Setting up an American Time and Strike Clock<br>by David J. LaBounty, CMC FBHI

The modern clock repairer will come into contact with a myriad of different clocks by many manufacturers and a large variety of styles, each with their own particular setup procedures. An in-depth discussion of each style and manufacturer would fill many volumes, and much has already been written ${ }^{1,2}$, but a brief overview of one particular style may benefit the clockmaker. The Connecticut American count wheel striking mantel clock is one style where a generalization of the setup procedure is possible and is likely to cover most of the striking American mantel clocks encountered.

## Drawing the Movement

The setup procedure will actually begin prior to restoration and before the movement is disassembled. It is important not only to know how the movement functions but also the location of each part. Studying the movement, and making drawings, forces the repair person to become familiar with the parts in a way that simply can't be done by taking a photograph. Understanding how the parts interact before disassembly will greatly reduce the amount of time necessary to setup the movement.

The drawings don't need to be highly detailed, nor to scale, but the parts should be labeled and easily identifiable. Noting orientation is also a plus. (Figure 1)

## Reassembly



Fig. 1 Reference drawing to aid in reassembly.

Using the detailed drawings, the movement can be reassembled with all of the gears and levers in their proper positions. The time train on an American mantel T/S movement may be installed without concern of the need to synch the gear train. The strike train, however, does require several of the gears to be properly oriented so the movement will strike properly.

## Setting Up the Strike Train ${ }^{1}$

The butterfly and the hammer lever may initially be left out of the movement to aid in assembly. These can be easily installed once all of the other gears and levers are jigged into place and the plates secured to the pillar posts. Leaving them out will make it easier to position the key strike
 gears.

Fig. 2 Hammer and Fly

The key strike components are (See figure 3)...
-The count lever
-The maintenance lever
-The stop lever
-The maintenance cam on the 3rd wheel


Fig. 3 Key strike components.
-The stop/warning wheel
The count lever, maintenance lever, and stop lever are often attached to the same arbor so their installation is done all at once. The gears they interact with are installed using the levers as a reference, with the notch in the maintenance cam lining up with the maintenance lever and the pin on the stop/warning wheel in close proximity to the stop lever.

The position of the stop/warning wheel can be fine-tuned after assembly by gently lifting the plate just enough to disengage the pinion from the 3rd wheel. The stop/warning wheel can then be rotated and re-engaged with the 3rd wheel. This process can be repeated until the gears are properly synched. This means the maintenance lever is in the middle of the notch when the stop/warning pin is engaged with the stop hook. The butterfly and hammer assembly may be installed using the same technique of lifting the plates slightly.

All of the other conditions for proper strike may be attained by adjusting the levers once the movement is assembled. Be sure the lever return springs are well attached with enough tension that the levers don't move when the movement is turned upside down.
(See footnote \#1 for a more detailed description of the levers of American striking clocks.)

## Setting Up the Time Train

It should be mentioned that setting up the clock would also include adjusting the escapement for proper function. Time and strike American mantel clocks were made with recoil, half-deadbeat, and Brocot escapements and each is handled in a slightly different manner. The condition and proper adjustment of the escapement will greatly effect how the clock runs. ${ }^{3,4,5}$

## Strike Lever Adjustments ${ }^{1}$

There are several lever adjustments which need to be made once the movement is assembled. The goal is to adjust the levers for the greatest reliability and least chance of fault. The movement is designed to allow room for error due to play of the gears, motion of levers, temperature changes, minor wear, etc... The levers should be adjusted so they are in the "sweet spot". That means the count lever rests in the middle of a notch in the count wheel, the maintenance lever rests in the middle of the notch on the maintenance cam (at stop), and both the warning and stop levers properly catch the stop/warning pin.

The strike release point should also be checked and adjusted so that the clock strikes when the minute hand is pointed directly at the 12. Some movements strike the half-hour so this should be checked as well. The adjustment for an early or late release is done on the "J" lever.

## Adjusting the Hammer ${ }^{1}$

The amount of lift of the strike hammer is also something that should be checked when setting up the clock. Too little lift and the hammer won't provide a solid enough blow to be heard. Too much lift and the strike train could stall due to insufficient power to lift the hammer. The ideal is one hammer-head's length of lift and the adjustment is done on the hammer detent (Figure 4). Bending the detent one way or the other will change the position of where the hammer tail dwells in the hammer lift pins on the 3rd wheel. The result is more or less lift as the hammer tail falls off the pin sooner or later.


The final setup for the hammer is done once the movement is in the case. Adjust the hammer arm so the hammer properly hits the gong, bell, or rod. The hammer should hit squarely and rebound after a single blow. If the hammer is too close, it will stutter or come to rest against the gong, rod, or bell deadening the sound.

## Setting the Beat

Once all of the lever adjustments have been made, the movement may be installed into the case and made to run. The movement should be wound, the pendulum hung, and then the beat checked.

The beat of a clock is the sound of the escape wheel tooth being caught by the pallet and is noticeable as the "tick-tock" sound. The swing of the pendulum controls the beat and it should ideally occur at the same point in the swing of the pendulum both sides of center. If the beat occurs closer to one side of center than the other, the movement is said to be out of beat.

This part of the setup of the clock should be done with the clock sitting on a level surface (Figure 5). An adjustable level board is handy but any surface which is known to be level will work. Setting the beat is done by slightly bending the crutch wire (Figure 6) in such a manner that the crutch foot is moved towards the side with the longest pause after the beat. So, with a clock having a pendulum moving left-right, left-right and a beat sounding like "tick, tock, pause, tick, tock, pause", the crutch wire should be slightly bent towards the right. The


Fig. 5 Clock sitting on a level board and ready for the beat to be adjusted. beat should sound even, like a metronome, without any limping sound.

Those of us with poor hearing can use a more empirical method. The evenness of the beat, or balance, can be determined by carefully moving the pendulum right or left, just until the beat occurs, and then letting it go. If the beat occurs as the pendulum moves the other direction,
repeat the process by moving the pendulum to the opposite side. If at any time the released pendulum doesn't produce a beat, the movement is out of beat and must be adjusted. The goal is to have the swinging pendulum produce a beat when carefully released in both directions. Using this method, the crutch wire should be bent opposite the direction of the side which doesn't produce a beat.

There are a variety of electronic tools available which can aid in setting the beat. Amplifiers and timing machines are useful but not essential.

## Dial Installation

Installing the dial may seem straight forward but there are always problem clocks lurking around which can cause setbacks. The dial must be carefully


Fig. 6 Setting the beat using a wire bending tool. aligned so that the center shaft and wind arbors are centered in their respective holes. Shifted movement feet and/or multiple dial screw holes can make this a frustrating endeavor. If things don't line up, it is often a result of the dial screws being in the wrong holes. (Figures 7-8)


Fig. 7 Poor dial alignment.


Fig. 8 Acceptable dial alignment.

## Installing the Hands

Install the hour hand and use the minute hand to rotate the center shaft until the strike is released. Once it is determined where the strike release point is, the minute hand may be installed so it is pointing at the 12. The hour hand can be moved so it is underneath the minute hand and both are aligned at the 12. This will position the hour hand so, when the minute hand is rotated, the hour hand will be pointing properly all around the dial.

The clearance between the hands and the dial, as well as each other, is something that should be carefully noted. Reshape the hands and/or position the hour hand on the hour pipe to correct any problems. (Figure 9-10)


Fig. 9 Poor hand alignment.


Fig. 10 Acceptable hand alignment.

## Synchronizing the Strike

Setting up the clock so the strike matches the time can be done several different ways. There are positives and negatives to each.
-Move the hour hand to the number just struck. While this method is fairly simple, it will create a problem when the hour hand gets loose and gravity causes it to always point at 6 . It can be difficult to push the hour hand back into place without first removing the minute hand.

- Move the minute hand rapidly around the dial. Doing this will advance the time without giving the strike train a chance to complete the sequence. The problems with this method are the risk of breaking or bending the minute hand, levers getting jammed or pins broken, and the difficulty in getting the strike synchronized due to the hit-or-miss nature of the method.
-11-9 Method. Move the minute hand up past the 11, but not all the way to the 12, and listen for the strike train to go into warning. Move the minute hand backwards to the 9 and the strike train will be released. Repeating this process will advance the strike by $1 / 2$ hour, or by 1 hour if there's no release at the half hour. The disadvantage of this process is that it can be time consuming. There are several advantages. It is easier on the movement. It is a lower risk to the hands. And it can be easily controlled.


## Rating the Clock

The final step in the setup of the clock is to adjust the position of the pendulum so the clock will keep time. Spring-driven movements suffer from isochronal error. This is the error in rate caused by the difference in power from when the mainspring is fully wound to when it is unwound. In some American mantel clocks, the error in rate can be as much as 15 minutes per week. Adjusting the rate for the best day to day run on a clock with large isochronal error will cause a great deal of frustration. It is best to adjust the rate for the best run over a week rather than over a single day. The clock may be fast at the beginning of the week but will slow down at the end and be zero minutes fast/slow after 7 days of running. As with setting the beat, a timing machine is useful but not necessary.

## Instructions to the Customer

The above detailed instructions may be beneficial to the professional clockmaker but the average customer will start to tune-out after the first few sentences. Since it is important that the owner of the clock not be afraid to use it, less detailed operating instructions should be given for each clock returned.
-Remove the pendulum any time the clock is moved. Leaving the pendulum on the movement could damage the clock, and knock it out of beat, if the pendulum is allowed to bang around.
-Put the clock on a solid and level surface. The clock will run best if it isn't on a rickety surface which can get jostled.
-Hang the pendulum. The customer should be shown where to hang the pendulum and allowed to install it themselves.
-Wind the clock. The clock should be wound once per week for an 8-day clock and once per day for a 30-hour. For an 8 -day clock, pick a day and wind the clock on the same day every week. If forgotten, the clock has a grace period before it will stop. When winding, push the key all the way in, turn, and gently let it back against the stop. Don't get in a hurry or let the key snap back. Wind until the mainspring is fully wound; until no more "clicks" can be made. Don't over stress the key by trying to force the mainspring beyond fully wound. Wind both sides and it doesn't matter which side is done first. Show the customer which direction to wind and allow them to wind one side. If a double-ended key, explain what both ends are for. The small end of the key is for rating the clock and the large end is for winding.

Customers will often ask if they should let the clock run down or if they should stop it when they are gone on vacation. Spring-driven clocks should be allowed to run down. The mainspring has a "memory" and, if a spring is left fully wound for a long period of time, it will become set and not unwind fully. They should expect the strike to be off when they return and need to be re-synched.
-Start the clock running. Pendulums which can be accessed from the front, may be given a gentle push to start it swinging. Where the pendulum is only accessed from the rear, like in a tambour mantel, lifting one side of the case and setting it down will start the pendulum.
-Listen for an even "tick-tock" sound. Have the customer listen for an even beat and then lift one side of the clock so they know what is like to be out of beat. The clock needs to be in beat or it won't run well. It may be necessary to shim one side of the clock in order for the clock to be in beat.
-Synchronize the strike. Show the customer how to synchronize the clock. The 11-9 method is recommended. Allow them to do it several times.
-Set the clock to time. The minute hand may be moved backwards a few minutes only but stop if any resistance is met. It is best to move the minute hand forwards to set the time, stopping at each hour and half-hour to allow the movement to finish striking. If the movement isn't allowed to finish striking, it will get out of synch and must be re-synched.
-Rate the clock. The clock will keep a different rate in different locations. This is due to temperature, humidity, and a number of other factors. So, the clock may run a little fast or slow when it is set up at home. The rate can be changed by using the rating nut (or fast/slow adjuster on the dial if so equipped). Turning to the right makes the clock go faster and turning to the left makes it go slower. For an 8-day clock, adjust the rate after the clock has run a week.

1. LaBounty, David J., CMC FBHI. The Levers of American Striking Movements, 2001. http://www.abouttime-clockmaking.com/downloads/Levers-2.pdf
2. LaBounty, David J., CMC FBHI. Alarms of American Mantel Clocks, 2007. http:// www.abouttime-clockmaking.com/downloads/ Alarms\%20of\%20American\%20Mantel\%20Clocks.pdf
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