible to measure in one system and convert to the other with a simple formula or a conversion table.

Metric Measurements

The metric system is based on a decimal sequence of measurements. The standard unit of metric measurement for length is the meter, but generally the clockmaker uses the centimeter (cm) and the millimeter (mm) scales. All units in the system are divisible by ten. For example:

10 millimeters = 1 centimeter
10 centimeters = 1 decimeter
10 decimeters = 1 meter

Clearly, the metric system is more convenient to use than the inch system, since it is not necessary to work with fractions. Some conversion factors for metric to inch scales are:

25.4 mm = 1 inch
2.54 cm = 1 inch
1 cm = 0.3937 inches
1 mm = 0.03937 inches

This device is sometimes referred to as a scale, ruler, or steel rule. (See Figure 1.) It usually is made from stainless steel. Soft metal, wood, and plastic are not practical for the clock shop. The surface of these materials becomes easily scratched and/or defaced to such an extent that it is impossible to read the scale with accuracy. Frequently, the rule will be a combination device with inch and centimeter scales back to back on the same side. The metric scale is graduated in millimeters, and the inch scale, usually, in sixteenths or thirty-seconds of an inch. Of the three measuring tools to be discussed, the rule is the least accurate, but adequate for many routine measurements of length, width, and diameter where extreme accuracy is not required.

The slide caliper rule is similar to the rule, with the addition of a stationary jaw at the end and a sliding jaw that can be moved up and down the scale. The one illustrated in Figure 2 has a 15 cm scale. The sliding jaw can be locked in position by lock screw (a). Measurements for outside diameter can be taken between the jaws, as illustrated at (b). Inside diameter is measured between the surfaces (c) and read at (d) which compensates for the

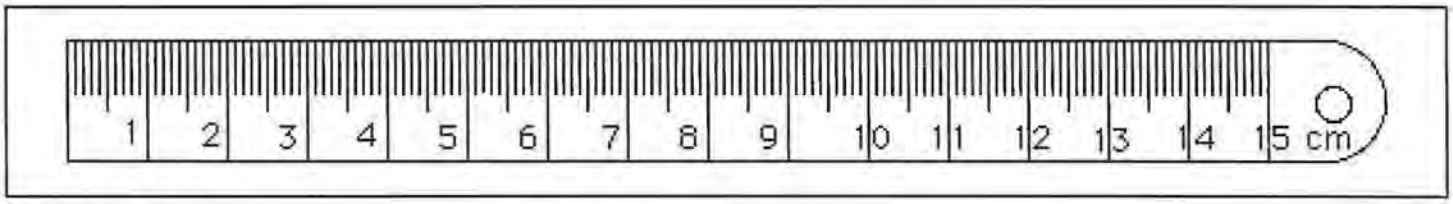


Figure 1. Rule.

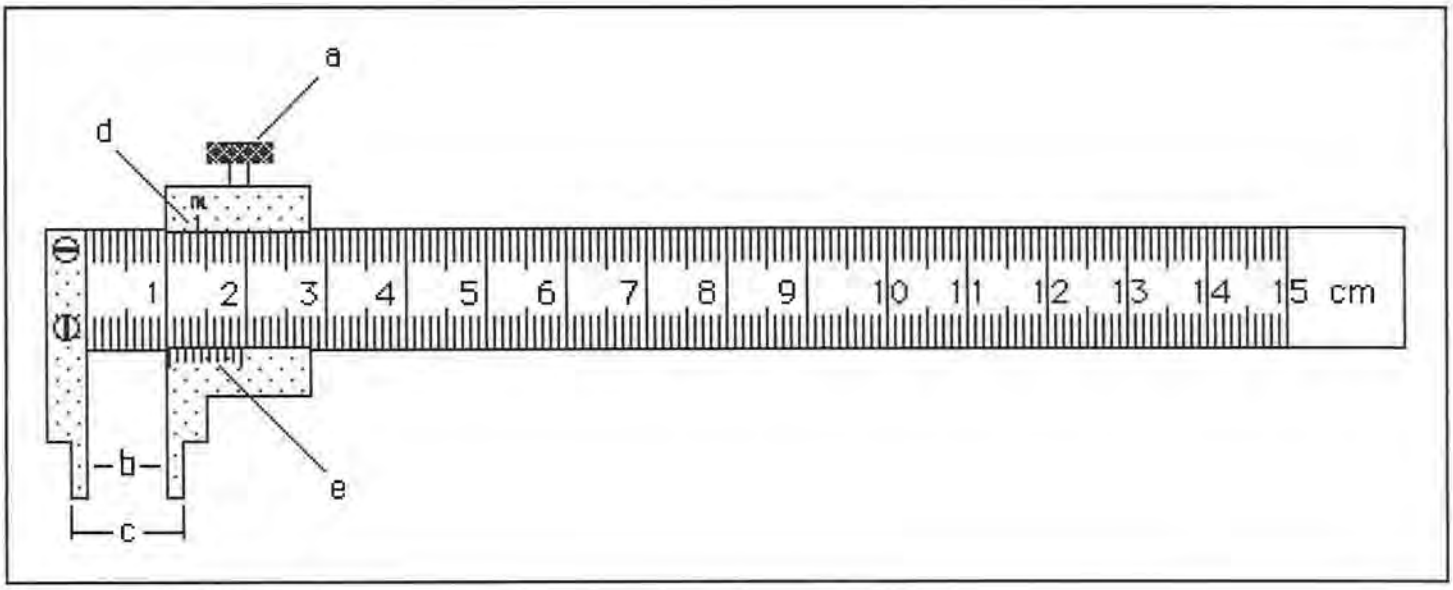


Figure 2. Slide Caliper Rule.

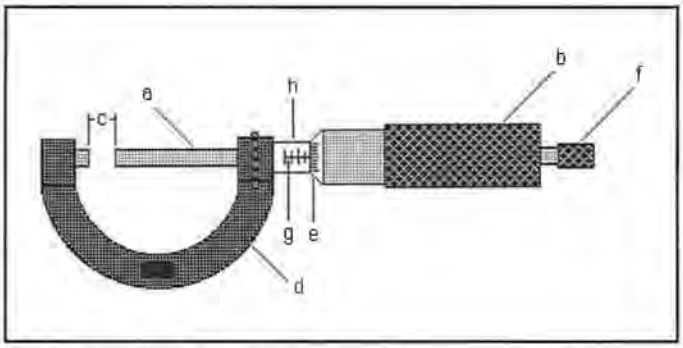


Figure 3. Micrometer.

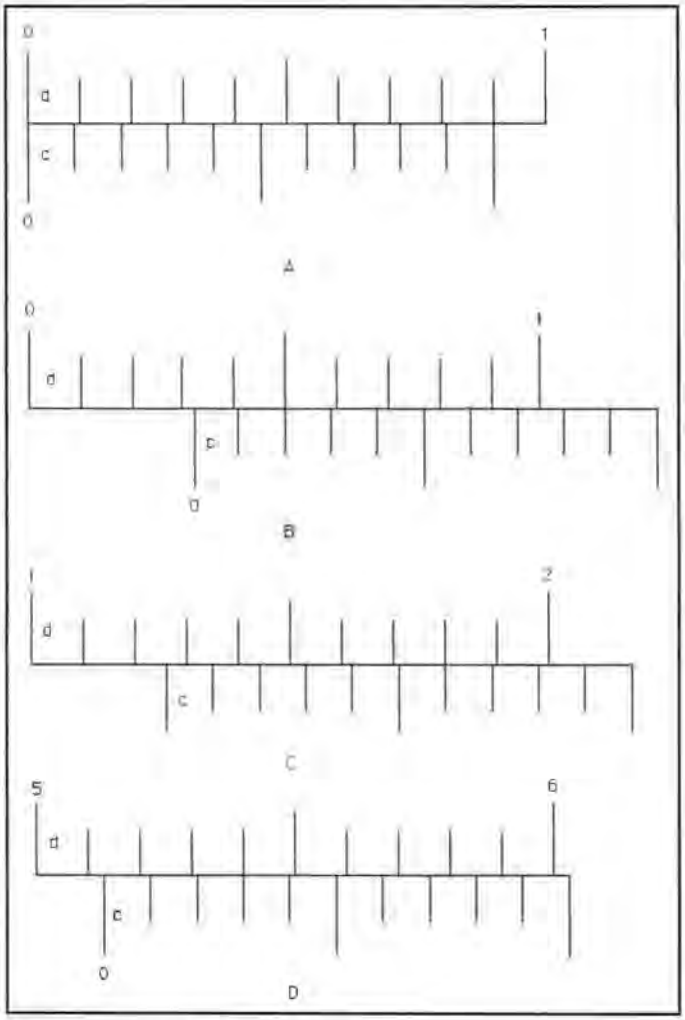


Figure 4. Vernier Scale Readings.

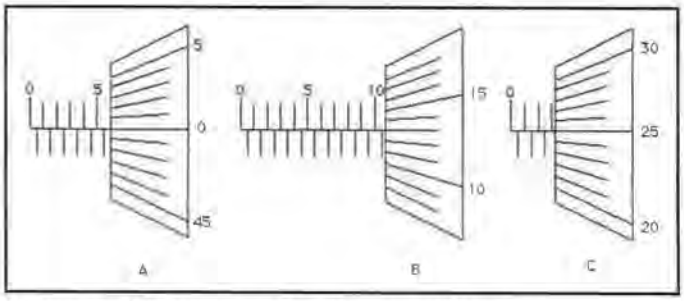


Figure 5. Micrometer Readings—millimeters.

thickness of the jaws. Some slide calipers are equipped with a thumb screw to move the jaw, and measurements are read on a dial or on a digital scale. Some may have a steel rod depth gauge built in that extends from the end when the jaws are opened. Electronic digital models are readable to 0.01 mm. The caliper illustrated in Figure 2 is equipped with a Vernier scale (named after the inventor) at (e), which is accurate to 0.1 mm.

Vernier Scale

For improved accuracy, a reading to one-tenth of a mm (0.1 mm) can be taken from a Vernier scale. This scale is located at (e) in Figure 2, and illustrated in Figure 4 A. Notice that scale (c) is made up of ten equidistant lines in the space of nine millimeters. When closed, the zero on the Vernier scale (c) will line up with the zero on the metric scale (d). In this position, the next two lines on the scale will differ from each other by 0.1 mm and the difference will increase by 0.1 mm at each graduation up the scale until line 10 on (c) scale corresponds with line 9 on (d) scale. To read a Vernier scale, determine which line on (c) scale aligns with a line on (d) scale. Count the lines on (d) scale up to that point and read directly. For example, Figure 4B shows the zero on (c) scale beyond line three on (d) scale. This indicates 3 mm plus the distance between line three on the (d) scale and 0 on the (c) scale. Since line two on the (c) scale lines up perfectly with line five on (d) scale, the additional distance can be read directly from the Vernier scale and expressed as 0.2 mm. The total reading is 3.2 mm. In Figure 4C the reading is 12.6 mm. In Figure 4D it is 51.3 mm.

The micrometer is an instrument used for extremely accurate measurements. The frame (d) is made from ridged steel with an adjustable cylinder, illustrated at (a) in Figure 3. Turning knurled nut (b) called the thimble, moves cylinder (a) to adjust the distance between the points (c) where the measurement is made. A scale on the sleeve (h) and another on the thimble (e) is read, and combined to provide a measurement in millimeters or in thousandths of an inch, depending on which system you are using. It is necessary to develop a "feel" or "touch" for the correct pressure when adjusting the micrometer to take a measurement. The points should never be closed tightly on the piece being measured, or damage could result to the instrument or to the part. A "Ratchet stop" (f) is available on the end of the thimble of some micrometers. It is adjusted to the exact amount of tension for a correct measurement. Use of a ratchet is satisfactory for most clock work, but it should not be used for watch work where damage might occur to the tiny parts from the force of the points.

Micrometers are used to measure length, thickness, and outside diameter. Inside diameter also can be determined by using an inside caliper to measure the distance, then reading the span of the caliper with a micrometer.

All measuring tools should be handled with care. Dropping or mishandling a micrometer or a sliding caliper will result in inaccurate readings. Sliding calipers and micrometers can be easily checked for accuracy by indexing at zero to verify that the graduations line up.

Reading a Metric Micrometer

The scale (g), on sleeve (h) in Figure 3, is usually graduated in 0.5 mm, and numbered at 0 mm, 5 mm, 10 mm, 15 mm, etc. (Some may be graduated in full millimeters, but numbered the same.) Scale (e) on thimble (b) is marked with 50 equal divisions of 0.01 mm, numbered at 0 mm, 0.05 mm, 0.10 mm, 0.15 mm, etc., and moves 0.5 mm in a full revolution of the scale on thimble (e).

When making a reading, the number of full divisions visible on sleeve scale (g) are first counted. The reading will be millimeters. Next, the numbers of divisions on thimble scale (e) are counted up to the one that coincides with the axial line on scale (g), and read as a decimal part of a millimeter. This reading is added to the reading from scale (g). Figure 5A shows a reading of 6 mm on sleeve scale (g) and 0 mm on thimble scale (e) for a total of 6.0 mm, Figure 5B reads 10.5 mm on sleeve scale (g) and 0.13 mm on thimble scale (e), or a total of 10.63 mm. Figure 5C would be 3 mm plus 0.25 mm or a total of 3.25 mm.

Reading an Inch Micrometer

The scale (g) on the sleeve is graduated in 0.025 inch, and numbered 1,2,3, etc. at every fourth division to mark hundreds of thousandths. Thimble scale (e) is marked in 25 equal divisions of 0.001 inch, numbered at zero, 0.005 inch, 0.010 inch, 0.015 inch, etc. One full turn of the thimble is equal to 0.025 inch.

To make a reading, count the number of full divisions visible on sleeve scale (g) and multiply by 0.025 inch. Next, the number of divisions on thimble scale (e) are counted up to the one that coincides with the axial line on sleeve scale (g), read as thousandths of an inch, and added to the count on sleeve scale (g). Figure 6A shows 0.150 inch on sleeve scale (g) and 0 on thimble scale (e) for a total of 0.150 inches. Figure 6B reads 0.225 inch on sleeve scale (g) and 0.020 inch on thimble scale (e), for a total of 0.245 inches. Figure 6C would be 0.100 inch plus 0.012 inch or a total of 0.112 inches.

Frequently, it is necessary to refer to a conversion table to convert the decimal into a fraction when working in inches. These tables can be found in engineering text books, and are sometimes stamped on the "U" frame of the micrometer.

Both metric and inch types of micrometers will sometimes have a Venier Scale stamped above the sleeve scale that coincides with the thimble scale for readings of further accuracy. It is used in the same manner as on the slide caliper rule.

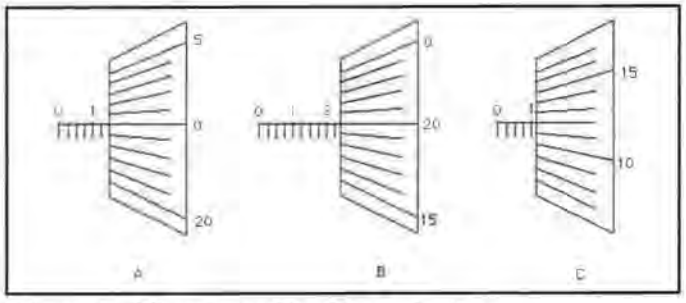


Figure 6. Micrometer Readings—inches.

Repairing Mechanical Watches & Clocks

A Complete Series of Bench Practices

Replacing Regulator Pins, Unit II, Part 2

By Henry B. Fried, CMW, CMC, FAWI, FBHI, ★FNAWCC

Another method of repairing a broken regulator pin is to file the stump of the broken pin flush with the underside of the regulator. Then a very fine pivot drill, set into the nib of a bench screwdriver is made to drill a hole through the center of the stump, as shown in Figure 16.

A fine piece of wire is then prepared which will fit tightly into this hole, and the length is adjusted to suit the regulator key. This finished job should appear as shown in Figure 17.

Replacing pins for a Breguet regulator is easier than furnishing those for a flat hairspring. The pins may be thicker since there are no adjacent coils that can contact them. Generally, the space required between the two pins of a Breguet regulator is not as great as between the pin and key of a "flat" regulator. However, these pins must be perpendicular, parallel to one another and present a smooth appearance.

The pins of a Breguet regulator must not be too long or they might protrude down into the lower level of coils. However, they must be long enough to contain the overcoil. This is shown in Figure 18, where the regulator pins straddle the overcoil but are long enough to extend only slightly below the bottom of the overcoil.

The very ends of Breguet regulator pins must not be burred because, as shown in Figure 19, it will be difficult to place the overcoil in between the pins. Furthermore, burred pins present the danger of the lower coils getting caught on the shelf of the burr should the watch receive a bump that would cause the lower coils to be jarred upwards.

To remove any burrs from the inside ends of the pins, a fine screwhead file is used. To prevent the lower coils from getting caught on the burrs and to provide additional clearance in such a case, the outside ends of the pins should be filed and beveled as shown in Figure 20. This should be done preferably with a fine Arkansas oilstone slip as a coarse file may raise burrs itself.

The space between Breguet regulator pins should be close enough to brace the hairspring without any noticeable light between the pins and the hairspring, but yet not so tight that it binds the spring so that any movement of the regulator index causes the spring to buckle as was shown in Figure 7. (See Unit II, Part 1.)

When the pin holes in the regulator are drilled far apart so that the pins appear as shown in Figure 21, these then must be brought closer together to comply with the requirements stated in the previous paragraph. However, they must not be bent as shown in Figure 22 as this, in turn, will cause the error that was illustrated in Figure 4. (See Unit II, Part 1.) When the pins are planted far apart, they may be brought closer together by bending these pins so that they appear as shown in Figure 23. Of course this operation shortens the pins so that this must be taken into consideration when the pins are made.

To bend the pins as in Figure 23, a special pair of tweezers is recommended. These tweezers are shown in Figures 24 and 25 and are very useful for adjusting Breguet regulator pins. Figure 24 shows the tweezer into which a groove (B) is cut in each point. These grooves fit partially around the regulator pins. A very thin strip of mainspring wire "A" is riveted to the lower inside of one of the tweezer blades at "C."

"The space between Breguet regulator pins should be close enough to brace the hairspring without any noticeable light between the pins and the hairspring, but yet not so tight that it binds the spring so that any movement of the regulator index causes the spring to buckle..."

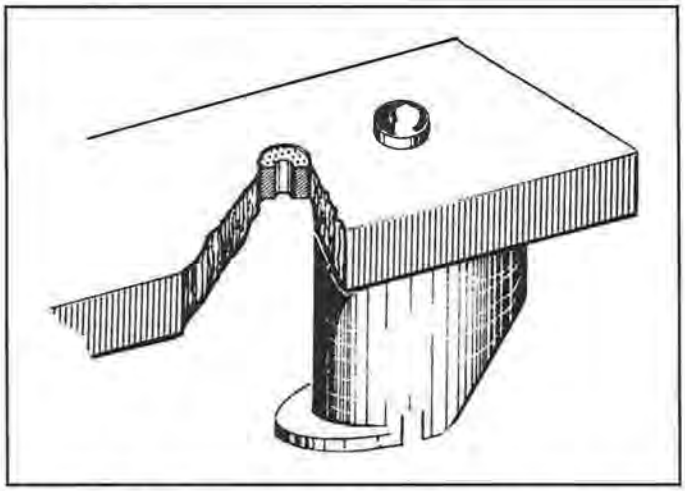


Figure 16. Preparing old pin for repair, top is filed flush with the regulator and hole is drilled in center of stump of old pin.

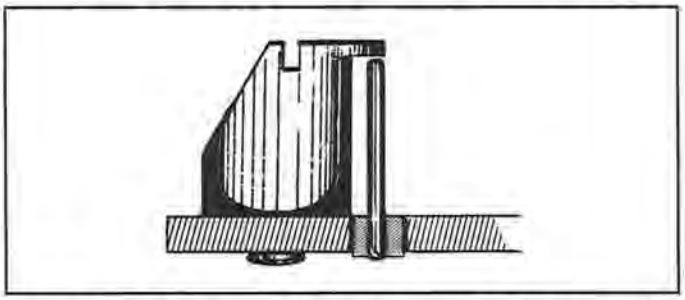


Figure 17. A fine piece of wire is inserted tightly in drilled hole in stump and its length is adjusted to fit regulator key.

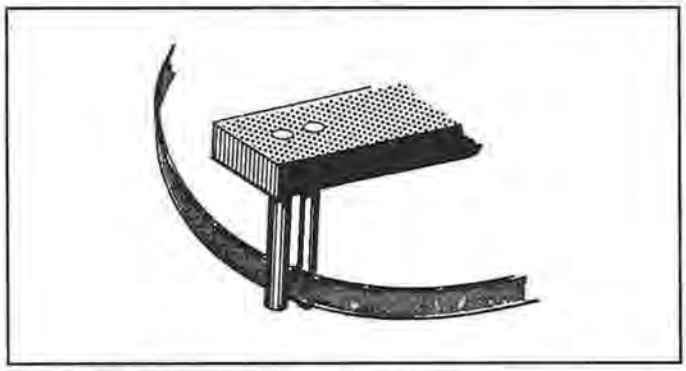


Figure 18. Regulator pins should be only long enough to extend slightly below the bottom of the overcoil.

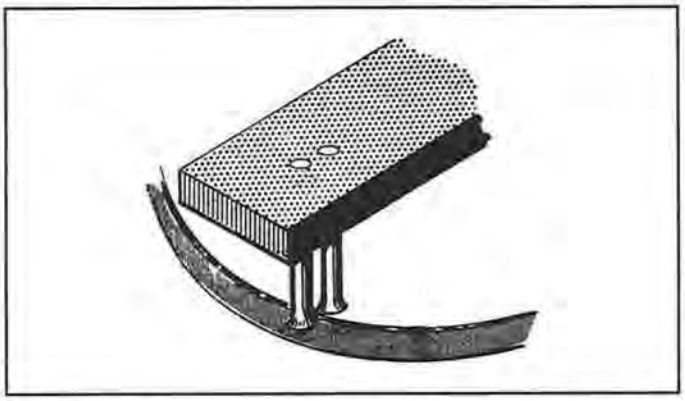


Figure 19. Bottom of the pins should not be burred as this could cause lower coils to catch if watch receives jar.

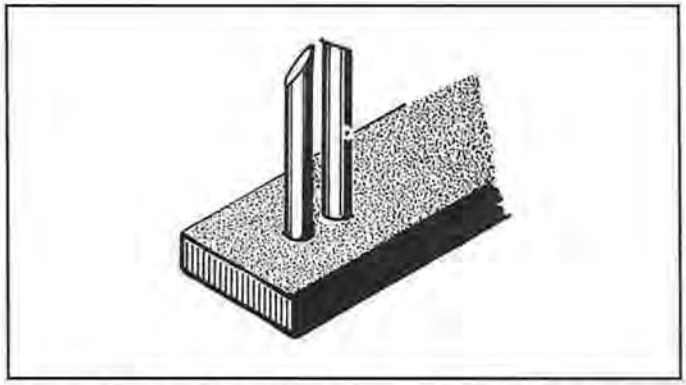


Figure 20. Outside ends of pins are beveled as shown to prevent catching of lower coils.

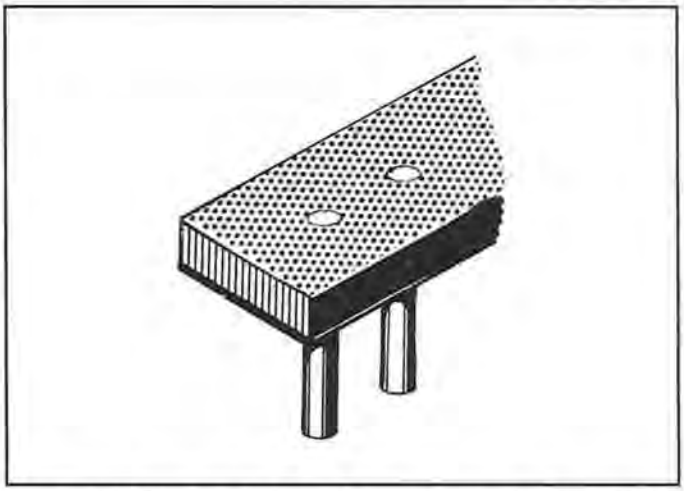


Figure 21. Pins placed too far apart must be brought together to brace the spring.

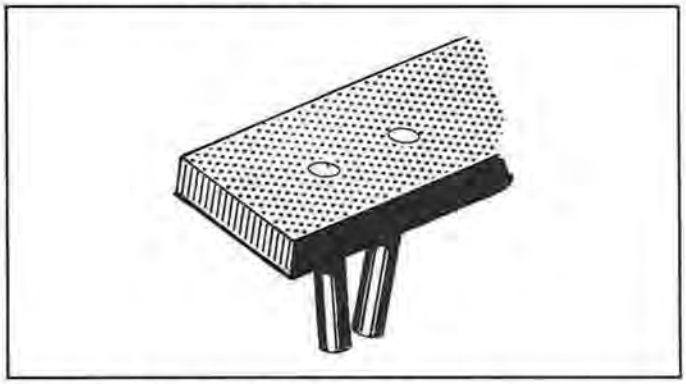


Figure 22. Pins bent together as shown will not support a hairspring along its width and will cause it to shimmy.

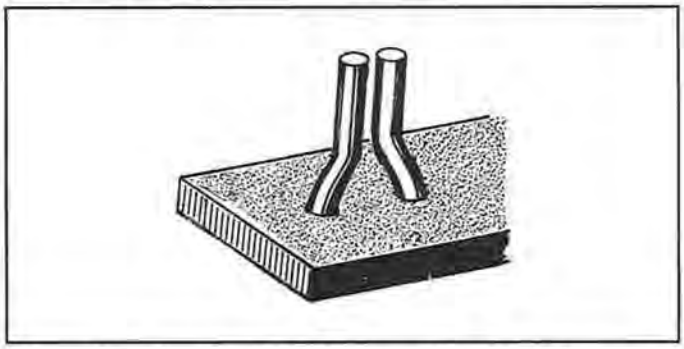


Figure 23. Pins should be bent together like this so as to give full support to spring.

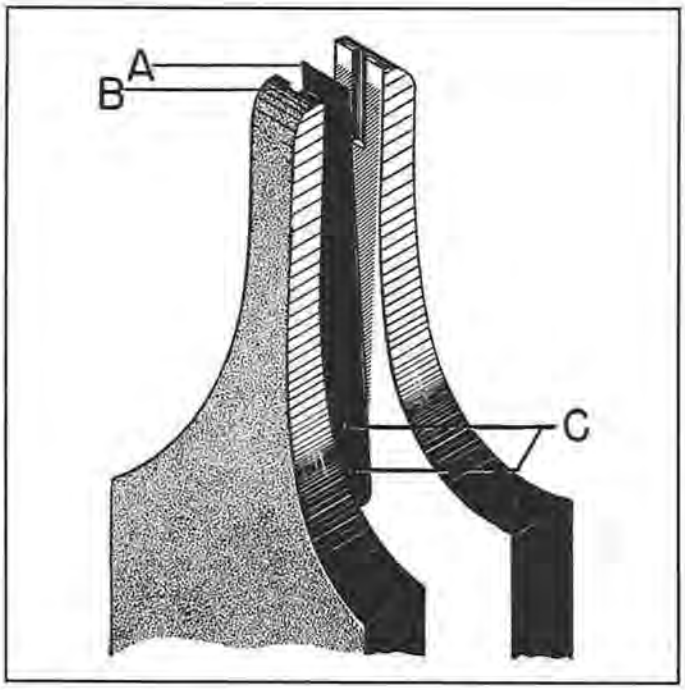


Figure 24. Special tweezers are necessary like these shown for adjusting pins in a Breguet regulator.

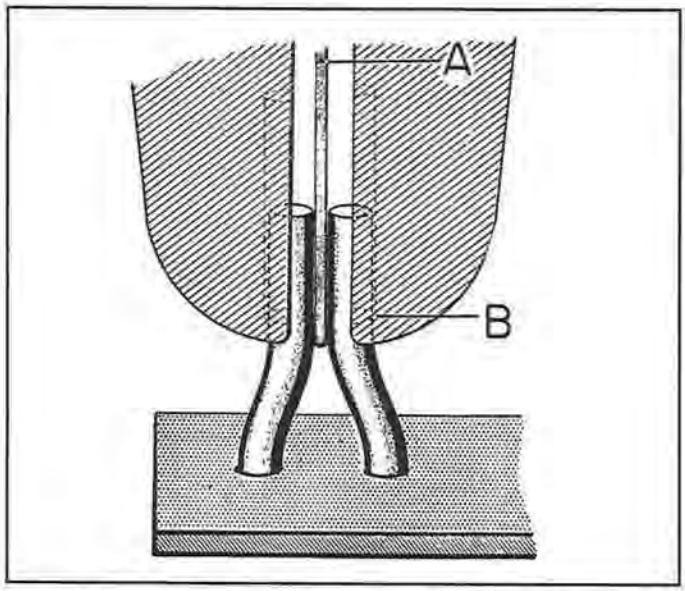


Figure 25. Showing how the tweezer is placed over the regulator pins with spring (A) between pins.

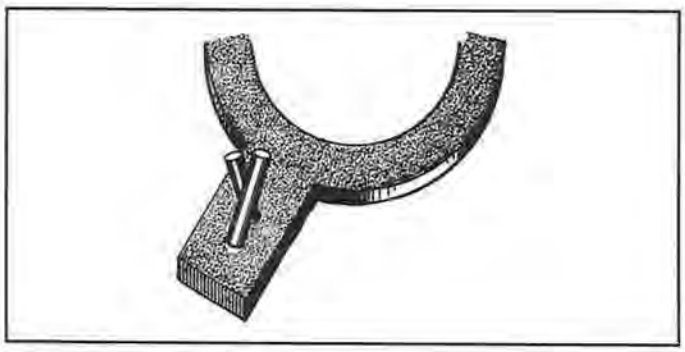


Figure 26. Regulator pins bent as shown may be straightened with the special tweezers.

In operation, the tweezer is placed over the regulator pins so that the spring "A" is between the regulator pins, and the grooves "B" straddle the pins. (See Figure 25.) Pressing the tweezer points together will bend the pins closer together, the amount depending upon the pressure applied. The pins will be upright and parallel. The spring tongue "A" keeps the pins from closing altogether or from scratching each other. These tweezers can be made from an old pair of general work tweezers. The grooves are best made by drilling a thin hole downward into the points while these are tightly clamped together, each point containing half a (deep) hole. The tongue "A" is made from a strip of thin, narrow bracelet mainspring. This spring should be no thicker than .07 mm. Other details are clearly shown to guide anyone interested in making up a pair.

When regulator pins are bent as shown in Figure 26, these may be straightened with the regulator pin-tweezer by inserting the tongue blade between the bent pins and the grooves around the pins and twisting the pins to an upright position. Pressure upon the tweezer will rectify any small errors still existing.

When regulator pins must be spread apart, this may be done with a needle, ground flat, sharp, and very gradually tapered. The sides should be rounded off and the flat tapered surfaces of this blade should he highly polished to prevent scratching the inside of the pins. This miniature screwdriver-like blade is inserted in between the pins in a light wiggling motion, making sure that the pins are not being bent *away* during this operation.

Figure 27 shows a type of regulator used with Breguet hairsprings. This has the key or "boot" of a regulator used with a flat hairspring and has two straight pins which contain the Breguet overcoil. The regulator is, of course, a Breguet type of the conventional two pins but with the key added to keep the overcoil from escaping from the pins should the watch be jarred. Repairs to this type of regulator are made according to the combined instructions given for both flat and Breguet regulators.

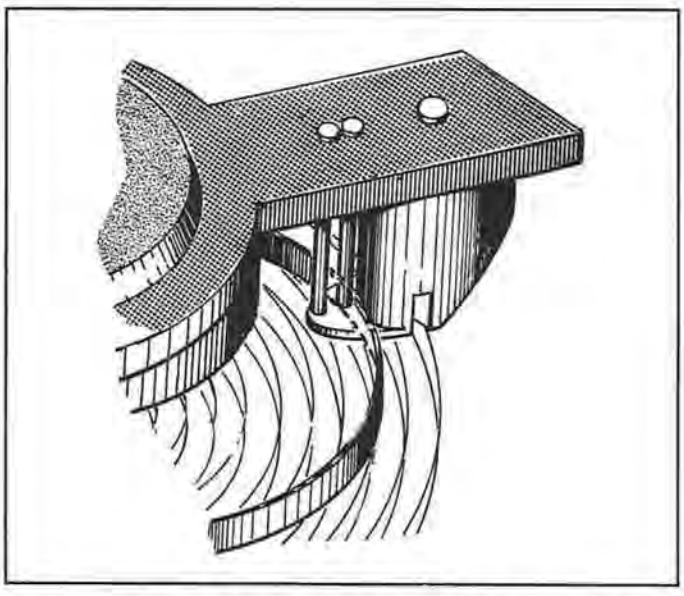


Figure 27. Type of regulator used with a Breguet hairspring, with key of a flat spring regulator used with two pins for Breguet overcoil.

EDUCATION UPDATE

By James E. Lubic

First on this month's agenda is the Academy of Watchmaking. The scholarships for this full-time training have been named as follows:

The J.M. Huckabee Scholarship was created because of Mr. Huckabee's generosity. Mr. Huckabee has donated the royalties from his newest book, *The Top 300 Trade Secrets of a Master Clockmaker*, along with his writer's fees for the articles he writes for the *Horological Times*. Mr. Huckabee also donates the rental fees from his video tapes to the ELM Trust, which are then used for Project Extend grants.

The second scholarship is funded by Hattori USA. Hattori's commitment to education will sponsor a student for three consecutive years.

The AWI-ELM Trust has agreed to sponsor a third scholarship. This is ultimately possible because of the generosity of all the AWI members that donate their used silver oxide cells to the ELM Trust. So please remember to give your silver cells to your local affiliate chapter to be passed on to the Trust at the Annual Board of Directors Meeting this year. You may also send them directly to AWI Central. However you get them here, we will be sure to credit your state's totals for the annual competition between affiliate chapters.

The fourth scholarship is a Memorial Fund Scholarship. The George McNeil Potomac Guild of HAV made a large donation in memory of their member Marvin E. Whitney. Other donations have been recieved in memory of Joe Crooks, Henry B. Fried and a number of others who have died throughout the year.

Many thanks go to the generosity of many people for making the Academy of Watchmaking possible. Next month we will be able to award these scholarships to four dedicated students of horology. Applications for the full-time 45-week program, which begins July 15, have exceeded our expectations. If you are interested in information about the AWI Academy, please write for a brochure.

By now I'm sure you have all had a chance to fill out and return the Bench Course Survey which appeared on the envelope for the April issue of *Horological Times*. This information will be very important for scheduling future Bench Courses. If you haven't taken the time to participate in this survey, please do. If you need another copy of the survey, feel free to request one from AWI Central.

There is still room in the Project Extend Advanced Quartz Watch Repair Course scheduled for June 23-27. If you haven't had a chance to see the new headquarters, this would be the perfect time to visit AWI. After the class is completed you could stay and meet the Board of Directors and participate in the Annual Meeting, June 28-30.

Figure 1. The recent Clock Case Repair Class. (Left to Right)—Carol Tillett, Charles Wolfe, Instructor Jim Williams, Jose Loubriel, Monroe Troyer, Louis Burwinkel, Clayton Herbert, Gil Davis, Sterrie Weaver, Alfred Young, Norm Kocher, David Claggett.

Figure 2. Bernhard Stoeber advises Louis Burwinkel during the recent Chronograph Course. Ari Roman (front) and Bob Ridenour are hard at work.

INDUSTRY NEWS

The Cyclonic By Witschi

The Cyclonic's primary function is to help the watchmaker or jeweler pinpoint the area(s) causing the watch to function improperly — whether it's the battery, electronic circuitry, mechanical gears, or a combination of these areas.

As such, it is a highly valuable and useful tool. For instance, when a customer comes into your store with a stopped watch, there is some anxiety as to how much it is going to cost him/her. With the Cyclonic, you can help ease this tension by identifying the problem and perhaps even solving the problem by replacing a dead battery or the clearing of a small blockage in the watch's train.

Once the problem has been identified, you are able to give the customer an approximate cost of repair. Then, your customer can make a decision to have the watch fixed or buy a new one while he/she is in your store. You win either way with the Cyclonic.

Newall Manufacturing's Green Dragon

Newall Manufacturing Inc. introduces the next generation of Atmospheric Steam Cleaning Machines, "The Green Dragon." This compact (12" x 9" x 10" H), mini-version delivers 60-90 P.S.I. of dry steam instantly on demand. This 20-pound machine produces steam with the comparable performance to a larger machine without the necessity of boiler permits, blowdown plumbing, etc. It's safe to operate in malls, stores and factory show rooms. For more information contact Newall Manufacturing at (800) 621-6296 for your local authorized distributor.

James J. Lazarus Honored With Humanitarian Award By The National Conference

James J. Lazarus, president of L&R Manufacturing Company, a global leader in the manufacture of Ultrasonic Cleaning Systems, Solutions and Accessories for seventy years, was recently honored with a national humanitarian award for distinguished service in the field of human relations by The National Conference of Christians and Jews, an organization dedicated to fighting bias, bigotry and racism in America.

"Jim Lazarus is certainly deserving of recognition," said Zita Dorn, director of financial development for The National Conference. "He believes in the goals of our organization, and over the years has helped us move forward to reach them. He is a true philanthropist and a great humanitarian."

The National Conference, founded in 1927 as The National Conference of Christians and Jews, is dedicated to fighting bias, bigotry and racism in America. Its goal is to promote understanding and respect among all races, religions, and cultures through advocacy, conflict resolution, and education. Last year's recipient of this prestigious National Humanitarian Award was Hugh Glenn, president of Cyma Watch/Glenn Corporation.

Lazarus believes in the utmost importance of getting young people talking and learning to understand one another, despite their differences. "We cannot afford for young Americans to wait until they are adults to begin the dialogue," he says. "We learn bias, bigotry and racism early in our lives. Therefore, we must also begin unlearning them early. That's where The National Conference does some of its most important work—in the trenches teaching children tolerance and understanding. I am honored to be part of The National Conference and am deeply committed to living up to its standards."

For more information, contact The National Conference, 71 Fifth Avenue, Suite 1150, New York, NY 10003. Phone: (212) 807-8440.

Cas-Ker Company Publishes New Watch Movement Catalog

Cas-Ker's new thirty-six-page catalog features over 200 different movement models and lists dimensions, dial feet position, hand size, and the correct stem and battery for each movement. Prices are also included for each model. The handy pamphlet-sized catalog, and its interchangeability list, make invaluable bench reference for any watchmaker. The catalog is free on request to

watchmakers and jewelry stores. For more information, call Cas-Ker at 1(513) 241-7073 or 1(800) 487-0408.

Batt-Tronic Improved Lithium Starter Kit

Batt-Tronic Corp. has improved their 3V Lithium Starter Kit to include new and increasingly popular lithium batteries. The cabinet has been expanded from nine to fifteen drawers. The Batt-Tronic drawer numbering system organizes batteries by size regardless of manufacturer.

"We have seen a steady increase in the sales of lithium batteries since our 3V Lithium Starter Kit was introduced in 1989. Manufacturers of watches, calculators and cameras depend on lithium batteries to power their products. Lithium batteries provide a reliable power source as they do not 'fade out'." said Harry Hillson, president of Batt-Tronic.

The new 15-drawer Batt-Tronic 3V Lithium Starter kit (9 1/8" x 7 1/2" x 6 3/8") includes 57 name brand batteries, 14 of the most popular types, Battery Center point-of-purchase cards and the "Batt-Tronic Interchangeability Guide." The lithium starter kit cost is $41.95. Batt-Tronic also carries a full line of lithium camera batteries.

For further information call or write Batt-Tronic Corp., Battery Park, P.O. Box 10, Orangeburg, NY 10962. Toll free nationwide, call 1 (800) 431-2828; New York State, call 1 (800) 942-1944; Monday-Friday from 9:00 am-6:00 pm.

New Catalog Of Equipment/ Supplies For The Jewelry Manufacturer

Gesswein announces their new *1996-1997 Jewelers Catalog #45*. Their 384-page inclusive catalog features tools, supplies and equipment for professional and manufacturing jewelers. There are over 6,000 items, many illustrated and in full color, to help their customers with product selection. Their extensive assortment covers everything from abrasives to videos. It includes equipment and supplies for casting, polishing, soldering, tumbling, engraving, electroplating, and rolling. In addition to many exclusive Gesswein products, other popular brands offered are Foredom, Busch, Muller, Galloni, Yasui, Kerr, R&R, Ferris, Matt, Cratex, Ney, Lindstrom, Grobet, GIA, New Hermes, Castaldo, Supra, B&L, and Herkules. To request a catalog, call Gesswein at 1(800) 544-2043, ext. 241. Fax or mail a request on letterhead or forward a copy of your business card to: Gesswein, P.O. Box 3998, Bridgeport, CT 06605. Fax (203)366-3953.

BULLETIN BOARD

A. NEW REQUESTS

Mastercraft Automatic Watch Winder

Jeffrey Ohst, Muskegon, MI, has a device for testing automatic watches by winding them; it was made by Mastercraft. He is seeking the instruction manual for this device.

Branson Cleaning Machine B-52H

Edward Bolan, Bridgewater, NJ, seeks a service and operator's manual for a Branson cleaning machine B-52H, 117 volts, 50/60 hz, 440 watts.

Tweezer Sharpening Service

Jeffrey Forslund, Delafield, WI, recalls that at one time someone advertised a tweezer sharpening service in *Horological Times*. He believes the service was in Florida. Can anyone recommend such a service?

Clock's Identity

Bernard Petit, Dothan, AL, has frequently helped readers by responding to "BB" questions; now he seeks some help. He has the clock shown in Figure 1 which has no identity other than "Swiss." There are some parts missing and in order to restore it, he needs something to go by. Can anyone identify and supply information? Perhaps you have one.

Figure 1.

Serrari Quartz Watches

Truman Hamilton, Burbank, CA, is seeking information about the distributor or service agent for a quartz chronograph watch, "Serrari," made in Japan.

22L Arogono 8-Day Alarm

Truman Hamilton, Burbank, CA, seeks information for a 22L Arogono 8-day, key-wound alarm clock, calibre 22N. Spare parts, distributor, and service information will be welcome. This item is listed in the "Bestfit" catalog on page 331.

B. RESPONSES

Removing Scratches from Glass Crystals

One response was phoned in by a gentleman who did not leave his name; the other came from Todd Farmer, Williamsport, MD. The recommendations were identical.

Glass crystals can be polished with Cerium Oxide. It is available from any good glass shop. Use a wet slurry on a hard felt buff at slow speed as per the instructions on the label. The scratches will disappear.

Vigor Electric Soldering Machine, Model SM-800

Allen Linkey, Director of Gem City School of Horology, Quincy, IL, has sent a copy of the instruction manual for this machine as requested by William Carson, Groton, MA.

Aurora Clock by Kirsch Hamilton

Donald Chambers, Lafayette, IN, advises Walter Celli, Nanuet, NY, that the Aurora Clock by Kirsch Hamilton is no longer in production. Don Chambers has serviced these clocks and has offered to help Walter Celli.

C. ITEMS STILL NEEDED

Clock Strikes at Rapid Speed

Jordan Renaud, Deep River, Ontario, Canada, has an antique Beehive-type clock with lyre plates, circa 1860-1870. This clock has eight wheels in the strike train including the fly. The third wheel in the strike contains the pin that activates the hammer tail. Even though the fly is attached tightly to the arbor, the strike sequence occurs very rapidly. The clock has the original power springs in it. Can anyone suggest the reason, and a remedy for this rapid striking problem?

"Regina" Music Box

Cameron Spicknall, Elmira, NY, is seeking the phone number and/or address of the distributor of "Regina" music boxes. We have directory listings for firms using the name "Regina;" they are located in Schwenningen and Porzheim, Germany and Les Genevez, Switzerland. They are basically watch/clock manufacturers and there is no indication which, if any, produces music boxes. Can anyone help with a distributor in this country, or manufacturer in Europe?

Sharp Talking Clock

Gary Block, Agawam, MA, seeks the address/phone number of the firm which distributes Sharp Corporation Clocks by Bentley Inc. out of Los Angeles, California. These are talking

clocks. We have a listing for the Sharp Talking Clock in Japan; it is Sharp Corp., 22-22 Nagaike-Cho, Abeno-Ku, Osaka, Japan. Can any reader supply a contact for this clock in the United States?

Waltham Display

George Kuckenbaker, Harpers Ferry, WV, recently received the Waltham display as a gift (see Figure 2). The circular Lucite contains model 771,681, and 6/0-D, 21-jewel movements all marked 5 adj., made in U.S.A. There are gold hands on all of the movements.

Any information about this display, such as its purpose and approximate date will be appreciated.

Trinad Rock Klox

Donn Kummer, Tangent, OR, has a Trinad Rock clock with loose hands. He can get the back off but can't get the dial out of the bezel. It doesn't seem to pry off. The glass crystal, which he is afraid of chipping may be epoxied. Mr. Kummer hopes to hear from anyone with information about this clock.

Waterbury #100 Hall Clock

Richard Porter, Minneapolis, MN, has frequently helped with "BB" requests. Now he seeks information about a Waterbury #100 pin wheel escapement hall clock movement which he has for restoration. Specifically, Mr. Porter seeks the following information:

1) Suspension Spring: Material, length, width, thickness, and is it single or double leaf?
2) Cable: Size and material?
3) Date of manufacture?
4) If possible, a source for or picture of the sweep second hand that fits the protruding tapered end of the escape wheel arbor.

Pictures or technical information from someone familiar with this clock will be appreciated.

Figure 2.

CLASSIFIED ADVERTISING

REGULATIONS & RATES

Ads are payable in advance 75¢ per word, 80¢ per word in **bold type.** Classified display ads are $30.00 per column inch, 2-1/4" wide. Ads are not commissionable or discountable. The publisher reserves the right to edit all copy. Price lists of services will not be accepted. Confidential ads are $5.00 additional for postage and handling. The first of the month is issue date. Copy must be received 30 days in advance (e.g. July issue closes for copy on June 1st).

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CLOCK, MUSIC BOX MAINSPRINGS, GEAR PINION CUTTERS, MATERIAL & PARTS CUSTOM MADE. **TANI,** Box 338, Atwater, OH 44201; (330) 947-2268. Catalog $3.00.

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ARTICLES FOR SALE

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MINI QUARTZ MOVEMENTS. Guaranteed lowest prices--as low as $2.30. Two-year guarantee. Large selection of hands and numerals. Free delivery. SASE or call (704) 333-0221. HALL CLOCK SHOP, 1512 Central Ave., Charlotte, NC 28205.

USED WATCH MOVEMENTS. H. HERB & SON, 908 RIVA RIDGE DR., GREAT FALLS, VA 22066; Phone (703) 549-8045, Fax (703) 759-5837.

USED EQUIPMENT: Vibrograf and L&R timing machines from $695; engraving machines from $500; wide variety of used watchmakers' and jewelers' tools. Sheely Wholesale Distributors, Call 800-222-2540.

BULOVA VC-10 CLEANING MACHINE, $500.00. (805) 929-5317.

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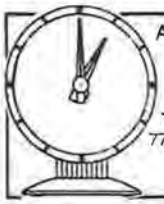

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sometime during the period 1938-1952, or their families, could be eligible for a large reward for their assistance. Anyone recognizing any of the three codes could also be eligible for a reward. Please write for details.

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American Watchmakers-Clockmakers Institute
36th Annual Board of Directors Meeting
June 27, 28, 29 & 30, 1996

Commonwealth Hilton • I-75 & Turfway Road • Florence, KY 41042 • (606) 371-4400

THURSDAY, JUNE 27

3:00 PM - 6:00 PM	REGISTRATION
7:00 PM - 11:00 PM	AFFILIATE CHAPTER DELEGATE RECEPTION & ROUND TABLE *Alternate Delegates & Board Members Welcome*

FRIDAY, JUNE 28

7:00 AM - 8:00 AM	REGISTRATION
8:00 AM - 3:00 PM	AFFILIATE CHAPTER MEETING *Keynote Speaker - Mark Butterworth*
10:00 AM	AWI-ELM TRUST MEETING *Trustees Only*
11:00 AM - 2:30 PM	RIVERBOAT CRUISE LUNCHEON *Spouses, Family & Guests*
7:30 PM - 9:30 PM	AWI HEADQUARTERS OPEN HOUSE

SATURDAY, JUNE 29

8:30 AM - 10:00 AM	DIRECTORS' BREAKFAST MEETING *Directors, Past Presidents & Newly-elected Directors*
10:00 AM - 4:00 PM	AWI BOARD OF DIRECTORS MEETING
6:00 PM - 7:00 PM	PRESIDENT'S RECEPTION *Cash Bar*
7:00 PM - 11:00 PM	AWI'S BANQUET & AWARDS PROGRAM *Fred Burckhardt, Emcee*

SUNDAY, JUNE 30

9:00 AM - NOON	AWI BOARD OF DIRECTORS MEETING (CONCLUSION)
1:00 PM - 3:00 PM	EXECUTIVE SESSION *(Board Members Only)*
	AWI PERPETUATION FUND COMMITTEE MEETING
Following Board Meeting	CHAPTER 102 MEETING

"Ms. Dependable"

Betty Danner Retires

Leap year day, February 29, was a special one for longtime AWI employee Betty Danner. It was the day she leaped into retirement after more than twenty years of service with AWI.

Betty Danner recalls that she began work with AWI while Jim Broughton was president. She was pressed into service when an emergency developed in processing the old "AWI News" for bulk mailing. From that day on Betty Danner was called upon to help with many emergencies.

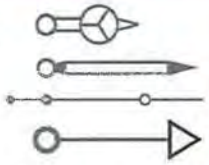
At that time, our staff was very small; when one person became ill or was on vacation there was no one else to pick up their work load. That became Betty's area of expertise. She became familiar with every job in the office. Her office skills were such that she had no problem analyzing what needed to be done, then get it done.

The unusual thing about this twenty-year employee is that she never worked on a full time basis. She was willing to be available whenever she was needed, for whatever task, for as long as it took to accomplish it. We depended on Betty Danner so much that Milt Stevens dubbed her "Ms. Dependable". Everyone at AWI wishes her a long and healthy retirement!

Advertising Index

SATISFACTION GUARANTEED OR YOUR MONEY BACK!

GENERIC Hands to fit Rolex



Fits Rolex	Set of	Price
1530 Divers (S)	3 HMSS	$30
1530 GMT (S)	4 HMSS24H	40
1570 (Y)	3 HMSS	30
2035 (Y)	3 HMSS	30
2135 (Y)	3 HMSS	30
3035 Divers (S)	3 HMSS	30
3035 Divers (Y)	3 HMSS	30
3035 (S)	3 HMSS	30
3055 (Y)	3 HMSS	30
3085 (S)	4 HMSS24H	40
3085 (Y)	4 HMSS24H	40
3135 (Y)	3 HMSS	30

GENERIC Rotating Bezel Inserts to fit Rolex

Fits Rolex	Part No.	Color
315-16750-6	3151	Blue/Red
315-16753-1	3152	Black/Yel
315-1675-3	3153	Brwn/Gold
315-16750-1	3154	Blck/Silver
315-16758-1	3155	Black/Yel
315-16760-7	3156	Black/Red

Bezel Inserts $30.00ea

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206C	300	32.45
246C	400	49.95
295C	500	37.45
286	600	49.95

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2130	568	3135	568

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2295 Steel 5.3mm
2296 Yellow 6.0mm
2297 Steel 6.0mm

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GENERIC Case Back Gaskets to fit Rolex

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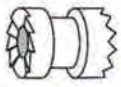

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1996 Bench Courses

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DATE	CLASS INSTRUCTOR	LOCATION FEE
MAY		
5	Servicing ETA Quartz Chronographs Jeff Broughton	Oklahoma City, OK $50.00
10-13	Lathe Course (Phase II) Roy Hovey	Charlotte, NC $280.00
17-19	Advanced Clock Repair Ron Iverson	Seattle, WA $150.00
18-19	Intro to American Pocket Watches Alice Carpenter	Dallas/Ft. Worth, TX $100.00
JUNE		
1-2	Filing & Flat Polishing Joe Cerullo	Tucson, AZ $100.00
7-10	Cross Slide Operations Roy Hovey	Minneapolis, MN $240.00
8-9	Mechanical Chronographs Mark Heist	Seattle, WA $100.00
JULY		
12-15	Lathe Course (Phase III) Roy Hovey	Charlotte, NC $280.00
19-22	Lathe Course (Phase I) Roy Hovey	Arlington, TX $280.00
23-24*	Intro to American Pocket Watches Alice Carpenter	Chicago, IL $100.00
27-28	400-Day Clock Repair Ron Iverson	Oakland, CA $100.00
AUGUST		
3-4	Striking Clocks Buddy Carpenter	Dallas, TX $100.00
24-25	Intro to American Pocket Watches Alice Carpenter	Cleveland, OH $100.00
SEPTEMBER		
7-8	Hairspring Vibrating Joe Cerullo	Greensboro, NC $100.00
13-16	Lathe Course (Phase II) Roy Hovey	Arlington, TX $280.00
14-15	Mechanical Chronographs Mark Heist	Newark, NJ $100.00
14-15	Striking Clocks Buddy Carpenter	Oakland, CA $100.00
20-22	Advanced Clock Repair Ron Iverson	Austin, TX $150.00
OCTOBER		
4-6	Mechanical Watch Repair James Lubic	Cleveland, OH $150.00
5-6	Mechanical Chronographs Mark Heist	Seattle, WA $100.00
12-13	Striking Clocks Buddy Carpenter	San Diego, CA $100.00
25-28	Lathe Course (Phase III) Roy Hovey	Arlington, TX $280.00

1996 Project Extend

AWI's continuing Education Program offers one-week and two-week classes in various phases of watch & clock repair techniques. Work alongside reconized leaders in the field of horology. See how they handle the everyday situations we all encounter. All Project Extend classes are held in AWI's training rooms in Harrison, Ohio. Call or write for information and details for the classes that interest you! **AWI Central, 701 Enterprise Dr., Harrison, OH 45030 Phone (513) 367-9800, Fax (513) 367-1414**

PROJECT EXTEND WATCH CLASSES

DATE	CLASS INSTRUCTOR	FEE
JUNE		
10-14	Accutron Repair Henry Frystak	$262.00
23-27	Advanced Quartz Watch Repair Robert Bishop	$250.00
JULY		
22-26	Beginning Horology James Lubic	$250.00
AUGUST		
12-24	12-Day Lathe Course Roy Hovey	$780.00
26-30	Machine Shop Practices Ron DeCorte	$250.00
SEPTEMBER		
9-13	Band Repairs & Crystal Replacement David Christianson	$250.00
16-20	Basic Jewelry & Watch Case Repair Marshall F. Richmond	$250.00
21-22	Watch Case Finishing Dennis Warner	$100.00
23-27	Introduction to the Watch Movement James Lubic	$250.00
OCTOBER		
7-11	Time Train, Dial Train & Friction Jeweling James Lubic	$250.00
21-25	Drawing the Lever Escapement James Lubic	$250.00
28-Nov. 1	Adjusting & Repairing the Lever Escapement James Lubic	$250.00
NOVEMBER		
18-22	Balance Assembly - Staffing, Truing & Poising James Lubic	$250.00

PROJECT EXTEND CLOCK CLASSES

DATE	CLASS INSTRUCTOR	FEE
AUGUST		
12-17	Striking & Chiming Clocks Buddy Carpenter	$250.00
19-23	French Clock Repair Ron Iverson	$250.00
SEPTEMBER		
23-28	Antique Clock Restoration David Christianson	$250.00
30-Oct. 4	Prep for CMC Examination David Christianson	$250.00
OCTOBER		
7-11	Introduction to Clocks Jim LaChapelle	$250.00
21-25	Advanced Cuckoo Clock Repair Jim Williams	$250.00