



Founded 1858

British Horological Institute

The Portfolio - an example of supplementary work:-

The following pages serve to provide an example of work suitable for one Portfolio item. The material presented is drawn from an excellent Portfolio submitted by James Robinson in May 2006.

The supplementary material is structured under the headings:-

1. Appraisal
2. The Conservation / Restoration Process
3. A Justification of the Conservation / Restoration Approach
4. Research

There have been additions to Mr Robinson's work because of changes to form the structure above; these are principally within the section "A Justification of your Conservation / Restoration Approach". It is expected that the justification will consider the various approaches outlined in the Examinations Board information "The Servicing of Clocks and Watches".

The work for each of the five Portfolio items must contain a section for each heading but, in order to provide a comprehensive example for guidance to candidates, this illustration has been drawn from two Portfolio items.

The Examinations Board expresses gratitude for this opportunity to use a candidate's work to provide this example.

APPRAISAL - Initial Condition of the watch movement and its case

This watch was cased in a brass full hunter case, which although intact was heavily oxidised (fig 1). The dome was engraved “Remontoir Perfectionne, Fabrication Suisse”, although this was barely legible.

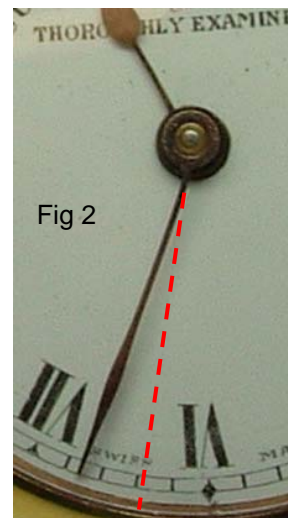


All of the case parts such as lock, crown, push piece, springs and joints were intact and functional, with the thin mineral glass being in near perfect condition.

The Dial and Hands

The copper enamelled dial was also in near perfect condition apart from some very minor scratches and some slight discoloration (most of which was under the bezel and not visible). The only other faults with the dial were that one of the dial screws was missing and the slot in the edge of the dial for the second screw (12 o'clock position) had been enlarged by previous over tightening, making it larger than the diameter of the screw head.

The hands although showing some discolouration were, considering their age, in good condition apart from a slight bend in the minute hand towards the collet (fig 2, the dashed line showing the correct position of the hand).



The Movement

The movement however was not in such a good condition. Fig 3 shows the movement in the condition I received it. It can be seen that besides discoloration the escapement (balance, pallets and escape wheel) is all missing.



Fig 3

These parts were all separated from the movement and arrived in a small plastic pot. The escape wheel (fig 4) had its lower pivot broken, but besides that was intact and serviceable. The pallets (fig 5) were in poor condition with the staff missing and the exit pallet pin missing. The balance assembly had been dismantled (fig 6), the balance spring was distorted in the round and flat throughout, the staff badly worn with visible wear to both pivots and the impulse finger so badly worn it only occupied half of the space in the notch of the lever. The rim of the balance was oxidised but showing no signs of other damage.



Fig 4



Fig 5



Fig 6

The winding stem/clutch wheel support block (fig 7) was also broken. This was made from a casting of a soft alloy with brass bushes inserted either side to accommodate the winding stem pivots, leaving only a thin section of the soft alloy top and bottom presenting an obvious fracture point.

Besides these major faults several other points were noted; these included the need to bush the barrel, barrel cap and the barrel arbor pivot holes in the plates. The rest of the train also needed bushing with elongated holes throughout, this included pallet and balance pivot holes. All pivots were showing signs of slight wear although none, excluding the missing escape wheel pivot, were beyond repair. The wheels and pinions themselves were also showing signs of wear, all teeth and leaves were however intact, presenting no major difficulties. The blue steel mainspring was not serviceable as when removed from the barrel it only expanded to about twice the diameter of the barrel, besides being distorted in the flat, probably due to previous hand winding. The single index pin was also missing with only the single rivet left in the index. Also one case screw was missing and the head of the crown wheel screw was broken, both required replacement.



Fig 7

The Conservation / Restoration Process

The design / making of the two missing / replacement components

The two components missing from this movement required careful consideration if originality was to be maintained.

The first was the pallet staff, the original design of this component not being difficult to reproduce. The distance between the pallet cock and plate could easily be measured as could the correct height of the pallets from the plate, using the escape wheel and position of the impulse finger on the balance staff as reference. The same applied to the size of pivots required, their length could be calculated by measuring the cock/plate, taking into account the depth of the oil sinks and their diameter could be approximated at by measuring the worn pivot holes. Several clues also remained on the pallets as to the type of staff, there was no sign that the pallets had been riveted or screwed to the original staff e.g. marks/threads around the hole. There was also a ring left on the underside measuring $\varnothing 1.5$ mm where there was much less corrosion, indicating a seat onto which the pallets fitted. These factors led me to arrive at the design shown in the sketch (fig 8, dimensions in mm) onto which the pallet frame could be pressed friction tight.

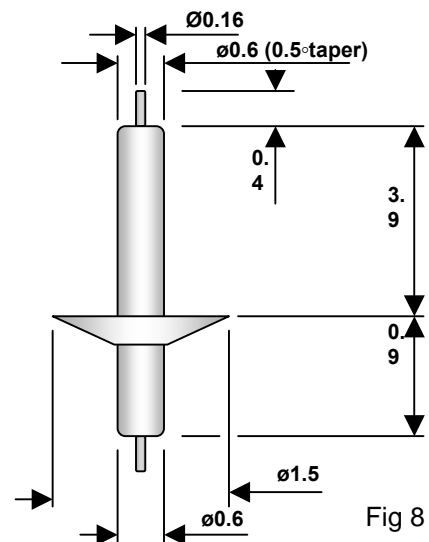


Fig 8

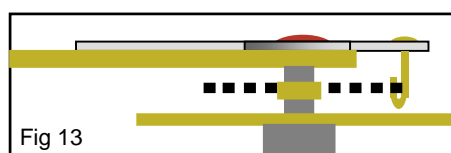
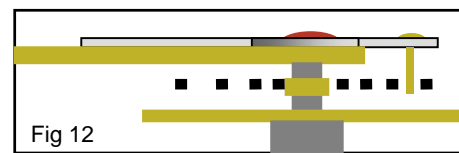
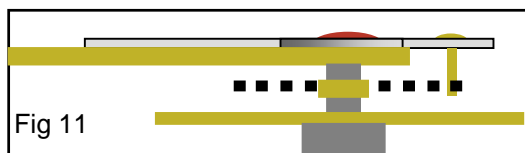
The second component was the winding stem/clutch wheel support block. The original block was made from a casting of a soft alloy, with two brass bushes inserted for the stem to pivot in. This presented a difficulty; where the bushes were fitted only a small section of the casting remained. This was not a great problem with regards to the large hole, as most of the forces acting upon it would be at right angles and extra support is given at these angles by the plates between which it is sandwiched. The pivot hole which was broken however was the small hole for the pivot at the end of the stem. This had broken due to the force exerted upon it by the stem when it was depressed to open the front cover, as this bush, in conjunction with the square on the stem acts as a stop for the winding stem. Here no additional support is provided with all of the force taken by the small section of the casting above and below the brass bush. Fig 9 shows the original block.

This component was beyond satisfactory repair mainly due to the size and direction of the forces acting upon it and the soft alloy from which it was made did not lend itself well to having a new section keyed into it. The decision was made to make a new block to the same design as the original, but to make it from solid brass (fig 10).



The other work undertaken to the watch

Another missing component was the single index pin. This was most likely of the loop variety as a single pin would only act on the balance spring through approximately half of its swing. As the balance spring relaxed it would move out of contact with the index pin, the balance then effectively becoming free sprung until contact with the pin was re-established as the spring tightened. Figs 11 & 12) show this effect. The duration with which the spring would be in contact with the pin would vary dramatically with amplitude of the balance, this making a watch which would be almost impossible to regulate. Fig 13 shows the most likely design for this component, with the spring simply being passed into the loop before pinning the spring.



The Train

The barrel was bushed first, opening the holes to a suitable diameter and soldering brass bushes into place, the pivot holes were then broached to the correct size, checking both end and side shake (fig 14). The barrel arbor pivot holes in the plates were then bushed, keeping end and side shake to a minimum while keeping the depthing between intermediate setting wheel, cannon pinion, third wheel and minute wheel correct. The next point to be tackled was the broken escape wheel pivot, the arbor was successfully drilled and a piece of blue pivot steel fitted, this was then finished and burnished. All other train pivots were then re-finished, taking care not to reduce their diameters by any more than was necessary, in order to maintain their strength.



Fig 14

The train was then re-bushed, using the depthing tool to check the correct depthing of each wheel and brass bushes pressed into the plates, these were then broached to the correct sizes. With all pivots serviced, the train (including the barrel) was assembled, freedom of rotation and the uprightness of each pair of wheels being checked as work proceeded (fig 15). The oil sinks could then be re-cut to the same style as the originals.



Fig 15

The Escapement

The escapement was repaired next. First the balance staff was made from blue pivot steel to the same dimensions as the original, along with a new impulse finger from hard, hammered brass to the same style as the original but much wider, occupying the space in the notch correctly.

A decision now had to be made regarding the balance spring. This was in a poor state and a new spring would have undoubtedly improved time keeping, however with the steps already taken to maintain originality the distortion was corrected. This resulted in a functional but far from perfect spring, although with the condition of the train as discussed earlier, this was not such a major issue, at least as far as performance was concerned. The new index pin was then made and fitted, the whole balance assembly fitted and further adjustments made to the spring.

The pallets could then be repaired, first making and fitting the new exit pallet pin to the same pattern as the intact entry pin. The staff was then made to the design shown in the following section, and fitted (fig 16).



Fig 16

The action of the escapement could then be checked, with some adjustments being made to the exit pin to achieve correct locking. However this was simple due to the design of the pallet frame lending itself well to adjustment (fig 17). Some adjustment to the guard pin was also necessary to provide equal shake on either side of the safety roller.



The movement could then be re-cleaned and assembled, correctly lubricated and tested.

The Case, Dial and Hands

Very little work was needed with regards to the case, all parts were intact and functional and the only work undertaken on the case was a light polish, removing oxidation and minor scratches. The dial was left untouched as it was in such good condition and the only other work undertaken was the straightening of the minute hand and the replacement of the dial screw.

A Justification of the Conservation / Restoration Approach

A comparative evaluation of the selected approach with alternatives and steps taken to maintain originality.

The appraisal indicates the extent of the work to be undertaken. The watch is of limited value and parts are not readily available but the object was to ensure that the watch was in reliable working order but retain, as far as possible its originality. The scope of the work is beyond “Repair” with missing components and the winding stem/clutch wheel support block beyond requiring replacement; the overall focus is on “Conservative Restoration” with the exception of the support block. A closer consideration of two parts will illustrate the approach that was followed.

1 The pallet staff, the original design of this component was not difficult to determine from the movement itself. The distance between the pallet cock and plate could easily be measured as could the correct height of the pallets from the plate, using the escape wheel and position of the impulse finger on the balance staff as reference. The same applied to the size of pivots required, their length could be calculated by measuring the cock/plate, taking into account the depth of the oil sinks and their diameter could be approximated by measuring the worn pivot holes. The evidence available ensures that the replacement component is “restoration” / “conservative restoration” – the missing component is essential to the functioning of the piece and the replacement is made according to the design of the original.

2 No part of the support block could be re-used; it was originally made from soft alloy which was unsuitable for attaching a new section. A replacement was made to the same design as the original but from solid brass.

This change in materials was chosen for three main reasons. Firstly the original was made by casting as it reduces manufacturing/machining costs in mass production and in such a cheap watch cost comes before quality, whereas here a satisfactory and lasting repair is

the main priority. Secondly the material from which the original was made could not definitely be identified (similar appearance to aluminium but much less ductile), making an exact copy impossible.

The use of an alternative material for the support block is exceptional both for “restoration” and “conservative restoration” and could more accurately be described as a “repair”. It can be justified because of the lack of availability of a suitable replacement material and due to the fact that the original design could be considered to be of limited life. Finally, once the work is completed the responsibility for conservation falls into the hands of the owner and, with a piece such as this with no real cash value, a watch that repeatedly breaks will incur cost to repair. It is much more likely to be discarded, making any previous attempts at conservation wasted time and effort.

Overall, the approach that was adopted for cleaning, the correction of balance spring defects, etc., suggests “conservative restoration”. The exception, for the support block, is acceptable because of the inherent weakness of the original and the lack of suitable alternative materials.

An evaluation of the work undertaken to the watch

Several points are worth mentioning in this section, the first being the train. All of the wheels and pinions in this movement showed signs of wear, the most severe in the barrel and third wheel/pinion and of course a broken pivot on the escape wheel. If the watch was ever to perform well these should have been replaced. However the decision was made to keep the original train in order to maintain originality as far as possible. Two factors helped to make this decision; firstly their condition was not so bad as to render the movement useless and secondly a Roskopf movement of this quality and age should not be expected to be a superb timekeeper, rather it should be preserved in its original condition as far as is possible.

The design of the replacement components resulted from the evidence available from the piece itself. It was not possible to suggest any variation or improvement to the design.

Small components cannot readily be marked to indicate that they are replacements but notes and photographs summarise the work that was undertaken.

I feel that the repair on the watch was a success, with most of the parts (excluding balance staff, impulse finger and winding stem support) that were supplied with the watch being re-used. The parts that were manufactured were made as closely to the original designs as possible. The exception is the support block and the reasons for the use of brass have been presented in the above section. The case was not really an issue as no real work was needed, only a light polish. The result was a pocket watch restored to working order, and as much of its originality preserved as possible.

Research to discover the historical background of the maker of the watch

This section provides an example of research into the historical background of the maker. It is the also the work of James Robinson submitted for Unit 13 in May 2006 but relates to a different watch to that in the sections above. (Gents Hamilton Intra-matic Calibre; Hamilton 92) It does provide an excellent example of the nature of the material required but candidates should remember that “Research” must relate to the item itself; there are three possibilities for research:-

- 1. research to discover the historical background of the maker of the clock / watch*
- 2. research to determine the design of a replacement component*
- 3. research to learn about a manufacturing process required to produce a replacement component*

The Adams and Perry Watch Company was created in 1874 in Lancaster, Pennsylvania, USA, founded by Mr. Perry a watch designer, and Mr. Adams an organizer and promoter. Bringing skilled watchmakers to Lancaster they began production in 1875. However Adams and Perry did not have the financial means to market their product. This was resolved in 1877 when Lancastrians came to their rescue, raising \$225,000, and restructuring the company, renaming it the Lancaster Watch Company. The Lancaster Watch Company continued to suffer monetary difficulties and in 1884 was again restructured, this time as the Keystone Standard Watch Company. However these financial troubles continued until 1892. In this year the Hamilton Watch Company was created as the result of another re-organization.

In 1893 Hamilton produced its first watch. Designed by H.J. Cain, one of the company’s founding members, the Hamilton Railroad pocket watch (fig 1) was initially manufactured to provide the country's railroads with reliable timing devices. This was soon adopted as the official watch of the American Expeditionary Forces worldwide. A wrist watch version of the railroad watch was issued to American forces during WW1, accompanied Admiral Byrd on his expeditions to the North and South Poles, served the Picards well on their first balloon ascent into the stratosphere, and was on the wrist of the first American to scale Mount Everest.

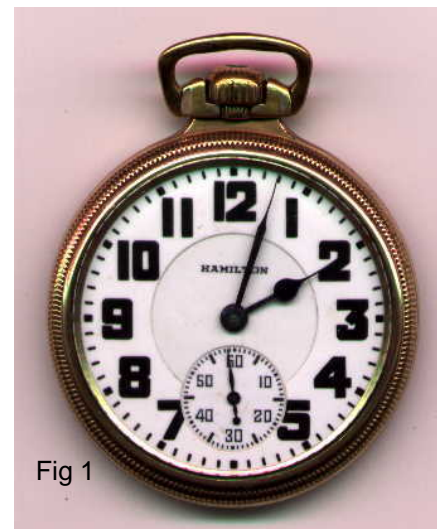


Fig 1

In 1928 Hamilton introduced the Yankee watch (as the Yankees won the World Series that year). New designs such as the Yankee and the Piping Rock established Hamilton firmly as a leader in watch design. By 1930 commercial aviation was becoming increasingly popular and Hamilton became the official timepiece of the most famous American airlines, TWA, Eastern, United and Northwest.

By 1940 however production of watches for the public was halted due to the USA joining the Second World War, Hamilton then produced watches solely for military use. In total Hamilton produced nearly one million watches during this period, the Hack (fig 2, used in conjunction with a camera onboard aircraft to record the release and detonation times of bombs) was one of these watches, this is now very popular among military watch collectors.



During the 1950s with the war over, Hamilton embarked on a program of expansion and diversification. As a result, the company currently produces watches in six plants across the world, under three brand names, Hamilton, Vantage and Buren. They also manufacture plated and sterling silverware, fabricate and process rare and exotic metals, as well as producing mechanical and electronic measuring devices including missile timers and safety and arming devices for military applications.

In January 1957, Hamilton introduced the world's first electric wrist watch, the Ventura (fig 3). This was a breakthrough for the industry and the first major change in portable timekeeping since the 16th century when the mainspring was invented by Peter Henlein. Powered by a tiny battery guaranteed to run the watch for more than a year, the new watch completely eliminated the need for a mainspring. The electric current necessary to operate one 100-watt bulb for one minute could run an electric watch for 20 years. The Ventura became an instant success and was worn by people like Elvis Presley, as seen in his film Blue Hawaii. This breakthrough was followed by another in 1972 when Hamilton shocked the world with a completely new kind of watch, manufactured at its headquarters in Pennsylvania, Hamilton introduced the world's first digital watch, the Pulsar (fig 4).

