An Analysis of Two Pivot Polishing Techniques

By Robert Whiteman, 2008

The following pictures were taken of two pivot samples prepared by Scottie and LaBounty to observe the differences in their methods. Scottie's sample was polished using progressively finer grits of paper and then finished with a final polish using Simichrome[1] polishing compound, while LaBounty's sample was filed and burnished.

These pictures were taken by Scanning Electron Microscope (SEM) to get the best detail and resolution possible at various magnifications. The sample number and magnification are shown in the lower left corner of each photo. The scale is indicated in the lower middle of the picture by the white bar and distance in µm.

Sample number #1 was prepared by Scottie and Sample #2 by LaBounty. This short study was a follow up of an exercise I had presented some time ago and can be seen at :

http://abc.eznettools.net/D304430/X353088/Pivots.pdf

PLEASE NOTE THE FOLLOWING:

The samples shown in the following SEM photographs were cleaned with isopropyl alcohol before the pictures were taken. However, the samples had been taped to a piece of paper for mailing to me and we later found residue from the tape adhesive remained on the samples after the brief cleaning process. Ordinarily we would have re-cleaned the samples with more aggressive methods to thoroughly remove all contaminates and retake the pictures; however, the available time in the lab did not allow this. Some of the larger foreign objects seen on the pivots were from this adhesive and should be ignored as they are not the result of either technique nor representative of the individuals' workmanship. The features we should be looking at are the surface finish available from each technique.

Each method and time required for the respective process is described in more detail below:

Sample 1 by Scottie:

-1500 grit supported with a steel rule, dry = 1 min.
-2500 grit supported with a steel rule, dry = 1 min.
-Simichrome[1] polish with thin cotton cloth backed by a steel rule, again = 1 min.
-As this would normally be done BEFORE the cleaning process, it should not have residue. The pivot was not cleaned or rinsed after polishing.

Total time = 3 minutes.

Sample 2 by LaBounty:

Started at 10:37:30

-Pivot file used to remove wear and bring to a flat surface.
-Carbide burnisher, lubricated with Hoppe's no. 9 lubricating oil[2], used in 2 stages:
1. Coarse side to remove file scratches.
2. Fine side to remove more scratches.
-High speed steel burnisher, lubricated with Hoppe's no. 9[2], used to burnish the pivot surface. This was used since the steel was slightly too soft to burnish with a carbide burnisher.

Completed at 10:38:19

Total time to polish and burnish = 49 seconds.

Analysis 1/14/08 by Bob Whiteman

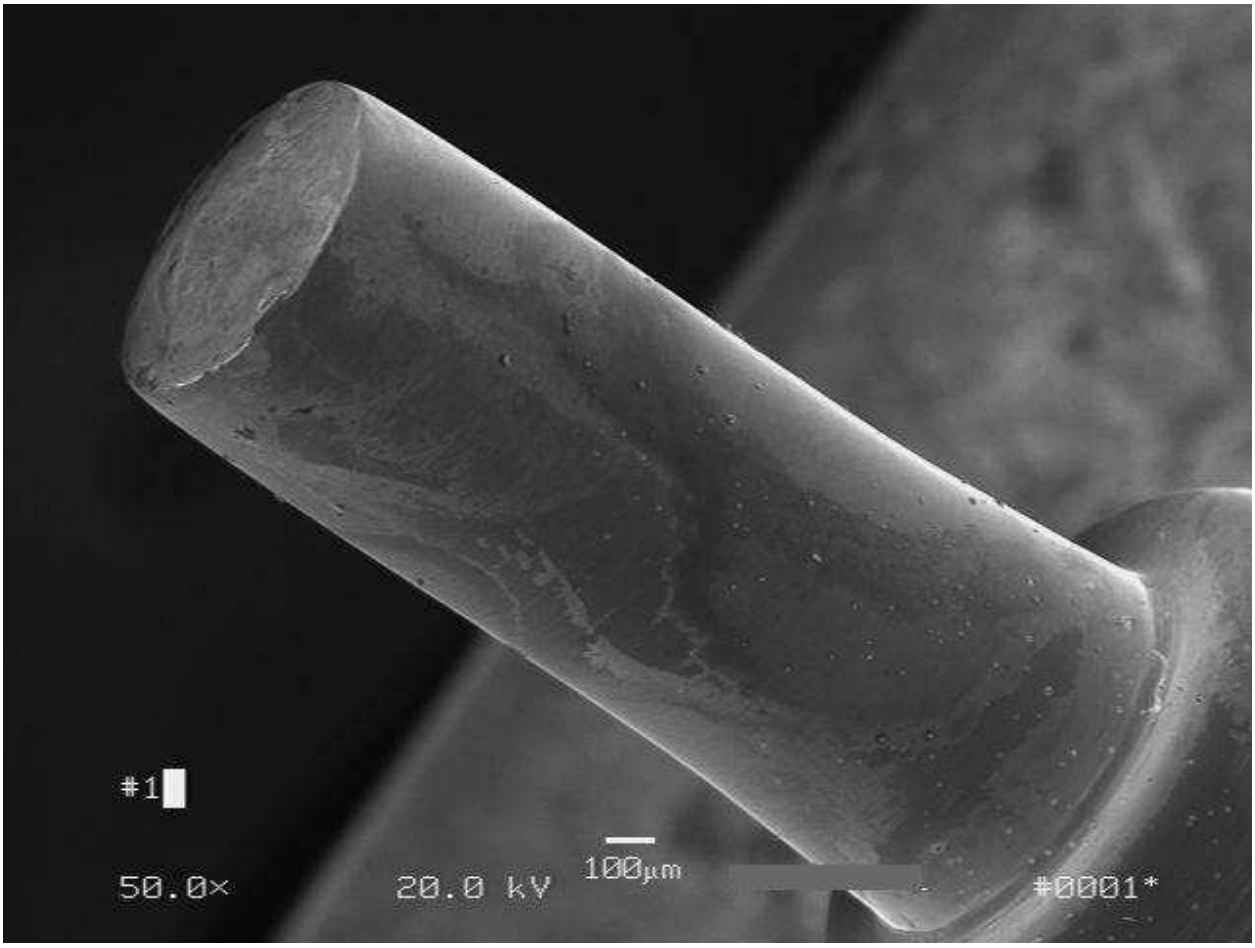

Figure 1: Scottie's method

In this photo you can see some shading in the surface texture which appears to be residue from the Simichrome[1] polishing compound. Also there is a taper or non-cylindrical shape to the overall pivot. There are small 'dots' visible which were identified as iron (Fe) during the element scan which will show up in a little more detail in the later photos.

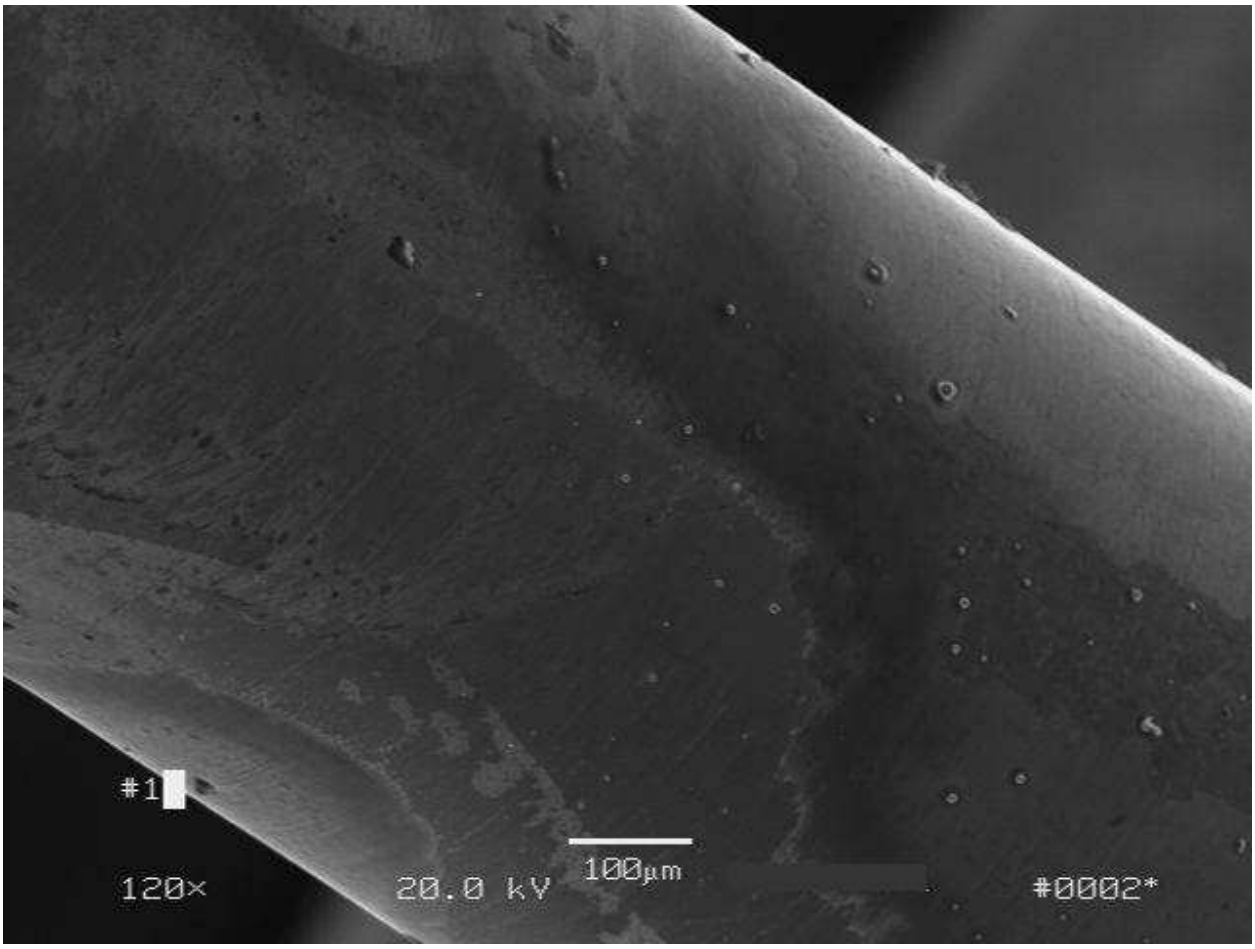

Figure 2: Scottie’s method

Here you can see the specs of iron particles that are present on the surface. Prior to assembling this pivot back into a clock it would need additional cleaning steps to remove these contaminants. Also the polishing compound residue is a little more evident as dark shaded areas in the photo.

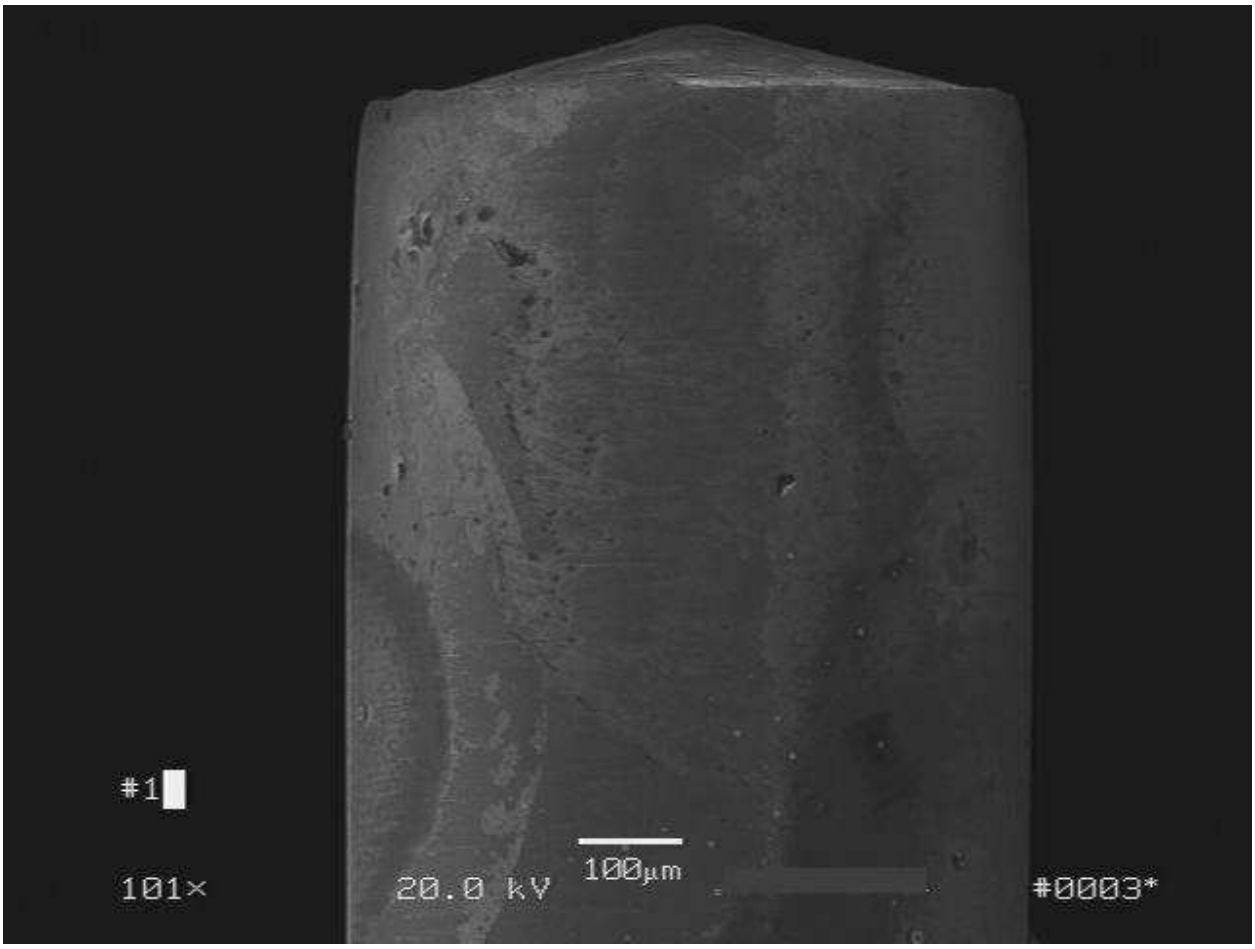

Figure 3: Scottie's method

Although additional cleaning should be done the general surface texture is not that bad. This technique has eliminated most of the surface scratches.

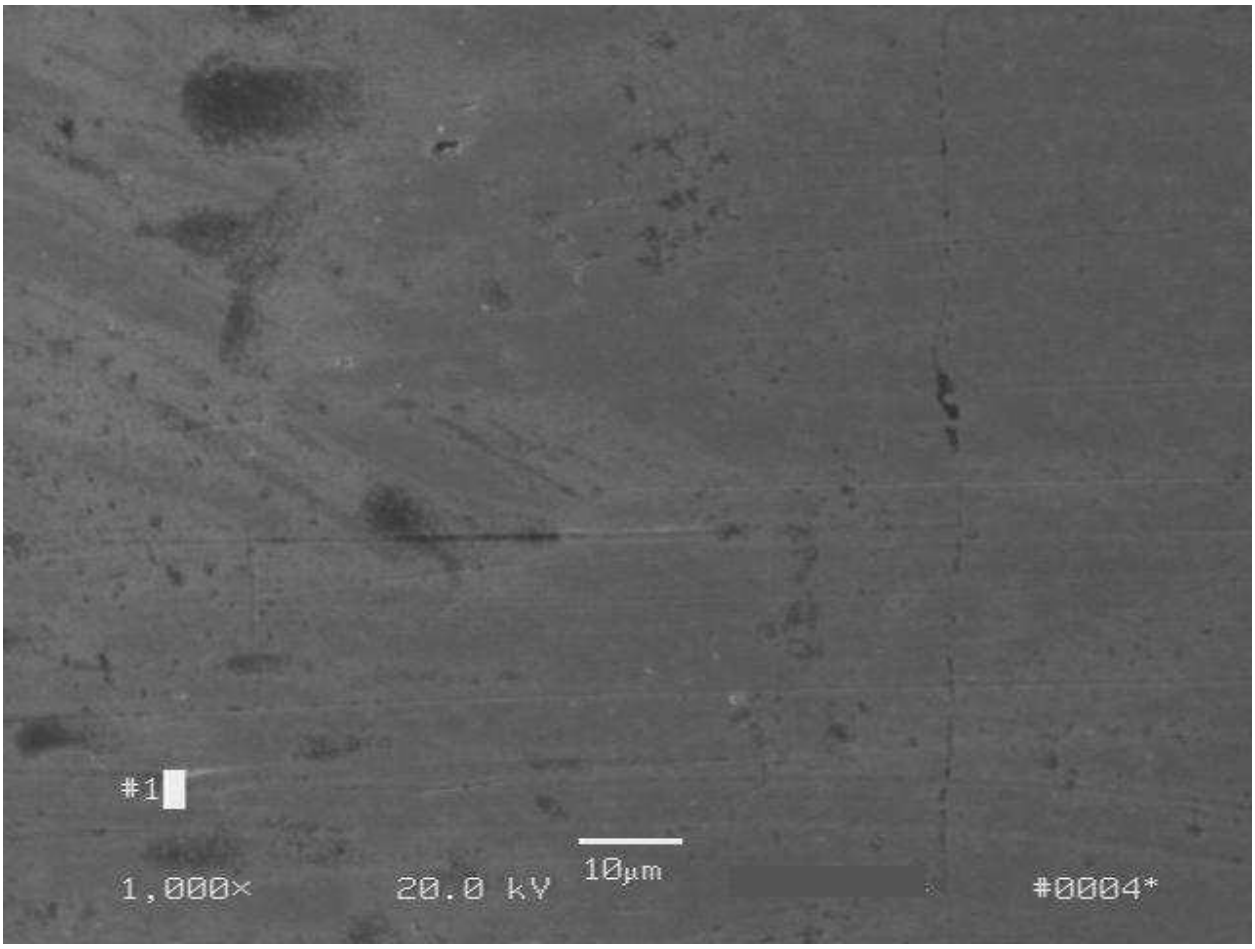

Figure 4: Scottie's method

Here remaining scratches (horizontal and diagonal) are visible but would probably not have any detrimental effects of the performance of a clock. The darker shaded areas are lower atomic number particles, probably the residue from the polishing compound.

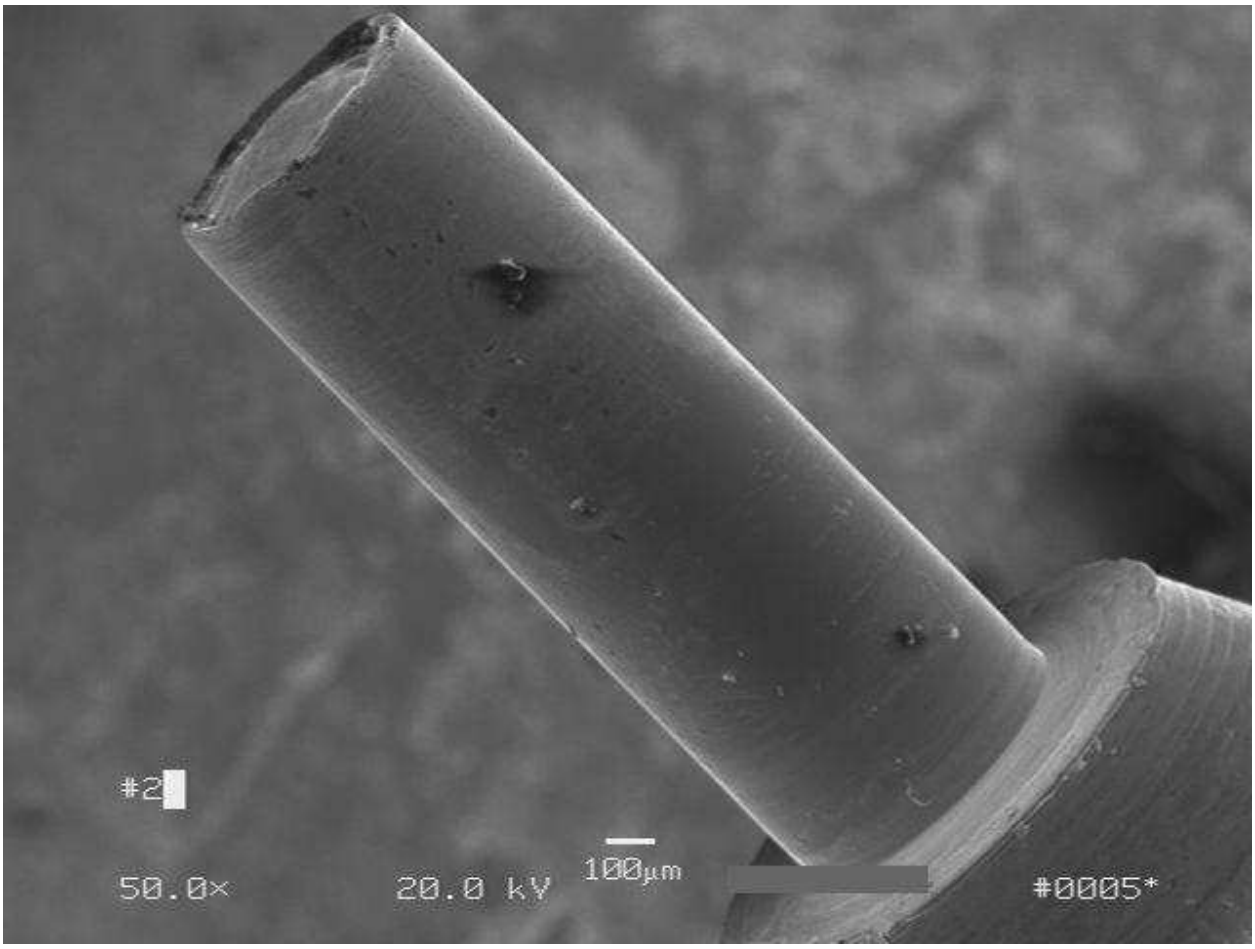

Figure 5: LaBounty's method

This photo has several large dark contaminated areas that were identified as the residue from the tape used during shipment and should be ignored while viewing this photo. In this view it is easy to see the cold flow of material at the tip of the pivot caused by the burnishing process. The pivot has a cylindrical shape of uniform diameter.

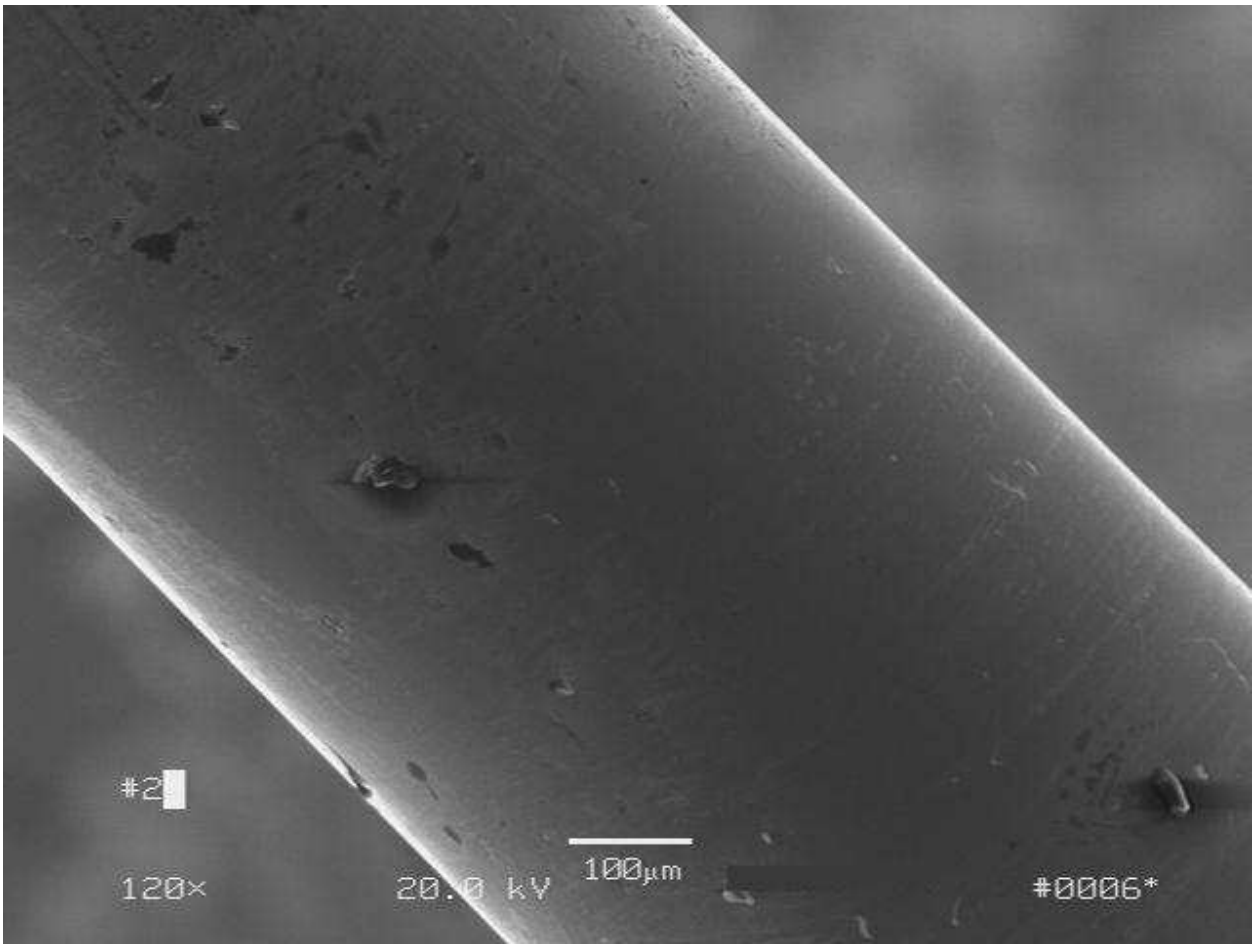

Figure 6: LaBounty's method

Again the dark areas and larger tape adhesive contaminates should be ignored. The surface is generally smooth with some small circumferential scratches visible on the upper right surface of the pivot.

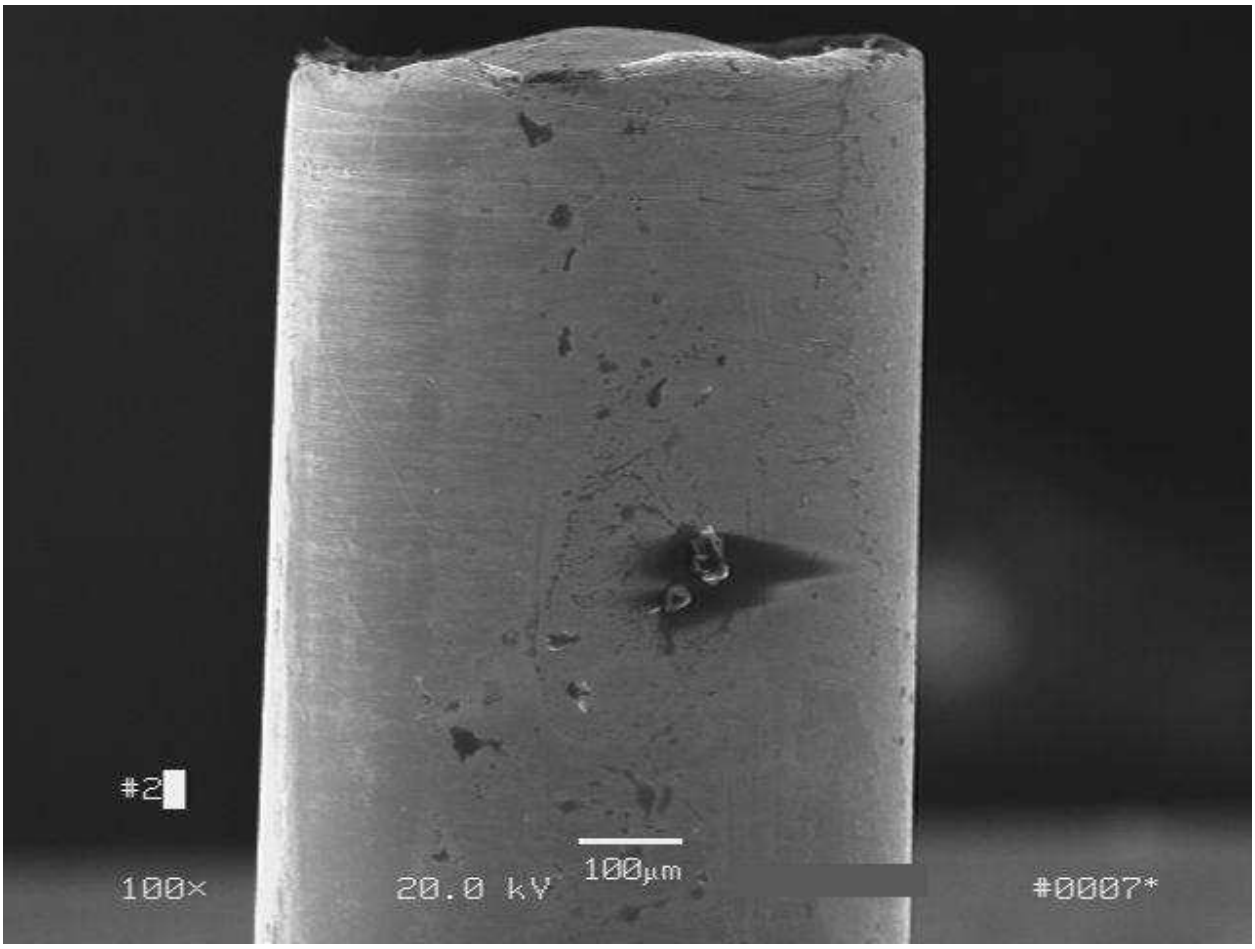

Figure 7: LaBounty's method

The tape adhesive contaminates are again visible in this picture. The material flow at the end of the pivot is clearly visible in this picture. Some scratching and material flow is visible on the surface of the pivot. The lighter areas (most of the pivot seen) are higher atomic number elements which is mostly iron

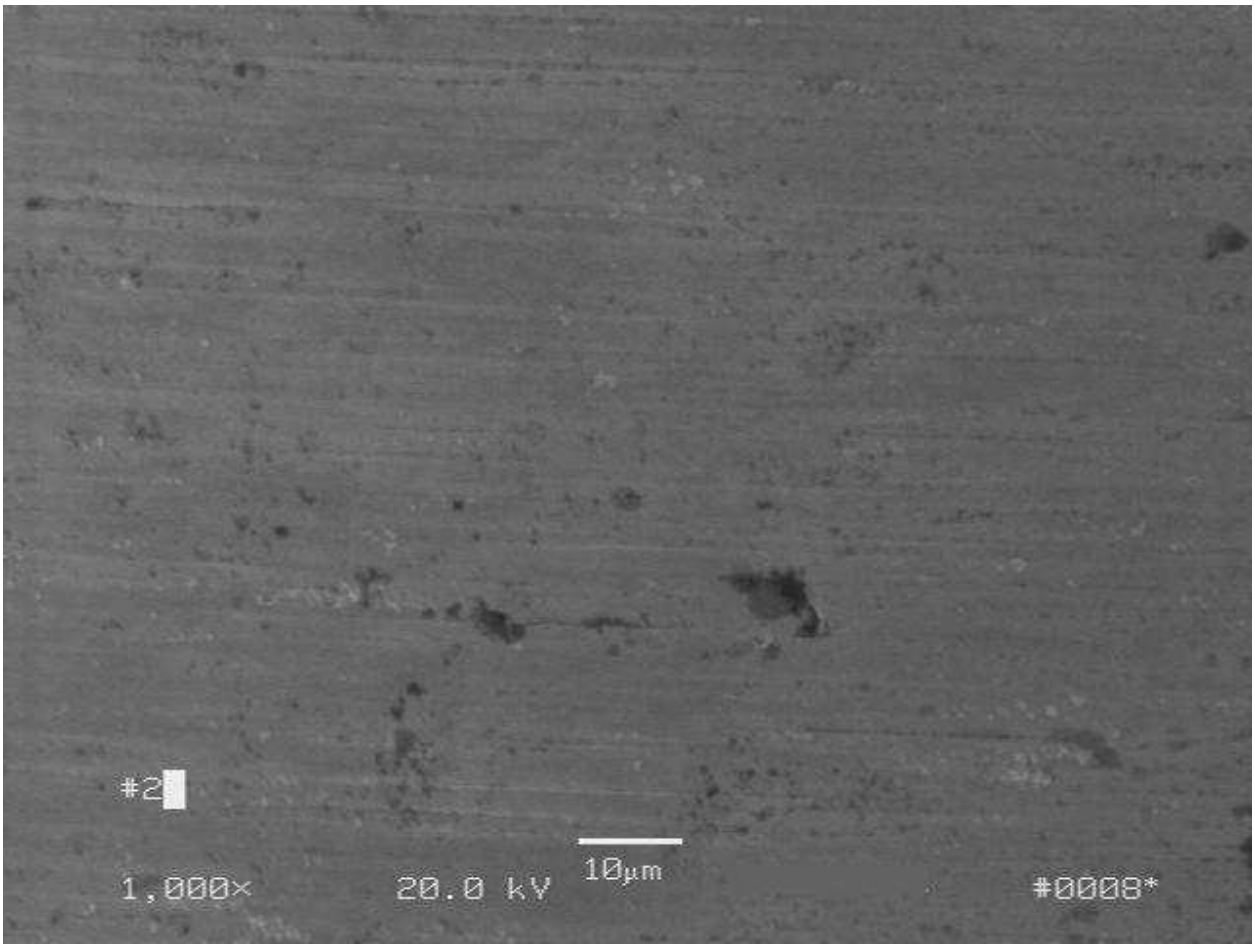

Figure 8: LaBounty's method

The surface appears uniform with very slight horizontal scratches visible over most of the surface.

1. Simichrome is available from Competition Chemicals, Inc., Iowa Falls, Iowa 50126, phone (641) 648 5121
2. Hoppe's no. 9 Lubricating Oil, Hoppe's is a division of Michaels or Oregon Co., PO box 1690, Oregon City, OR 97045, www.hoppes.com

Biographies

Robert Whiteman – Bob is a Manager of Development Engineering with a Fortune 500 company. He has a BS in Mechanical Engineering and currently has 87 patents. In his spare time he enjoys machining, wood working, electronics, flying RC and CL model airplanes, and of course working with clocks.

Howard S. "Scottie" McElroy, - Age 67. Retired communications technician, AT&T. Began clock interest 1999. No formal courses. No certificates. Current interest; Vienna clocks and escapement study.

David J. LaBounty, CMC FBHI- David is a certified professional clockmaker with over 20 years bench experience. He owns and operates a shop in Mitchell, NE.