

The BHI and American Watchmaking, 1858-1862: Three Unfortunate Mistakes

By Richard Watkins, FNAWCC (AUS)

The Beginning, February to September 1858

In February 1858, "a number of persons engaged in the Watch Trade" in London decided to establish the *British Horological Institute* (the BHI), and in June 1858 it was created.

The first significant step taken by the BHI was the publication of the *Horological Journal*, and the first issue appeared in September 1858. This issue was largely occupied by information about the BHI, including a statement of objectives: "to develop the science of Horology, ... and to stimulate and encourage the production of the best workmanship ...". There was no explicit mention of education because that was the prerogative of the Clockmakers' Company and the master-apprenticeship system which it controlled.

Until the BHI became established, there would be few contributions to the journal, and the editor was faced with the problem of filling the pages. So he depended on pre-prepared articles.

The first issue started a series titled *What is Horology?*, which was a history of clocks and marine chronometers but, rather strangely, it largely ignored watches. And there was an article on *Decimals, for our Junior Readers*. This is even stranger, as the *Horological Journal* had few readers and they were unlikely to have been young! But then, maybe some of the old masters appreciated help with arithmetic. (It is worth noting that in the 1860s the BHI had only about 200 members out of the many thousands of people working in the watch and clock trades in London.) Then "*The principles of Mr. Harrison's timekeeper*" was serialized; I have no idea why this was done as it is a dry, unintelligible description of H4 and of little interest. But it did fill up many pages. And someone calling himself *A Mechanic* wrote "*A few words in defence of English watch-work*." Despite the title, these articles are verbose, don't defend anything, and are mainly descriptions of fuseses and escapements.

Unfortunately, many early contributors to the *Horological Journal* used pen names, and, like *A Mechanic*, we do not know who they are.

The editor, who obviously enjoyed writing, included a piece titled *To our readers* in the first issue, of which the

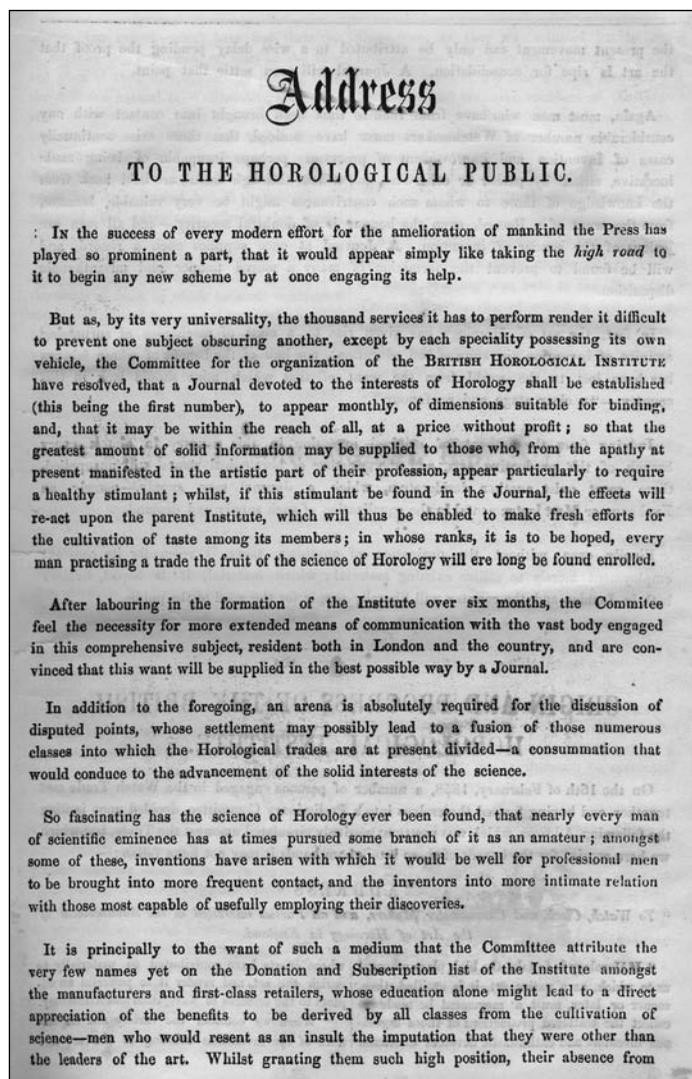


Figure 1. The first issue of *Horological Journal*.

following is an extract:

Mind can no more come in contact with mind without eliciting a spark of intellectual light, than can flint with steel without bringing forth the spark of fire.

And frequently the more forcible the contact, the brighter the scintillations.

Be it a part, then, of our plan, to supply the intellectual tinder, which our correspondents may fan into a blaze,

which shall purify by its light, and comfort with its warmth, every member of the Horological fraternity.

The Article, October 1858

Still stuck for material, in the second issue, published in October 1858, the editor devoted four pages out of 12 to articles reproduced from other publications. And one of these, quoted in full below, was on American watch-making:

THE AMERICAN WATCH MANUFACTORY,
AT WALTHAM, MASSACHUSETTS.

(From *Leslie's Illustrated News*, a New York paper, of August 21, 1858.)

This manufactory stands on the banks of Charles River, in the town of Waltham, Mass., and occupies a site of surpassing beauty, the enterprise having been removed from Roxbury, where it was first started in 1849-50, and made permanent where it now stands.

The manufactory occupies an area of one hundred by one hundred feet, and forms a quadrangle, with an open court in the centre.

The building is two stories in height, and has eight hundred feet of floor line, with about sixteen hundred feet of bench line for the accommodation of the workmen.

The motive power is a twelve-horse steam engine, which gives motion to lines of shafting in all the rooms, to which are attached the numerous ingenious, delicate, and wonderful machines which are used in the various processes for transforming the crude materials into the exquisitely finished parts of the watch, the completest result of human ingenuity and skill yet attained.

The original projectors, after a number of years of trial and experiment, became involved financially, and the enterprise in 1857 fell into the hands of Messrs. Appleton, Tracy and Co., the present enterprising proprietors, who have made arrangements to extend their operations, and to continue the manufacture on a scale commensurate with its importance, and in accordance with the enlarged views of the originator, Mr. A. L. Dennison, who still continues to occupy a high position in the establishment, to the organization of which he has given years of thoughtful care and intelligent skill.

Appleton, Tracy and Co. have added about one hundred acres, forming an admirable and delightful location, for home sites for their workmen, several of whom have already purchased lots and erected comfortable homes in the immediate vicinity of the manufactory, and every facility is afforded to encourage and attract the attention of intelligent and skilful workmen; who are here afforded largely remunerative and constant employment under the most pleasant conditions, with an opportunity in a few years of securing a competency and an independent home in the midst of scenery and surroundings as beautiful and interesting as can be found anywhere in the Swiss cantons, at Locle or La Chaux de Fonds; at Prescott or Coventry, in Lancashire or

Warwickshire in England; with other advantages and attractions such as are nowhere else to be found.

The plan of manufacture is highly philosophical, comprehensive, complete and peculiarly American, resembling that which Eli Whitney first applied so successfully to the manufacture of firearms, and which has been since most thoroughly tested and demonstrated at the Springfield U. S. Armoury; by Col. Colt, at Hartford; at Enfield, in England; and which has been more lately introduced at Bridgeport, Ct., in the manufacture of sewing machines. It extends to every part of the watch, commencing with the rolled plates of brass, steel and silver, the wires used for pinions, pins, and screws, and the gems for jewels; and by punching, swaging, cutting, turning, polishing, burnishing, drilling, enameling, gilding, &c., brings out the perfect living mechanism. All is done by machinery, each machine doing its peculiar work to a gauge or pattern, with an exactness that no skill of handicraft can rival. With the exception of the jewels and the pivots that run in them, every watch is in every part exactly like every other, so that a thousand might be taken to pieces and then reconstructed with pieces taken indiscriminately. As to the jewels, after they are drilled with a diamond, and opened out with diamond dust on a soft iron wire, resembling a hair in size, their perforations must have certain microscopic differences; so the pivots of steel that are to run for ever in these jewels without wearing out in the least, after being turned to a certain size, must be exquisitely polished, and by this last operation their size is reduced a little more or less. These jewels and pivots, after being thus finished, are put into the hands of a female operative, who, by means of a gauge, consisting of slightly converging lines so delicately graduated as to detect the difference of the ten thousandth part of an inch, first classifies the pivots. Then, by means of the pivots, she classifies the jewels. Jewels and pivots of the same number exactly fit. But for each pivot of a particular watch a jewel is selected with a hole that is a degree, or a ten thousandth part of an inch, larger, so that there may be sufficient play or side shake.

The sizes of the several pivots and jewels in each watch are carefully recorded under its number, so that if any one of either should fail in any part of the world, by writing to Waltham, or to Robbins & Appleton, general agents, 15, Maiden lane, New York, and giving the number of the watch, the part desired may be replaced, so as to be a working match. All the other parts are made precisely the same, and every dial-plate and case will fit one watch as well as another. The escapements, which in all foreign and hand-made watches have each its own individuality, are here alike, even to the escapement jewels, which are set in pallets, these being cut to a microscopic identity and rigid truth of form. It must be obvious to any one that such a system, directed by Yankee skill and ingenuity, must very nearly approach perfection, and greatly excel handicraft production.

No one who examines the machines employed in this manufactory, and attends to the attenuated details of the system, will doubt that the work of the best European watch-

makers must be equalled, if not distanced, at half the cost of production. In the American watches nothing is left to the eye or touch of the workman. On every part the machine impresses its own precision. The human care is employed merely to see that the machine is properly fed. Gauges, as already mentioned, nice enough to appreciate the ten thousandth of an inch tell when the work is done. Not one of the nearly one hundred male and female artisans who combine to make the watch need be a watchmaker.

The simplest form of lever movement has been adopted, and three styles have been produced, varying in finish, arrangement of jewels, and other conditions only affecting the cost of production, all being equally reliable timekeepers. Arrangements are now being made to furnish a small and elegantly-finished watch for ladies' wear.

It is intended to furnish from time to time, as the wants of the trade may require, other styles and sizes of watches, including an entirely new form of "sporting" or "timing" watch, which will indicate the minutest divisions of time with more accuracy than has ever before been attained.

The advantages of the American watch to dealers and wearers will be understood by the following enumeration, namely, it has fewer parts, unvarying uniformity; the ease with which it may be repaired, and a part broken or lost by accident may be restored; its greater durability, and the great reduction on the wholesale cost; to which is added a certificate of warranty for ten years, signed by the manufacturers. They are eminently adapted for railroad engineers and conductors, where exact and unflinching timekeepers are of the utmost importance, and where the continuous jar of the moving train offers the severest test to try the qualities of a watch. Several of the most eminent engineers and conductors on the leading railroads in the country have been supplied with these watches, and will now have no other.

In many parts of the country great difficulty is experienced in finding good watch repairers, and reliable timekeepers. By the introduction of the American watch this difficulty may be almost entirely obviated, so that the country merchant can regularly obtain watches as a part of his miscellaneous stock, and the buyer will take his regulated timekeeper, wind it up, and go about his business, as he would in buying any other article, without mystery or humbug.

We subjoin the following extract from the report of the judges in the department of watches, clocks and chronometers of the Massachusetts Mechanic Charitable Association, at its eighth exhibition, as to the merits of the American watch:

"The particulars in which they excel are such as uniformity of end-shake, perfect perpendicularity of the parts, correct depthings, good adjustment of the escapement, fitting of screws, and that substantiality by which, as watchmakers say, "the watch goes together twice alike;" or in other words, all parts find their place and keep it, and act well together, after being taken apart as well as before. Every watchmaker well knows how deficient the better classes, even of English watches, are in these particulars. The value

of these excellencies will be understood when it is said that the deficiency of them is what gives the most trouble to the repairer, and both trouble and expense to the owner. It should be remarked that the superiority of the American watches in these respects results not mainly, if at all, from superior skill, but from the principles and methods employed in the manufacture, which circumstance affords a guarantee that this superiority will be maintained."

There is no article in common use about which so much ignorance prevails, and around which so much sham, charlatanism, and swindling may be and is continually practised, as attaches to the watch; and it must be gratifying to all concerned, that the day for all sorts of "watch-stuffing" is likely very soon to pass away.

These watches are already furnished at half the price of the English lever watch, and can be manufactured at the rate of twenty thousand per annum with present means.

Perhaps it was because there was a bit of blank paper at the end of the page to fill. Or perhaps the editor was stung, if not wounded, by the suggestion that "the work of the best European watchmakers must be equalled, if not distanced." Anyway, he could not resist a jibe and he added a footnote:

After every deduction on account of the imaginative, of which the preceding article contains no small amount, there is doubtless enough of fact to induce English Watchmakers to bestir themselves.

The First Mistake, November 1858

There was a quick response. The next issue, November 1858, contained a letter from *One Who Admires Good Work*:

Mr. EDITOR, In any other publication than the Horological Journal I should have supposed that the account of the Factory at Waltham, Massachusetts, to have been one of those alarming statements occasionally put forth for trade purposes of the Puff School, intended to create a panic, to be taken advantage of in some way or other, as I doubt not this account was originally; but, standing where the copy does, it must be looked upon as admonitory, and deserves attention for the principles mentioned, whether they really are reduced to practice or not.

I have not seen a watch such as therein described, which is the only proof I would allow of value in the arrangement or execution, but I have seen a watch from America, and confess I could discover nothing very alarming for English watchmakers in any part of it, especially as it was to a great extent merely a rough and tasteless agglomeration of parts manufactured in England, apparently got up for the purpose of turning national vanity to account; and I should be sorry to see Englishmen drawn by any such ruse to abandon the vantage ground time has granted to them, for I am confident that the genius that originated and gradually brought to its present perfection the art of chronometry may be ex-

cused from copying every sample of trash that roughly measures time.

As for the principle, to which I alluded, the adoption of standard gauges is appreciated by all skilled workmen, and has been desiderated in England for years past, but has been hitherto postponed by the too free exercise of the "right of private judgment;" but as the Horological Institute has promised a thorough digest and reduction of principles in this matter to practice, I presume the subject may be left in the hands of those concerned. There can be no doubt that the production of the machine may be simplified to a great extent by the adoption of a limited number of sizes, and the employment of the going barrel form (which I predicate is the only one employed in the Factory mentioned); but this, with the lever form of movement, will leave the machine, however pretty, with but an indifferent character for that which should be the sine qua non in all, viz., the faculty of keeping time.

Let therefore Brother Jonathan go ahead, and create by any means that please him a continually increasing demand for good watches, and I feel confident that it will still be England from which a large part of the corresponding supply will flow.

The movement lately inaugurated, and which this Journal aids, is in the very direction to insure the keeping of British skill and ingenuity up to the mark demanded by extending civilization.

Unfortunately, *One Who Admires Good Work* was ignorant. To highlight this point, I have omitted one word from his letter. What *One Who Admires Good Work* actually wrote was not "I have seen a watch from America" but "I have seen a **National** watch from America."

But it is certain that the watch, this "rough and tasteless agglomeration," was not made in America. At that time there was no American *National* watch. The Elgin National Watch Company was not founded until 1867, and the Swiss imitations of American watches signed *National* appeared even later. And before 1858 only the Boston Watch Company, the Pitkin brothers, Luther Goddard, and a few less prolific individual makers had produced watches; but none of these makers signed watches with the word *National*. So we can be confident that the watch seen by *One Who Admires Good Work* was actually an English watch, probably coming from a Liverpool or Coventry manufacturer. This means that American watchmaking had been damned on the basis of the work of a fellow Englishman!

It should be noted that at this time the BHI was composed purely of London watchmakers. And it is interesting to note that it was not only *One Who Admires Good Work* who ignored the north of England. The words *Liverpool*, *Prescot*, and *Coventry* rarely appear in the early issues of the *Horological Journal*. This despite the fact that many rough movements for London watches and chronometers came from Lancashire. And despite the fact that Liver-

pool was the main port for trade with America and had a large and flourishing watch industry.

It seems London makers and the BHI treated the north with disdain!

The Second Mistake, December 1858 and January 1859

At this point, someone gave the BHI a genuine Waltham watch to examine (again, unfortunately, we do not know who). This prompted the editor of the *Horological Journal* to insert the following in the fourth, December 1858, issue:

We have just received a watch the produce of the American factory at Waltham, Massachusetts, of which we gave an account in No 2 of the Journal. We have not had time to make so minute an examination as to be able to report upon its quality. The external appearance indicates cheapness, and there is enough in it to prove that where it has been made, better may be produced, and we would seriously advise English manufacturers and workmen to lose no opportunity of preventing these articles from getting a footing in colonial markets, where, whatever their quality may be found to be, they could not fail to affect to some extent the sale of English watches. Old notions and prejudices must be cast aside, and advantage taken of every means by which the standard of quality in our own work may be maintained, while it is produced at the lowest possible price, which, considering the relative value of labour in this country and in America, ought to enable the English manufacturer to keep up a successful competition with our Transatlantic neighbours, who will let no opportunity slip of "going a-head."

*We may remark here, that the specimen we have received is upon the going barrel principle, devoid of any stop work; it has a sunk seconds, four pairs of holes jewelled, and a lever escapement. The external diameter of the case is 2.14 inches, its thickness about .44 of an inch and the size of the movement taken across the pillar plate 1.795 inch, and **of such an appearance and style as would harmonize with the character and costume of back-wood's man.** In our next we will report on its quality. [My emphasis.]*

I am sure the editor thoroughly enjoyed treating Americans with disdain!

By the way, the remark on the going barrel relates to an ongoing discussion in the *Horological Journal* on the retention of the fusee in English watches. That discussion engendered much more heat and opinion than fact, most writers displaying unfounded prejudices not supported by reason. And it is interesting that the idea of adjusting watches for isochronism, which is the main point of the fusee, was largely ignored!

A sensible letter was written by one calling himself *Cornhill*, in which he described tests on the rates of three fusee and three going-barrel watches. He concluded:

These trials, conducted in perfect fairness, would lead to the supposition that the superiority of the fusee is more apparent than real.

Later, another writer had the temerity to suggest that the fusee could be disposed of, if a suitably adjusted balance-spring was used.

Sadly, London watchmakers were not going to be swayed by reason, preferring to let their trade suffer a slow and painful death, buried under a mass of brass cones.

This is hardly surprising, considering these people were irrational enough to put fusees into the strike trains of clocks. But watchmakers have always been irrational, as illustrated by the German company Lange & Söhne, which has recently made wristwatches with fusees. And it is worth remembering that Rolex manages to make chronometer-certified watches without tourbillons, fusees, or other features supposed to be necessary for good performance.

True to his word, the next issue, January 1859, contained a report written by *Vertical*. I am not sure why he chose this pen name; perhaps he had a preference for verge watches and the vertical escapement, more likely, the context is beyond our grasp. Anyway, he wrote:

Sir, I beg to hand you a report of the result of my examination of the watch said to have been sent over as a specimen production of the new American Factory, and of which some notice has appeared in your columns.

The form of the watch is that of a dome hunter, with a going barrel, and having a lever escapement, - jewelled in 10 holes (not 8, as formerly inadvertently stated). The case is very well made, for the class of which it is a specimen, and has every appearance of having been executed by Swiss workmen in the factory. The dome form appears to have been selected in order to dispense with the cap, which latter is universally called for in English watches of like size intended for the American market; but as these variations are mere matters of taste, they call for no further remark.

The movement, as before-mentioned, is of the going-barrel form, of quite a rudimentary character, having not even a Lepine spring to counteract its great irregularities of force; and consequently its pull is so variable, that the balance is driven by it from half a circle of vibration when wound up half a turn of the key, to a circle and a half when fully wound up. Neither is there any stop work to prevent the strain upon the spring when wound up.

The frames are so plain that little need be said about them, except that, while studying economy, the designer might as well have dispensed with the third wheel bar at the back of the pillar plate.

The wheels and pinions are of the roughest make; the former being merely stoned across and coarsely electro-gilt. They are mounted by burnishing or riveting them on to brass collets which are driven on to the pinion arbors, the collets being ungilt.

The pinions, both in quality and pivoting, are very inferior, and finishing is entirely omitted.

The jewellery is of soft stones - both stone and setting of a character such as I should not like to trust myself to describe; suffice it to say, that they exceed in roughness and unsoundness the worst I ever saw in English work.

The holes [jewels], I have good reason to believe, were made by boys in England, and I think I could point to the very shop in which they were produced.

The scape wheel and pallets are, without doubt, as well as the dial (which has a sunk seconds), of the lowest class of Liverpool manufacture.

The hands are decidedly Birmingham.

The fittings - namely, the click, ratchet, and spring for the main-spring, are polished on the surface; in other respects they are as rough as they left the stamping press.

The watch, I should state, is sprung under the balance, having a stud of needless length screwed to the plate.

To compare this watch with any thing made either in England or Switzerland by decent makers, is out of the question. How far a home-made case and pair of frames, fitted with details of the coarsest and cheapest foreign production, can entitle it to nationality, I think we must cross the Atlantic to learn.

In using the terms finished and rough, I would explain, that the pinions, for instance, are, I verily believe, in a rougher and worse state in this finished watch than when they first left the pinion maker.

I forbear making any general remarks, considering that is more in your province than in mine.

*I am, Sir, your's respectfully,
VERTICAL.*

To which, the editor added his own opinion:

It is at all times an ungracious task to find fault, and particularly so with first attempts, for which fair allowances should always be made; but as the establishment of a Watch Manufactory was announced as not only in active operation, but that it was producing articles of first-rate quality, such as were not only to put every other manufacture of the same article into the shade, but to drive the manufacturer entirely out of the market, we felt a great desire to examine one of these grand national productions. We have done so - we have seen this thing dissected, and truth obliges us to declare, that our correspondent's report is by no means exaggerated; and that if an abandonment of all the acknowledged principles of good time-keeping, and of improvements which long experience has approved and adopted, and a return to rudimentary forms and unscientific principles, be the indications of a great national improvement in the practice of horology, then may this specimen of American talent claim to be its representative.

We do not make these remarks lightly. The watch has not only been examined by one person, but many respectable persons in the different branches have in our presence pointed out the very spot where the individual parts have been made, and named the persons by whom such articles are made for exportation to the States; and we know that

every practical and experienced workman possesses that intuitive knowledge of the style of work of his fellows in the same line, which, with almost unerring certainty, enables him to point out the makers of the different articles in his peculiar department, if he has but once seen work from the same hands. This is a fact which, although difficult to account for, we are sure will be acknowledged by all working men - and it is of this knowledge that we have availed ourselves. - ED.

We cannot dismiss these statements. Even allowing for every deduction on account of the imaginative there is no doubt that this watch, if not actually trash, was at least poor quality, and certainly *not* better than English watches as the *Leslie's Illustrated News* article had stated.

However, here is the second unfortunate mistake made by the Clerkenwell watchmakers; the watch chosen to be examined. I deliberately omitted one sentence from the editor's announcement of December 1858 which is of great importance:

"The watch is a silver double-bottom dome hunter, bearing the name of Appleton and Tracey, Waltham, Massachusetts, No 5438."

We actually know a little about this particular watch. The manufacturing records of Appleton, Tracy & Company, which subsequently became the Waltham Watch Company, show that it was one of the third batch of watches produced by Royal Robbins, and probably dates to September 1857:

Delivery date: Aug & Sept 1857

Serial numbers: 5201 - 5500

Name: AT&Co, TB

Size: 18

Jeweling: 4½ Pairs

Balance: Gold & steel

In addition Vernon Hawkins' records of watch sales lists this movement:

Serial number: 5438

Jewels: 16

Balance: Steel

Grade: not stated

Date sold: October 1857

Price: \$36.25

Discount: 40 & 2½%

Case: Silver hunter

Buyer: Robbins & Appleton

We might have some sympathy for the editor and Vertical because the serial number suggests Waltham had made over 5,000 watches, and surely such a watch should be typical of what the company produced; they probably thought that, if this watch was trash, then there must be more than 5,000 other watches that were trash.

But in May 1857 Robbins purchased a nearly empty building at Waltham, from which the materials and most of the machinery had been removed. So he had to start making watches almost from scratch and, probably because he knew his predecessor the Boston Watch Company had made about 5,000 watches, he began with serial number 5,001. So this watch was only the 438th made at Waltham by the new company. And, purchased for about \$20 and of a style that would *harmonize with the character and costume of back-wood's man*, it arrived at the BHI *one year and two months* after it was made!

That this watch may have been poor is not surprising.

When Robbins started manufacturing watches, what he desperately needed more than anything else was *cash flow*. He had 60 or so employees to pay, and he had to spend money on machines, tools, and materials. He needed to get money coming into the factory. Profit was not important, so he sold watches at substantial discounts.

And he sold watches to Robbins & Appleton, which was selling watches to himself! Maybe no profit, but by doing so he was able to transfer much needed cash to the factory to keep it going.

Robbins was also faced by a pressing need to reduce costs, so that the price of his watches could be as low as possible and competitive. After all, \$36 was more than a month's pay for a worker and such watches could only be bought by wealthy people, who could also afford good English and Swiss watches. (By comparing rates of pay for unskilled workers, the website www.measuringworth.com shows that \$36 is equivalent to more than \$6,000 today. Even the discounted price is equivalent to about \$3,500 today, an amount any worker would be unlikely to pay for a watch.)

So we can expect that to cut costs Robbins demanded that no unnecessary work be done, which explains the poor finishing of the wheels, clicks, and springs. In addition, Waltham relied on materials purchased by Dennison in England. Given the circumstances it is reasonable to assume Robbins ordered him to buy the cheapest available, and *Vertical's* comments make sense.

It takes more than a month for a movement to progress from raw materials to a finished product, and the third batch was probably started in June or July. But Robbins bought the defunct watch factory in May 1857 and, faced with an almost empty building, he *"kept the factory going, principally in the construction of tools and machinery."* Given the complexity of tools and machinery, not many of them could have been made in two or three months. So these early watches were probably produced mainly by the old hand methods by the old workforce.

Seen in this light, the criticisms of watch 5438 are reasonable.

But by November 1858 Waltham had produced about 9,000 watches in 15 months and was up to serial number 13,500! Using the new machinery, each watch was taking

about five days to make and the sale price had dropped by about one-third. That is, watch 5,438 was out-of-date and *not* representative of the watches being produced at the end of 1858. So American watchmaking had been condemned on the basis of the wrong watch!

The Third Mistake

Any sympathy we may have for the editor and contributors to the *Horological Journal* tends to evaporate in the light of the third mistake: In the excitement of examining a real watch, everyone ignored the *Leslie's Illustrated News* article! The editor wrote it off as imaginative, and *One Who Admires Good Work* considered it puff.

Admittedly, in the November 1858 issue the editor felt the need to reiterate the view of factories held by him, the BHI, and nearly all London watchmakers:

A great deal has been said about the introduction of Females and the Factory system. Now we will ask, Do you believe the Institute has been established for the purpose of introducing any such system; if you do, you are egregiously mistaken. For ourselves, we repudiate any such idea.

Although the article may have prompted this re-affirmation, it is quite likely to have been in response to the London watchmaker John Bennett. In 1856 and 1857 he had argued forcefully for the use of female workers, formal education of watchmakers, and the introduction of the going barrel. In addition, he sold Swiss watches! Consequently, he was generally hated by the rest of London's watchmakers. In this environment could we expect an article describing factories and female workers to be taken seriously?

However, the *Leslie's Illustrated News* article contains two concrete and very important pieces of information.

First, the article provides a detailed, and probably the earliest, explanation of the *Record*:

With the exception of the jewels and the pivots that run in them, every watch is in every part exactly like every other...

These jewels and pivots are put into the hands of a female operative, who, by means of a gauge, first classifies the pivots. Then, by means of the pivots, she classifies the jewels ...

*The sizes of the several pivots and jewels in each watch are carefully recorded under its number, so that if **any one of either should fail in any part of the world**, by giving the number of the watch, the part desired may be replaced, so as to be a working match.* [My emphasis.]

It was impossible to manufacture pivots and jewels that were interchangeable. So someone (probably Ambrose Webster) came up with the brilliant idea of measuring all the pivots of watches and recording them with the serial numbers on cards. If a pivot or jewel broke, the factory (which had a repair department) could make a new piece to the correct dimensions, and so provide a replacement

parts service. To my knowledge, when it began in 1857 this was the first ever customer spare parts system.

Second, get a copy of an early book on watchmaking, such as Berthoud's *Essai sur Horlogerie*, published in 1763, or an early edition of Britten's *Watch and Clockmakers' Handbook*, and look at the plates. There you will see an amazing range of machines and tools used in watchmaking.

What matters is that watchmakers have *always* used many machines. Indeed it has been called the craft of a thousand tools. So when we look at machines, it is not the *quantity* of them that matters, it is their *quality* and their *design*.

To appreciate this point we need to be a bit more precise.

Gauging is the practice of measuring using a gauge, an instrument which measures.

For example, suppose you want to make a pivot on the end of an arbor. Put it in a lathe and use a graver to cut down the end. Then *measure* it with a *gauge*, a micrometer or a go-nogo gauge. If it is too small, swear, throw it away, and start again. If it is too big, cut a bit more off and measure it again. And continue until it is the right size.

In contrast, *guiding* or *templating* is *not* measuring.

To make a pivot by guiding, put the wire in a lathe with the graver mounted on a special carriage. This carriage is free to move in any direction, but its movement is limited by a template. Now all we do is move the carriage back and forth and take out the *finished* piece. No measuring, no trial and error, no repeated cutting. Just one pass and it is finished.

The difference between gauging and guiding is enormous. It is the difference between a *dumb, slow machine* requiring a *highly skilled* operator and an *intelligent, fast machine* that can be operated by an *unskilled* worker.

And this is what the *Leslie's Illustrated News* article describes:

All is done by machinery, each machine doing its peculiar work to a gauge or pattern ... [which] tells when the work is done.

That is, the *Leslie's* article is describing a major shift in manufacturing methods. And the editor of the *Horological Journal* and its contributors completely missed this point.

Why did they miss these two points, the record and the type of machines?

That's simple. The master/apprentice system. Watchmakers became watchmakers by completing a long, arduous apprenticeship. And during it they were taught the *skills* needed and learned that watches could only be made by *highly trained artisans*. So English watchmakers believed watches and their replacement parts could only be made and fitted by experts. The work was so skilled that machines and ignorant workers simply could not do it.

This explains why the BHI was interested in *gauging* but not *guiding*. Throughout the early issues of the *Horological Journal* there were discussions of the need for

standard gauges, which, it was thought, would improve watchmaking. Indeed, someone suggested they would reduce costs, but why or how was not explained. So, in the fourth, December 1858 issue the editor wrote:

A Standard Gauge, capable of ready adaptation to the sizing of pivots, mainsprings, dials, movements, &c., has long been a desideratum with the Trade. ... All we desire is, to see something like system introduced into our manufacture; and we believe that the possession of a set of standard gauges and sizes would form the first element towards success in accomplishing that object.

But these discussions got nowhere in the period I am covering. As *One Who Admires Good Work* put it in the letter I quoted earlier:

The adoption of standard gauges is appreciated by all skilled workmen, but has been postponed by the too free exercise of the "right of private judgement."

Or, as another writer to the *Horological Journal* put it in 1870:

The present and passing generation of watchmakers are too prejudiced, and ignorant, and I am sorry to say, too idle and dissolute to learn anything that would supercede the rule-of-thumb method that they inherited from their forefathers.

But this is *not* the guiding principal discussed in the *Leslie's Illustrated News* article. The BHI was considering a system of *measurement*; that is, gauges are used to measure or test pieces to determine their size.

Both of these points should have rung alarm-bells, but they did not. It seems no one bothered to read the article carefully and think about its contents.

The Consequences, February 1859 to August 1862

So, having decided that American watches were trash, the editor and readers of the *Horological Journal* lost interest in the topic. For the next three years and seven months, until August 1862, the last issue which I have read, there is *not one* mention of American watches. In the meantime, Waltham continued to develop. By August 1862 the company had finished about 47,500 watches and was up to serial number 53,770. And watch number 5,438 was certainly *not* typical of the quality of these watches.

However, during this period Waltham was too busy supplying the domestic market to be interested in exporting watches, and so American watches had little or no impact on the London makers. Of course, there would have been some impact on watch exports through Liverpool. But, as we have seen, the BHI and the London makers were parochial and not interested in the rest of the country.

Did it matter, that the BHI lost interest? No, not really.

In the November 1858 issue of the *Horological Journal*, the editor succinctly stated the situation of English horology: "*The Clock trade is gone; the Watch trade is assailed by no contemptible enemy*" he wailed!

Clockmaking had been annihilated by French clocks and cheap American imports. And watchmaking was being strangled by increasing competition from Switzerland.

A year after the Waltham watch had been examined, the February 1860 issue had an interesting discussion under the title:

What is the reason the Swiss possess a larger market for their manufacture than ourselves, and has the education of the workman anything to do with it?

The participants did little more than moan. They moaned about low wages in Switzerland, they moaned about high taxes in England, and they suggested retreating like a leaderless rabble and giving up the cheap watch to the Swiss. No one mentioned changing the mode of manufacture, and no one mentioned that the real problem was the type of machinery and labor. And someone even suggested that the English trade was not in trouble! He must have been living in some sort of parallel universe!

Actually, there was one mention of America in the *Horological Journal*, but by a *mechanic*, not a watchmaker. Two years and nine months after the Waltham watch had been examined, the October 1861 issue had a short extract from the *Mechanic's Magazine* which contained the following:

*The leading members of the watch and clock trades of Great Britain cannot but be painfully aware that their position is a precarious one. They are brought into direct competition in the market with the results of **American automatic machinery** and of the cheap female labour of Switzerland, and it can scarcely be denied that they are losing ground.* [My emphasis.]

But with the London makers lacking leadership and torn apart by infighting, it is hardly surprising that they were not interested. And so this warning, like the *Leslie's Illustrated News* article, was ignored. The Americans were quickly forgotten. Until, of course, a few years later ...

But that is another story.

Notes

Watch quality. Words like "poor" and "trash" are relative. Craig Risch and John Wilson have examined a number of early watches made at Waltham and found very little difference between their finish and contemporary English exports to America, most of which were made in or around Liverpool. Both are good "ordinary" watches.

In contrast, the better London watches were undoubtedly superior, and the criticisms by Vertical and the editor should be seen in this light. It is apparent that London watchmakers ignored the northern makers because their products were regarded as very inferior.

Jeweling. The “pairs” notation used by Waltham ignores the balance and escapement jewels and only counts the pivot-hole jewels. Four pairs (15 jewels) are the lever, escape-wheel, 4th wheel, and 3rd wheel; making 8 jewels plus the 7 jewels for the balance, roller, and pallets. 4-1/2 pairs adds a jewel for the center-wheel.

In contrast, *Vertical's* “10 holes” counts all the pivot-holes, two each for the balance, lever, escape-wheel, 4th wheel, and 3rd wheel (making 12 jewels plus the 3 jewels for the roller and pallets). So 4-1/2 pairs would be 11 holes in that notation.

Although the records state that this watch had 16 jewels (4-1/2 pairs), *Vertical* only found 15 jewels. However, Vernon Hawkins notes that “the only Tracy & Baker known, 5,012, is actually 15 not 16 jewels.” From Ron Price’s lists, it seems that the jeweling of early watches was erratic, some having 16 and some 15; although Ron Price lists 5,012 as having 16 jewels. This variation may have been due to a lack of suitable jewels, or it might have been a cost-cutting measure.

In fact, the 16th jewel is not only unnecessary, it is virtually invisible, either being hidden under the balance-cock and balance or on the pillar plate under the dial. And so errors in jewel counting can be expected.

Pinions. *Vertical* states that the “the pinions [of watch 5,438] are in a rougher and worse state than when they first left the pinion maker,” implying that they were made in England.

However, a March 1856 article in the *Waltham Sentinel*, describing the pre-bankruptcy factory, states: “Here we saw the singularly ribbed pinions cut to proper lengths, turned to proper diameters in their various parts, the leaves recut and polished” If the pinions had been roughed out in England, then they would be turned to length not cut, which supports the view that Waltham was using raw pinion wire. Certainly by August 1858 pinion wire was being used, as the *Leslie's Illustrated News* article above mentions “the wires used for pinions.”

So I believe *Vertical* was wrong on this point, although he is vague and might have been referring to the *pinion wire maker*.

Waltham production. The serial numbers and number of watches produced seem not to agree. However, after the bankruptcy, watches were manufactured beginning at serial number 5,000 and, in addition, some 1,200 were made with serial numbers from 1,000 to 2,200. So the number produced is about 3,800 less than the serial numbers indicate.

Determining actual production is complicated by the fact that some watches, although started in serial number order, were not finished until long after, and there are a few serial numbers marked “not made.”

Hand-made and machine-made. These terms are relative and vague. The distinction between hand-made and machine-made is probably best done in terms of skilled and unskilled (or semiskilled) labor. Or, to put it another way, in terms of unintelligent tools and intelligent machines. For example, pivots may be turned in effectively identical lathes. But if one lathe has built-in stops, then the operator can be unskilled, whereas without the stops a skilled operator is required.

Manually operated, guided machines have always been important. For example, in a 1922 film on the Illinois Watch Company (made by the United States Department of the Interior) many guided manual processes are shown, including recessing plates. In the 1947 Hamilton Watch Company film *What Makes a Fine Watch Fine?* hand-operated wig-wag polishers are shown. Some operations, such as pinning a balance-spring to its collet and stud have always been done by hand, even in sophisticated factories.

It is interesting to note that in 1922 the Illinois Watch Company could not make interchangeable jewels and pivots; nothing much had changed since 1857. And in 1947 Hamilton was still making bread dough for cleaning parts!

Consumer spare parts. Spare parts had been manufactured before 1857. However, they differed in two important respects. First, they were interchangeable parts and did not require any system like the Record to fit them. Second, they were used “in house,” being used to maintain machinery within factories. In contrast, the main purpose of the Record was to provide spare parts to end users.

Sale prices. Comparing the relative values of prices between 1857 and 2009 is complicated. An alternative measure, the consumer price index, gives much lower values; \$36 is equivalent to \$913 and \$20 is equivalent to \$507. However, this is misleading. In 1857 wages covered not much more than the basic expenses of living and there was little discretionary spending because there was little else to buy. In contrast, today wages cover much discretionary spending, which is considered essential, on things like cars, TVs, and mobile phones, and only part is required for basic expenses. Consequently, although the CPI has not risen all that much, wages have risen far more and more realistically reflect the changes since 1857.

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About the Author

Since retiring from the Department of Computer Science at the University of Tasmania, Richard Watkins has devoted his spare time to the study of watches. With a personal library of more than 750 books on watches, his main activity has been to make information available to help others develop their knowledge and understanding. He has translated 15 books and booklets into English and produced an extensive bibliography. All except two of these are available for free from his website www.watkinsr.id.au, together with four hard-to-get English language books. His book *Practical Watch Collecting* was serialized in the *Bulletin*.