Waterbury Regulator No. 61

Restoration Log & Instruction Manual

Andrew LaBounty, 2002

Waterbury Regulator No.61

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A History of the Waterbury Clock Company

(1857 – 1942)

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

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

After the Civil War, in which most of Waterbury's employees participated on the Union side, the Company erected two large case-building shops. They were hardly used, though, before both caught fire and caused $25,000 damage, equaling about $270,000 in 2002 currency. Half of that was safely insured, and another case shop was built upon the same site. From here, the Waterbury Clock Company kept getting larger and more flushed with employees. In 1867, the first known catalogue of Waterbury clocks was released by the New York Sales Agency. Waterbury clocks occupied only a small fraction of the myriad of companies represented by the catalogue but that was soon to change. The company continued to grow and by 1875, had opened several offices in Chicago and San Francisco. By 1881, their own catalogue contained 94 of their own clocks on 122 pages. Ten years later they had grown to a full 175 pages offering 304 models of their own design.

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

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

As for a brief history of the Waterbury Regulator No. 61 and its long ancestry of precision regulators...

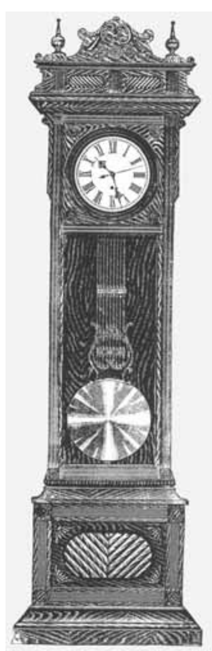
The Waterbury Regulator No. 61 was produced during Waterbury's business peak from 1903 to 1917 because of demand that stemmed greatly from the advancements made in the railroad. With the railroad came schedules, and people needed to know what the time was to a greater accuracy than simply night or day.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

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

The Process

To Begin – The Take Down

The first day of work began on the morning of February 27, 2002; ninety years after the presentation of the clock to the school by the class of 1912. We [David LaBounty CMC, FBHI and Andrew LaBounty, Apprentice] received permission from Asst. Principal Mr. Carmody to remove the clock's movement, dial, weight, and pendulum from the case and take it to our shop (then operating from home) for restoration. First, the pendulum was removed and placed to the side. Next, the weight was detached and placed with the pendulum. Finally, to take the clock movement and dial out of the case, it was necessary to loosen the seat board screws that held the metal box encasing the movement. After doing so, the metal box and movement, attached with the dial, were easily transported as a unit. The work had begun that would take place everyday during seventh hour for about a month.

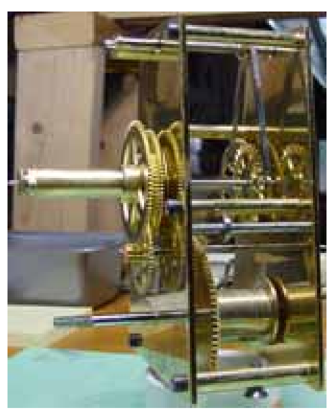


From Tran Duy Ly's "Waterbury" Reference Book

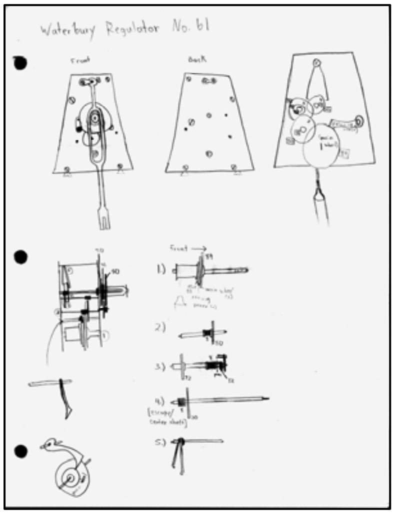
At the Shop – Cleaning it up

The first step in restoring the movement was obviously to remove it from both the dial and the metal box that encased it. To achieve this, the taper pins that held the dial to the box and the screws affixing the movement to the box were all removed. In addition, the hands were removed to take the dial off. After the movement was taken out, several observations were made concerning the general state of the movement. It had indeed, been restored previously. It was obvious that it had been bushed (discussed later) in some places that were not entirely necessary and not bushed in places where it would have been more helpful. It was also painfully obvious why the piece kept bad time, or more likely *no* time. Several pivot holes were worn, the pendulum was badly adjusted with the beat adjuster set far to the left, the escapement had far too much entrance drop and little to no exit drop, and it was probably set up incorrectly. All of the problems with performance are easily taken care of with no cost to the school, yet there is an aesthetic scar on the escape pallet arm placed there purposely by an unknown repairman. Unfortunately, it serves no cause for good or ill but to mar the otherwise gorgeous workings of a Waterbury Regulator 61, and it is irreparable. Apparently, someone took a punch and a hammer and beat consistently 16 times on the edge of the steel pallet arms. Again, it is senseless, useless, and obscene, so of course I'd like to point it out as a previous injury and not a recent one. Everything else seems to be in order and original, making for a beautiful timepiece. Having made these observations and taken pictures, the movement was then off to the ultrasonics to be cleaned. An ultrasonic tank is used because the ultrasonics agitate the liquid, causing small implosions, and knock off more dirt and grease than is possible any other way. First the movement was placed in an ultrasonic tank filled with ammoniated clock cleaning solution to remove the grease and dirt, as well as to brighten the brass. Then, it was rinsed in water to take off the ammonia solution and placed in an ultrasonic rinse solution of 50% xylene, 50% mineral spirits to bond with and remove the water. Finally, it was put in the dryer for several minutes at about 125^{o} F to evaporate the rinse solution. When it was finished, it was photographed again and ready to be disassembled.

Removing the Dial Pins



On Paper – Making a Map



My Drawing (see attachment C)

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

Bent Hand Nut

Taking it Apart – And Determining Beats per Hour

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

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

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

Polishing Pivots – The Dreary Part

Next, it was time to polish the bearing surfaces of the clock, called the pivots. The pivots are the ends of the gears that turn in the plate, and if they're not polished, the clock will be sluggish and possibly stop. This is mostly due to the dirt that will be trapped in the scratches on the pivot plus the high amount of friction caused by the rough surface. In addition, the pivot holes will wear more quickly into oblong holes causing gears to mate improperly and perhaps come into a locking situation. Needless to say, the pivots must be polished and clean before the clock can achieve maximum efficiency, so that is what I set out to do. To accomplish this, I used a tool called a jeweler's lathe, which holds the shaft of the gear and turns it on its axis so that the pivot is spun and can then be polished using a file, burnisher, and other tools. First, the file is used to dress the surface uniformly, and remove any deep gouges. Next, a cutting burnisher is used to lessen the scratches further, and acts as a very smooth file and technically isn't really a burnisher at all. Finally, a true burnisher is used. A burnisher is a piece of metal, usually very hard, that has very small consistent ridges on the surface whose design is to "grab" the steel of the pivot and stretch it to create a perfect polish. This must be done at high speeds and with a good amount of pressure, yet not so much of either to burn the steel. When done correctly, burnishing produces not only a beautiful shine upon the pivot, but also hardens the surface as the steel is worked and compressed. There are several things to keep in mind when polishing a pivot as well: it must be flat, straight, and the shoulder must be perpendicular and polished as well. If it isn't flat, it could trap foreign materials in the pivot hole and score both the pivot and the hole. To straighten a pivot, one must heat it gently then chuck it up in the lathe. This done, it can be carefully straightened until the whole gear turns true upon the pivot. Once straightened it may be polished. This entire process is the typical way to straighten and polish a pivot, and must be repeated for all the pivots, two to each gear. In all, I had to polish eight pivots this way, which is a minimum number for most clocks, since many contain upwards of twenty pivots. Fortunately for my patience, the Waterbury Regulators are time only, and have no extra gears to drive a chime or strike. In regards to this clock, there were no terribly deep gouges in any of the gears, however the main wheel had noticeable scratches on the surface, and all of the pivots were scratched in one way or another. Since the steel was of good hardness and quality, it was no surprise that there were no horrible gouges, but it also made it harder to polish at times.


A Jeweler's Lathe


File – The First Step

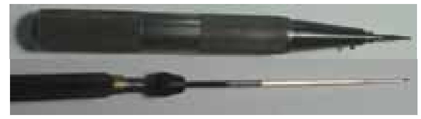

File from above


A burnisher

Major Project – The Escape Wheel "Nut"

After the pivot polishing process was complete for all eight pivots, I progressed to "bushing" the pivot holes. A bushing is a small cylinder of brass with a hole in the middle designed to replace a worn hole. To replace a worn hole, one uses a hand reamer (a small handheld tool that when twisted, can cut a hole quickly to an exact size) to ream the original hole into a larger one while keeping it centered and round to accommodate the bushing. The bushing is tapped into the newly expanded hole using a punch and a hammer, which secures it, assuming the hole was reamed to a size *slightly* smaller than the diameter of the bushing. Now, with the bushing secured in the original pivot hole, the replacement hole in the bushing should be centered where the original hole was. With a cutting broach (a tool similar to the reamer, yet provides more control and a slower cutting rate) the hole can be resized to the pivot, which creates a round, true, and centered hole where the old, worn hole was. With this process in mind, I checked the gears by feeling their tightness when placed in their pivot holes. If the gears were too loose and "flopped" around too much, I put them back in the plate to signify that those holes were worn or too loose, and needed bushing. When I came around to the escape wheel, however, I found that it became impossible to continue with out first repairing that pseudo hand nut that acts as the pivot hole for the escape wheel. The threads were bad, and the nut couldn't be screwed on tightly or far enough to determine how loose the escape wheel pivot actually was, so it had to be fixed immediately. The first step to repairing the threads was to discover what the pitch, or number of threads per inch, was for that particular screw and the diameter of the threads. With this in mind, we consulted the Machinery's Handbook for the proper tap and die set to use in order to create the new threads. We determined the diameter to be nearly the equivalent of a size 6 die, with a pitch of 40 threads per inch. This meant that the optimum set to use was the 6-40 die, but the diameter of the screw was still slightly too small for the hole it screwed into. This forced us to use a split round die, which allowed us to create an *oversized* 6-40. After discovering the correct die and the diameter of the new screw, I chose a piece of round brass stock and filed it down to the correct diameter. Then, I took the oversized 6-40 die and essentially screwed the piece of brass into the die. When it was unscrewed again, the die had cut threads into the brass. Now, with the new threads on the end of the brass, I set about cutting them off of the rod so I could use them in the nut. I cut the threads off successfully, so we were left with the old nut and new threads. First, I had to cut off the old threads from the nut. Then, we drilled a hole as though we were bushing the nut itself. Having done this, I

A Bushing



Hand Reamer vs.
Cutting Broach

That ol' Hand Nut Again

Pitch Finder

Split, Round 6-40 Die

inserted the smaller end of the threads (which I filed down) into the rim of brass that was the head of the nut and peened the end down by hammering it flat so that it wouldn't slip when it was screwed in. After the new threads were stuck tight in the rim, I drilled a hole through them, creating a threaded bushing, and eventually sized that hole to fit the escape wheel pivot. When I drilled the hole, I chucked up on the threads instead of the rim so that I could drill the hole centered in the threads. This was important since the escape wheel turned in that hole and it was necessary that it be in the center of the threads so the escape wheel wouldn't wobble.

Shaving off the end for End-Shake

Repaired Hand Nut

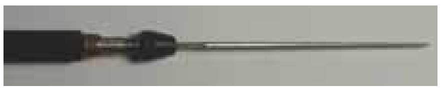
Before I sized the hole to the pivot, I polished the head of the mostly original nut and countersunk it to give the impression that it was made entirely out of one piece of brass, as the original nut was. Magnificently, it looks entirely original, and I'm very proud of it! We actually had to solder the threads to the hole, because they kept falling out during the sizing process, but it's not visible and makes the nut a good deal stronger but softens the brass somewhat. After sizing the hole, we had to shave off the end of the nut so it would screw down tightly and completely and still allow the escape wheel some end shake, or space between the plate and the shoulder of the pivot. Now, the escape wheel can move freely and securely, as opposed to being sloppy and inaccurate as it undoubtedly was with such a bad nut. In passing, there was another screw I had to create so that the plates would screw down correctly and fully. This was done in a very similar fashion, except it was done with steel and not brass. My goal was to make a longer screw to bypass a stripped upper portion of one of the pillar posts. With skill and care, I fashioned a screw out of a piece of O-1 tool steel, polished it, and blued it with gentle heating. According to the Machinery's Handbook, heating the steel gently, creates an oxidization of the steel resulting in a colored coating that not only matches the other screws on the clock, but also acts as a rust preventative. To my equal pride and dismay, it looks noticeably newer, shinier, and better polished than the original screws. The old screw is included with the clock upon set-up in the school.

Bushing – For Real Now

With the escape wheel secured and happy, I was ready to do standard bushings as planned. After sizing the new pivot holes of two gears, I countersunk them to the plate. This means I created a "bowl" with the pivot hole at its base, as shown in the picture of the repaired hand nut. This is done so that pivots better receive oil, but it also hides the bushing since the plate and bushing are both on the same plane after countersinking, to the effect that they're indistinguishable from each other. It only serves to look more professional when a movement appears entirely original and unaltered. I countersunk not only my own bushings, but also the bushings that were inserted by other repairmen at various times.

Polishing the Pivot Holes – Everything's so Shiny!

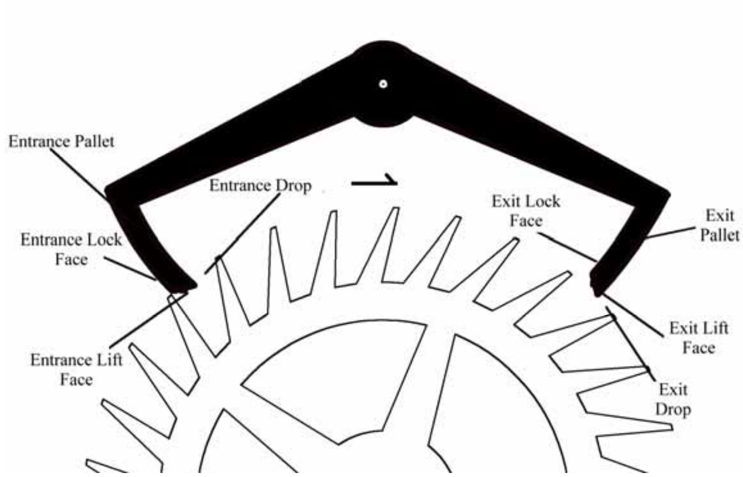
Since most of the hard part was completed, I was happy to move on to polishing pivot holes, as it meant the pivots would soon be in them and turning again. Unfortunately, the pivot holes take a little while to clean, though they go much faster if the bushings are done right. To polish a pivot hole, one takes a smooth broach just like the cutting broach except not faceted, and "burnishes" the inside of pivot holes with oil as though one were burnishing a pivot. With enough pressure and rotation of the hand, the holes will look as good as the pivots, but it gets tiring to do all ten holes (which now include the two escape pallet pivots). Actually, it's only hard the first time one does it, and only if the bushings are so loose that they come out during the polishing process. This is especially unfortunate because then one must go back and rebush it. I was terribly glad when none of mine fell out, and neither did any of the previously bushed holes. Having done this with oil on the smooth broach, there was now oil in the holes. To remove it, I used the xylene/mineral spirits mixture to rinse the movement and then used toothpicks to clean out any extra contamination from the holes. If contamination is present, it could react with the lubricating oils used later and cause the clock parts to become sticky and stop. Toothpick cleaning averted a disaster, however, and in no time at all, the holes were bushed and polished and the gears were free to be put back between the plates!



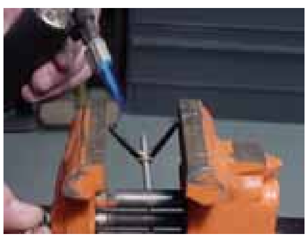
Smooth Broach

The Escapement – Theory, Practice, and Math

At this point, with the gears in their rightful places within the clock, it was time to calibrate the time keeping by adjusting the escape pallets. Some necessary terms are: entrance/exit pallet, entrance/exit drop, entrance/exit lock, and the lift/lock face of each pallet. The entrance pallet is the side of the pallets that allows teeth to enter between the pallets, and the exit obviously releases them. Entrance drop is defined by the amount of distance the escape wheel rotates after being let off of the entrance pallet. It is easily visible as the distance between a tooth and the inside edge of the entrance pallet as lock occurs. Conversely, the exit drop is the distance the escape wheel rotates after being let off of the exit pallet and is visible as the distance between a tooth and the outside edge of the exit pallet as lock occurs. The entrance/exit lock is the amount of pallet face that "catches" the escape wheel tooth when stopping the



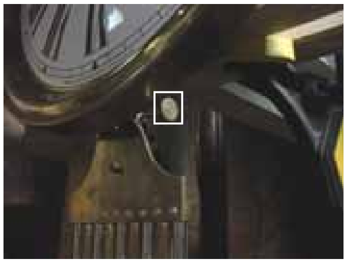
A labeled diagram of a Graham deadbeat escapement rotation of the escape wheel. The lock face is the portion of the pallet that stops an escape tooth. There are also lift angles on the ends of the pallets (the lift faces) that drive the pendulum sufficiently to keep the clock running, and are subject to wear (as are the lock faces). My first goal was to measure the lift angles. To do so, I measured the pallets from the center of the pivot to the mid-point of the pallet thickness. Dividing this by two gave a value of half of the length of the pallet arm. Knowing that measurement, I drew a circle with an equal radius and drew a tangent line on that circle. This represented 2^o of lift when the pivot of the escape pallets was placed through the center of the circle and the lift faces were lined up with the tangent line. For clocks with small, light pendulums, 2^o is an optimum lift angle. The Regulator has a large, heavy pendulum, however, and 1.5 degrees is most desireable for such clocks. To draw a 1.5-degree circle, I divided the original measurement by two to achieve one degree, and added half again to that for a total of 1.5 degrees. After checking the pallets, I found that the lift faces were rather well angled. I carefully filed off the wear, making sure to keep the angles as they were, then polished the faces using a buff stick and white rouge on the "buffer polisher" machine. Once the minimal wear was disposed of and the pallets were nice and shiny, I also filed off some of the burrs created by the punch marks on the exit pallet arm. It looks better, but to fully remove the punch marks would be to recreate the pallets, which is extremely difficult. Finally, I put the escape pallets back into the clock and we checked the entrance drop, which is always adjusted before the exit drop. We found the entrance drop to be too large (due to the fact that material was removed in the polishing process), so we put the pallets in a vice and heated them gently while squeezing, being careful not to break them. This achieved the desired effect of decreasing the entrance drop. Having done that, we next checked exit drop, which is adjusted by changing the distance from the pallets to the escape wheel instead of opening or closing the pallets themselves. After both sides had equal drop and sufficient lock (to ensure the wheel didn't slip past or hit the lift face), it was time to adjust beat rate and time keeping!



Beat and Rate Adjustments – Nuts and Knobs

With the movement ticking, the time had come to check the performance of the clock. First, however, I had to set it up properly on the movement stand and adjust it to keep time. The first thing I adjusted was the beat, or the consistency of the "tick-tocks" with the goal of making the time between the beats equal. In other words, I wanted the escape teeth to lock at the same relative point on each side of pendulum's arc. To do this, I loosened the screw where the leader attaches to the pallet arbor, which is the part of the clock that connects the pendulum to the escape pallets, and rotated it slightly so that it drove the escape pallets the same distance on each side of the pendulum's swing. To make sure the beat was correct, I used a timing machine (also used to measure the rate). This machine picks up the sound made by the clock and measures how much time passes between the beats. Then it calculates the difference. After getting the beat nearly perfect,

Timing Machine



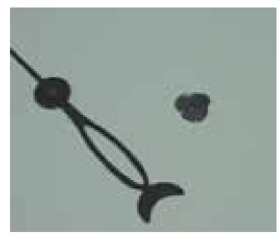
Fine Beat Adjuster

Rate Adjuster

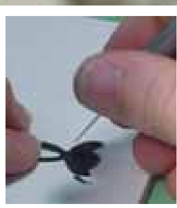
I used the finer adjustment knob nearer to the bottom of the leader to finish the adjustment. After setting the beat, I set the rate, or the quickness of the tick-tocks. This was done using the nut at the bottom of the pendulum. I used the same timing machine to measure how many beats the clock made per hour, which I found above to be 3600. I tweaked the nut until the measurement was just that or very close to 3600. Now, the clock was adjusted to keep time and our job was to watch it and record how well it performed!

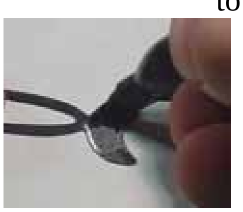
Refitting the Second Hand – Found in the Case

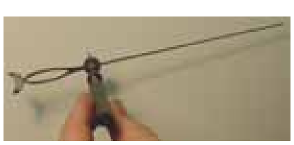
Out of poise
Second Hand



To put the second hand back on, it was first necessary to "poise" it, or balance it so that it would not hinder the clock in any way. When we received it, it was too heavy on one side. To poise it, I pounded a piece of lead flat and super-glued it to the back and bottom of the second hand to offset the heavier "long" side. I then put it on a smooth broach and checked its balance. Obviously, it was imbalanced at this point, so I carefully shaved off bits of lead first around the edges so it wouldn't be seen, then carefully evened it on either side until it was perfectly balanced and static on the broach. After it was poised, I colored the lead with a magic marker to disguise its presence. Such methods as super-glue and markers can be used on the second hand because they work well, will not interfere with the inner workings of the movement, won't be seen, and are removable. Having poised the second hand, we now had to re-affix it to the movement. To do that, it was necessary to close the hole in the second hand slightly with a round-head punch so that it would stay on. Then, it was reamed open slightly with a cutting broach until it just fit. After the hole was sized to the escape pivot, the second hand was attached solidly to it and works fine now. Remember that the clock has a beat rate of 3600 beats per hour, or 60 beats per minute. For this reason, the second hand is directly affixed to the escape wheel since each tooth represents one second exactly. One of the unusual features of this clock is the fact that the escape wheel front pivot, which has the second hand attached, comes out in the middle of the dial, through the center of the hands. This characteristic makes the Waterbury Regulator No 61 a "center seconds" clock.







Perfectly Poised and Static

Conclusion – And Thanks

I really enjoyed working on this lovely clock, and I'm honored to be a part of the history begun by the esteemed Class of 1912. Olathe North truly has one of the great clocks in existence today, and I trust it will be around for another 90 or 100 years. I would like to thank Mrs. Dorland and Mr. Carmody for their support in allowing me to restore the clock, and I'd also like to thank Ms. Reist for being so impressed and interested! The next section talks about the care and maintenance of the clock, as well the procedure taken in setting it up, if ever one should decide to relocate the clock.

Care and Maintenance

This Section by:
David LaBounty, Certified Master Clockmaker AWI, Fellow BHI

Winding

This clock should be wound on a regular basis and once per week is acceptable. The clock may run for twelve to fourteen days but it is important to avoid having the weight settle on the bottom of the case. Damage to the escape wheel teeth could occur if all power is off of the train (as in the weight resting on the bottom of the case) and the pendulum continues to swing. If winding the clock before it stops is not a possibility, it is preferable to stop the pendulum by gently touching it and bring it to rest rather than letting the clock run down.

Great care should be taken when winding the clock to be sure none of the hands will interfere in the winding process. This may require winding in stages to avoid the second hand which will get in the way every 20 seconds or so. Letting the second hand come into contact with the wind key will have the same results as letting the clock run down…i.e. damaged escape wheel teeth.

When winding, be sure the key is completely and securely on the wind arbor before turning the crank. Rotate the crank clockwise until the top of the weight starts to pass behind the dial. This is fully wound and quite preferable to "cranking until it stops" which causes the dents and dings found in the weight cap and may also cause the cable to break. If it is necessary to pause in the winding process be careful to gently let the crank back against a stop before letting go or removing the key.

Setting to Time

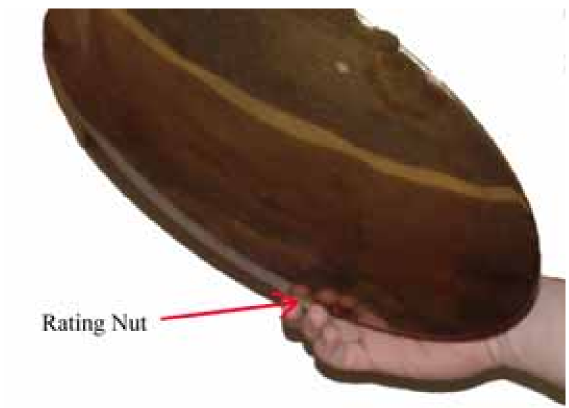
When setting the clock to time it is only possible to move the minute hand. The hour hand is set by rotating the minute hand until the proper hour is indicated. This may be done either forwards or backwards, being careful not to catch and drag the second hand in the process. **Never move the hour hand or the second hand!** It is also advisable to move the minute hand from close to the center of the dial rather than the tip of the hand. This will avoid any chance of bending the hand due to accidentally catching the tip on something.

Sometimes it is necessary to set up the clock so that it is synchronized to the second. This may be accomplished by stopping the pendulum and then restarting it so the second hand is synchronized with the other device.

One point of perfectionism is having the minute hand reach a minute mark at the same instant the second hand reaches the twelve position.

Rating

Rating the clock means adjusting the time keeping so the clock neither gains nor loses time while it is running. This is done by raising or lowering the pendulum bob using the rating nut on the bottom of the pendulum. Stop the pendulum to make all adjustments and then gently start the pendulum swinging when done. Minimize the amount of contact with the polished brass since the oils on a person's hands will leave dark splotches. Touch the edges when at all possible or use a rag over the hand. Rotating the nut to the **right speeds up** the clock by raising the bob. Rotating the nut to the **left slows** the clock by lowering the bob. One complete revolution of the rating nut will change the time keeping by one minute per day. It is important to know how long the clock has run without being reset before making any changes to the rate. If the clock is seven minutes off in one week, it will be necessary to make one complete turn of the rating nut. If it is seven minutes off in one month, ¼ of a turn is all that is necessary!



1 complete turn = 1 minute per day rate change

Cleaning

All cleaning of the mechanism (movement) should be done by a professional. It is recommended to have the movement serviced every 5-7 years or sooner if the time keeping becomes erratic. At the time of this restoration, LaPerle clock oil was used throughout.

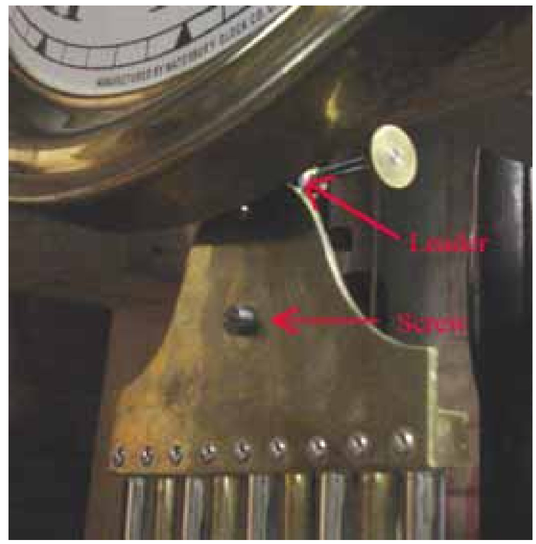
The glass may be cleaned on the outside with the usual care given to prevent soaking the wood. The inside of the lower glass shouldn't be cleaned unless absolutely necessary. The gold leaf lettering is very delicate and could be wiped away with nothing more than Windex. If it is necessary to clean the lower inside glass, spray the cleaning solution on a cloth rather than directly on the glass and avoid the lettering during the cleaning process. The upper glass may be cleaned on the inside using the same care as the outside with the exception that time be given to allow the fumes to dissipate so they are not trapped in the case with the movement. Ammonia will break down the oils causing them to fail.

The wood case may be dusted with a slightly damp cloth and it is generally not advisable to apply a dusting agent. Wax buildup and dirt will darken the case with years of use and could destroy the original finish.

Moving the Clock

At some point it may become necessary to relocate the clock. This may be done safely if certain measures are taken.

1. Allow the clock to run until the weight is well down in the case but not touching the bottom.



2. Remove the pendulum by: Stop the pendulum from swinging; remove the screw at the top; get a good grip (the pendulum is pretty heavy); with a finger on the leader, gently lift the pendulum up and away (it is held on with a pin); replace the screw in the leader to prevent it from being lost.

3. Remove the weight by lifting up on the weight cover cap and then unhooking the weight from the cable.

4. Remove the movement from the case by loosening the two seat board screws located behind the dial and under the movement. The movement will slide off of the seat board.

Once 1-4 have been accomplished successfully, the clock case may be moved like a nice piece of furniture.

Setup After Moving

Stability of the case is the most important part of setting up the clock. The case must be back against the wall in such a manner that the top touches on both sides. A good test is to push against the top to see if there is any give. If there is, it may be necessary

to place shims under the front of the clock to force it to lean back against the wall. If this isn't done, the clock may sway or worse yet, fall over!
The case must also be leveled side-to-side. Place a bubble level in the bottom of the case and shim one side or the other until the case is leveled.

The case must be back against the wall and level side-to-side before the movement is reinstalled.

Reinstall the movement, weight, and pendulum using the instructions for "Moving the Clock" as a guide.

Setting the Beat

One final adjustment will be necessary once the clock has been relocated and properly set up. The clock must "tick-tock" evenly; like a metronome. This is accomplished by turning the knob on the beat adjuster small amounts (while the pendulum is stopped) until the tick and tock occur on equal sides of the center of the pendulum's swing. The adjuster is located just behind and below the dial, where the pendulum attaches to the leader.

Bibliography

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Attachment A

Repair Itemization:

- Polish eight pivots
- Clean four shafts
- Straighten six escape wheel teeth
- Draw (stretch) escape wheel teeth
- Tip (machine) escape wheel teeth to true escape wheel
- Straighten two pivots
- Replace threads on hand nut
- Install three bushings
- Make one new movement screw (extra long and blued to match)
- Realign (true) pillar posts
- Close escape pallets to decrease entrance drop
- Poise second hand
- Tighten second hand on front escape wheel shaft

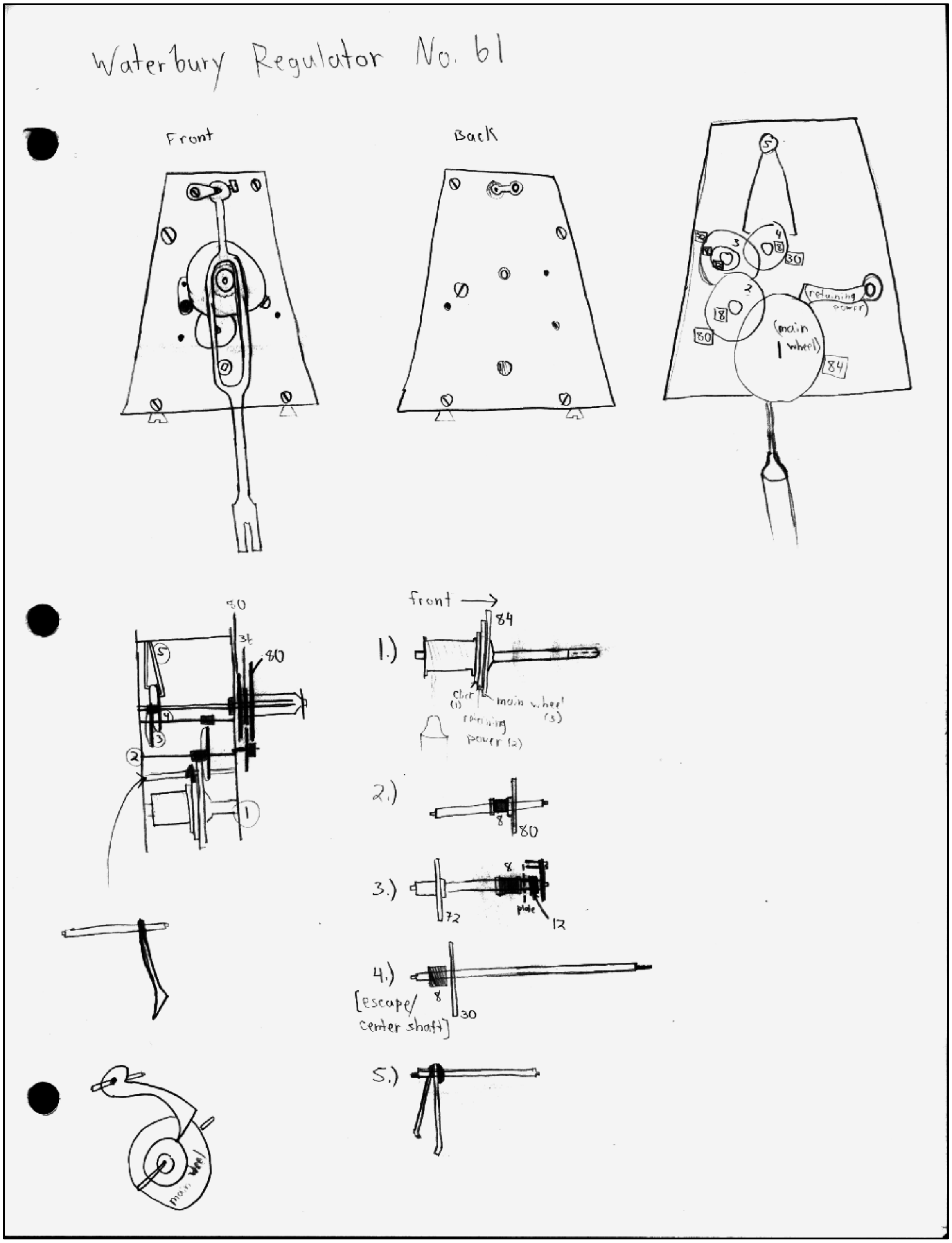
Attachment B

Tooth Count:

- Hour Pipe = 80 teeth
- Minute Wheel = 54 teeth
- Minute Wheel Pinion = 10 leaves
- Hour Wheel = 80 teeth
- Cannon Pinion = 36 leaves
- Main Wheel = 84 teeth
- Second Wheel = 80 teeth
- Second Wheel Pinion = 8 leaves
- Third Wheel = 72 teeth
- Third Wheel Cut Pinion = 12 leaves
- Third Wheel Lantern Pinion = 8 leaves
- Escape Wheel = 30 teeth
- Escape Wheel Pinion = 8 leaves

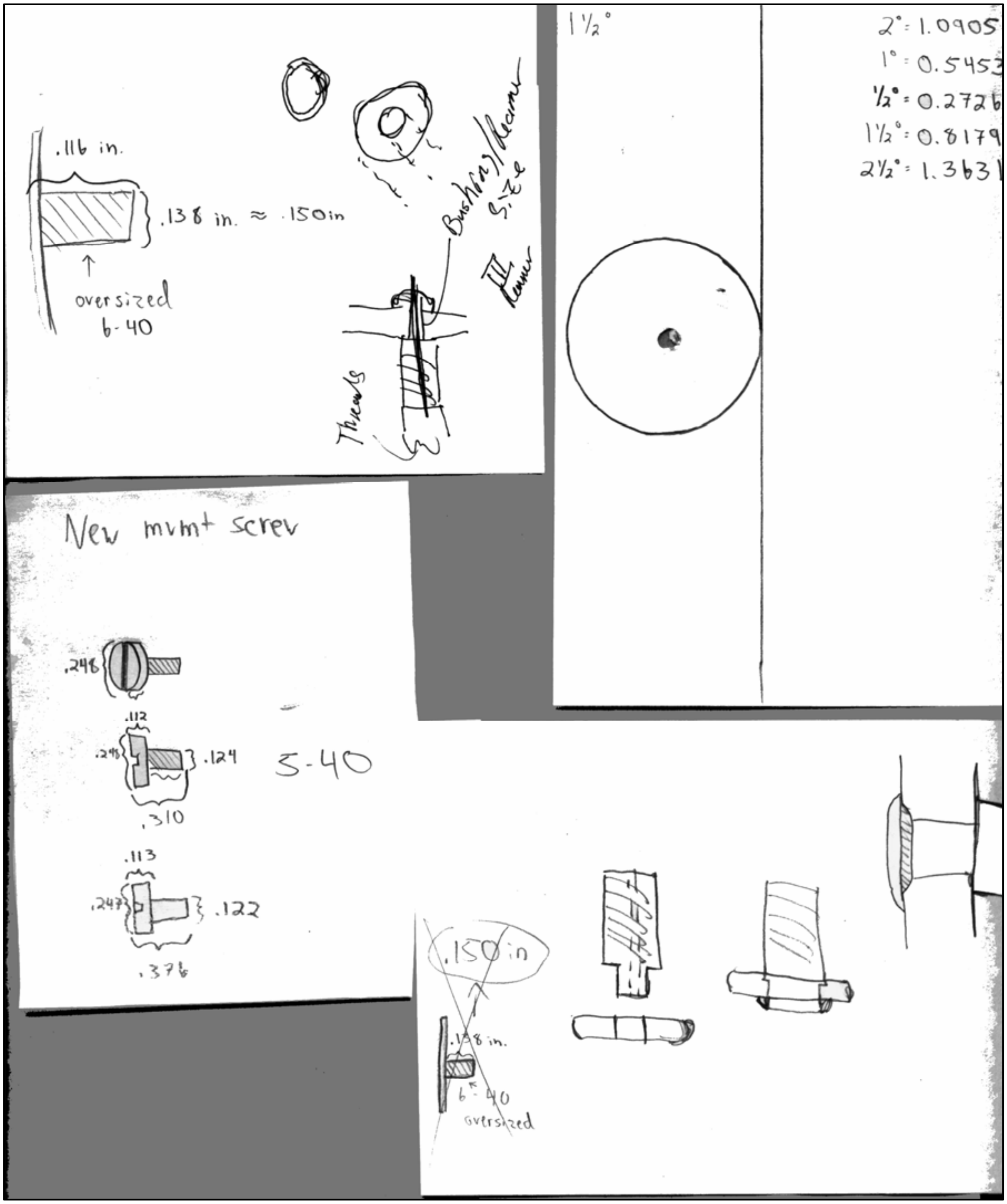
Attachment C

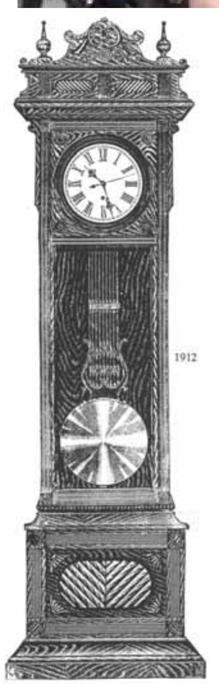
Original Sketch



Attachment D

Other Sketches





1912

REGULATOR NO. 61
Quartered Oak.

8 Day, Weight, Time.
Brass Weight.
Finely Finished Movement of Best Quality
Encased in Iron Box.
Dead-beat Escapement, Sweep Second,
Retaining Power.
12 inch PORCELAIN Dial.
Height, 96¾ inches. Width, 28⅜ inches.
With Gridiron Pendulum, Oval Rods..$90 00
With Compensating Mercurial Pendu-
lum 128 50
For Mercurial Pendulum See Regulator
No. 71.