

A “Pocket Time Keeper”, John Arnold, Joseph Banks and Constantine John Phipps



In the 18th century, a time keeper that would keep accurate time at sea was essential to find longitude. Britain’s Board of Longitude offered a massive prize of £20,000 for the inventor of such a device, contributing to major advances in timekeeping.

John Hawkins argues that a time keeper by London watchmaker John Arnold, subsequently modified, can be identified as the time keeper Arnold no 5 commissioned by Joseph Banks to be taken on Cook’s second voyage in 1772, and that this is the world’s first pocket chronometer.



1.

Arnold’s pocket chronometer 9/61, diameter 73 mm. I suggest that this enamel dial was originally signed ‘John Arnold London’ but unnumbered when constructed in 1772, then later re-numbered “No 61” after modifications. The two surviving Cook instruments of 1772 are signed “Arnold” and not numbered on their dials, although one dial is later. The spotted minute divisions to the outer chapter ring and the seconds dial cutting through at V and VI, emphasising these spotted division markers, are common to all very early timekeepers. Photograph courtesy J B Hawkins Antiques

2.

Arnold 1/36, with original dial, the case hallmarked 1778. The passage of six years sees the Arnold watch dial painter using the same layout with a slightly more sophisticated dial, replacing the spots with lined minute divisions to the outer chapter ring and omitting the five-second regulator dial divisions from the seconds’ ring. Photograph courtesy National Maritime Museum, Greenwich

JOHN HAWKINS

In partnership with George Somlo, I purchased the Arnold pocket time keeper in the Daniels Collection sale at Sotheby’s in London on 6 November 2012 (**plates 1, 5, 7 & 8**), described as follows:

Lot 98. A large 18k yellow gold dumb quarter repeating pocket chronometer with Arnold spring detent escapement 1789, no 9-61, gilt full plate movement with Arnold spring detent escapement and early double S balance with gold helical spring, free sprung, signed John Arnold, London Inv. et Fecit No 9-61 white enamel dial, roman numerals, outer Arabic minute ring, large subsidiary seconds, signed John Arnold, London below XII, plain polished back engraved with monogram surmounted with a coronet (possibly for the Earl of Mansfield), hallmarked for London 1789, case maker’s mark WL



(William Laithwait).
Diameter 73 mm.
Provenance Sotheby's & Co., 9 July,
1963, lot 249.¹

On the face of it, this is a reasonable description, but fails to note that it is $\frac{1}{2}$ – $\frac{1}{4}$ repeating and that the movement is considerably earlier than the gold case. A detailed study of the component parts and examination of the engraving on the case points to a more important and fascinating history.

Whose watch was it?

One should not judge a watch by its cover. The first anomaly in Sotheby's description is the engraving on the case. The monogram is not that of William Murray, Earl of Mansfield. Furthermore, the initials do not correspond to any earl in the British peerage alive in 1789. The monogram (**plates 7–8**) is that of the Hon. Constantine John Phipps (1744–1792), later 2nd Baron Mulgrave,² an Irish title inherited from his father in September 1775. It comprises M (Mulgrave) to the centre, J (John) to the left and C (Constantine) to the right, set under an earl's coronet.

Phipps was never an earl; on his death, with no heir, his assets went to his brother, Henry, with the family's Irish Mulgrave barony, his English barony, created in 1790, becoming extinct. In 1812, Henry became the 1st Earl Mulgrave, and his earl's coronet by a different hand is now

engraved above the monogram of his brother, Constantine John Mulgrave.³ Two different hands engraved the monogram and the coronet. (**plates 7–8**).

Phipps enjoyed the lifelong friendship of Joseph Banks from the time that they were together at Eton. He became a Fellow of the Royal Society when proposed by Banks at the Society's meeting on the 12 December 1771, his qualifications being a great working knowledge of astronomy and owning a famous library of nautical books, described as "the most perfect in England". Phipps and Banks were the youngest members, by some ten years, of the Council of the Royal Society when they were elected together in 1773 and again in 1774, crucial dates in terms of the voyage of Phipps towards the North Pole in the latter half of 1773.

In 1766, Joseph Banks and Phipps returned together from a private voyage to Newfoundland in the *Niger*, with Banks transferring in a fee-paying but private capacity to Cook's transit of Venus *Endeavour* expedition to the Pacific in 1768. After Phipps' unsuccessful 1773 voyage to discover a north-west passage to India, Banks brought Omai, the Tahitian recently returned from Cook's second voyage with Furneaux in HMS *Adventure*, to stay at the Phipps' family seat, Mulgrave Castle, near Whitby in Yorkshire.

Phipps wrote to Banks in 1790, some two years before his death:

3.

Arnold No 3 in its original box, the case with mitred corners, original key square to the fitted hands, domed coppered dial, with original lettering to the name Arnold and inscribed "Royal Society 36". Photograph courtesy The Royal Society

4.

Arnold, un-numbered, inscribed "Royal Society 37". It may have been dropped and as a result is in a later box which does not fit the dial which is now flat. The hand-altering square is raised, the Arnold lettering is of a larger size, the second hand is later. Photograph courtesy The Royal Society

... I hope to spend much of my time in your Society; we are, I believe, the oldest friends to each other, and I can with great truth assure you that the length has only added to the value of such friendship in my estimation.⁴

Cook's second voyage & John Arnold's timepiece 5

In 1771, Nevil Maskelyne, the Astronomer Royal, engaged the London watchmaker John Arnold to supply the Board of Longitude with no less than four of his newly invented gravity 'see-saw' detent marine timekeepers at 60 guineas each, or less, for comparison with Larcum Kendall's K1 during Cook's pending second voyage, due to depart in July 1772.⁵ Of these, three were ready at the time of sailing in their lockable wooden boxes, being referred to in contemporary texts as 1, 2 and 3.⁶

Banks intended to sail in HMS *Resolution* with Cook but he cancelled at the last minute after a dispute with the Navy Board over the dismantling of his already built and paid for 'Great Cabin'. This addition to the poop deck, constructed to house, in part, his proposed expeditionary party of sixteen and, in effect, creating an entirely new deck, had to be demolished because it made the *Resolution* top heavy and virtually unseaworthy.⁷

According to *Resolution* midshipman John Elliott, when Banks saw that Sir Hugh Palliser, the Comptroller of the



5.

Arnold 9/61, originally a pivoted detent timekeeper, with the later (SS) balance fitted, obscuring the original engraving. Positioning “No 9/61” directly below “Inv. et Fecit” is typical of pocket timekeepers up to No 5/42 of 1778; from 1779, the Arnold number is generally engraved after ‘Inv. et Fecit’ and no longer below. Photograph courtesy J B Hawkins Antiques

6.

Arnold 1/36, the movement shown to compare the engraving of numbers and signatures. This seemingly untouched pivoted detent pocket time keeper is fitted with the earlier (TT) balance, hallmarked for 1778. It has the sequential numbers placed below “Inv. et Fecit.” Photograph courtesy National Maritime Museum, Greenwich

Navy had had the cabin removed, with Cook’s agreement, he “swore and stamped upon the Wharfe, like a Mad Man, and instantly ordered his Servants and all his things out of the ship”. Not only had Banks outlaid a large amount on the cabin, he had also ordered, and Arnold invented, a bespoke fifth portable instrument made specifically for personal use on the voyage; the world’s first “Pocket Time Keeper”.

Banks had paid for ‘No 5’, the fifth proposed timekeeper supplied by Arnold

for the voyage, on 3 April 1772, for the then substantial sum, for a yet untried instrument, of £100 (**plate 9**). This was close to the sum the famous royal cabinetmaker John Cobb charged Banks to carpet, curtain, furnish and fit out his now-removed ‘Great Cabin’⁸ (**plate 10**).

For his personal use, Banks spent over £400 equipping himself and his party with instruments for the voyage on HMS *Resolution* and HMS *Adventure*. This list shows the detail involved born of his experience on Cook’s first voyage.

Pocket time keeper, Arnold No. 5 [John Arnold]	£100 0s 0d
1 x Knight’s Azimuth compass [Henry Gregory]	80 0s 0d
1 x Equatorial instrument compass complete [Jesse Ramsden]	63 0s 0d
2 x 4ft achromatic telescopes, barometers etc [Edw. Nairne]	46 5s 6d
1 x Barometer for measuring heights [Edw. Nairne]	13 13s 0d
1 x 15 inch sextant [Jesse Ramsden]	8 18s 6d
2 x portable barometers with stands	11 11s 7d
1 x 4 inch sextant	6 6s 7d
2 x best Ellis’ microscopes [Jesse Ramsden]	7 7s 0d
Cleaning & repairing 4 x Ellis microscopes, with magnifiers, watch glasses, Thermometers, hydrometers, pluviometers [P & J Dollond]	22 19s 0d
2 x cases of instruments in Nurse [shark] skin	9 9s 0d
1 x 15 inch sextant with new adjustment, plus cleaning and repairing Telescopes [P & J Dollond]	37 12s 0d
	£407 2s 2d

At this moment, Arnold was in a tricky position over the Cook second voyage, for he was serving two particularly demanding masters in Maskelyne and Banks. Maskelyne, in addition to the four 60-guinea, see-saw gravity escapement marine timekeepers, had ordered from Arnold two astronomical regulators for Greenwich on 2 April 1772,⁹ the day before Banks paid for his pioneer bespoke newly invented pocket timekeeper.

Banks would have been a hard but considered taskmaster; much time, effort and thought would have gone into the creation of this unique object with its specifically invented pivoted detent escapement that gave it portability. The original invoice may have provided a much more detailed description but only this receipt (**plate 9**) appears to have survived.

Arnold's first great breakthrough was inventing this escapement, which made this form of the instrument portable, later a much-trumpeted feature. Arnold's 'see-saw' gravity escapement in his Cook 1772 marine timekeepers functioned best when the instrument was kept horizontal, a problem partially solved by Arnold on the Phipps 1773 voyage by introducing gimbals.

Banks, having travelled over three years to the Pacific with Cook, would have been aware of the problems of having to use candle light at night. A dumb ½ – ¼ repeater would have enabled him to tell the time on land, in his tent or in a confined shipboard space without disturbing others. Further, the possession of his own personal, accurate, portable timekeeper and other instruments listed above would have allowed Banks to play a part in the voyages' astronomical and scientific adventures without recourse, as was the case when he travelled with Cook in 1768.

As a result of this important and unusual commission from Banks, I suggest Arnold fell behind on the fourth marine timekeeper ordered by Maskelyne. Later, Banks was to prove one of Arnold's greatest supporters.¹⁰

Harrison, Kendall, Mudge, Arnold and later Earnshaw were all circling the Board of Longitude Prize money pot of £20,000.

7.

Arnold 9/61, the back of the gold case with Henry Mulgrave's earl's coronet above the Phipps/Mulgrave monogram "JMC".

The J fits into the M on the left and the C on the right.

Phipps wrote to Banks using John as his first name, see note 2.

Photograph courtesy Sotheby's



Their respective inventions and various constructions in locked cases travelled the world in pursuit of this prize and the ensuing commercial advantage. For these inventors, mechanics and cutting-edge horologists, this was the biggest game in town. Joseph Banks, the rich savant, a member and future President of the Royal Society, botanist and now famous explorer, was the right man to have on your side in these circumstances.

On his way to the Pacific, Cook wrote to Banks from the Cape of Good Hope:

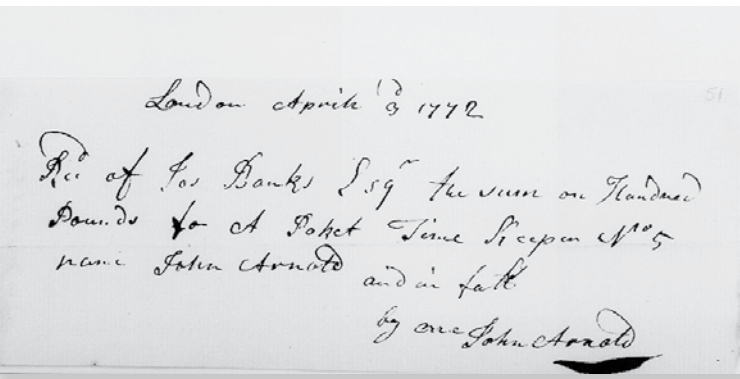
Some Cross circumstances which happened at the latter part of the equipment of the *Resolution* created, I have reason to think a coolness betwixt you and I, but I can by no means think it was sufficient to me to break all corispondance [sic] with a Man I am under many obligations too ...¹¹

This "coolness" was, I suggest, a reason that prevented Cook or his two astronomers from taking the Arnold pocket timekeeper, on loan from Banks, to the Pacific.¹²



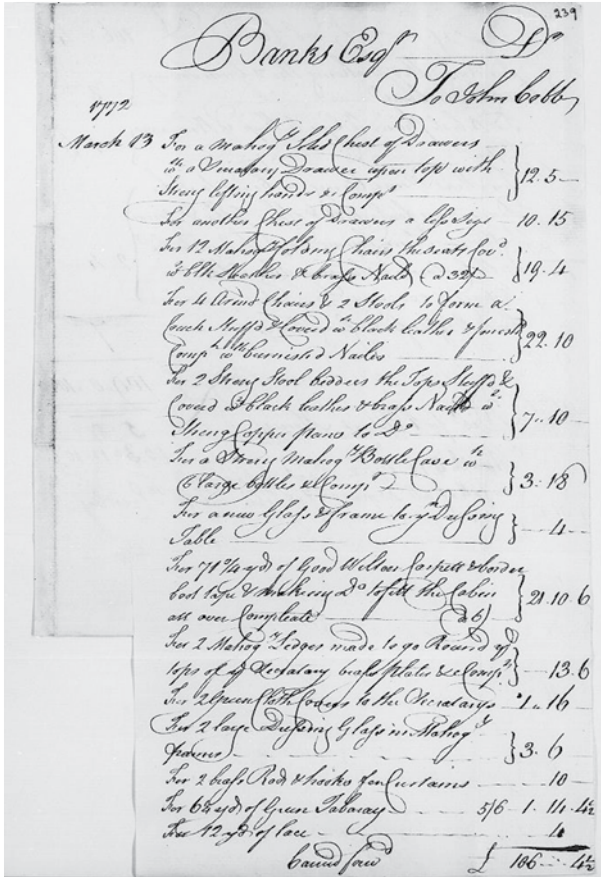
8.

Arnold 9/61, detail to compare engraving of the later earl's coronet to the earlier JMC monogram, which is by a different hand as you would expect from a now later hammered surface. Photograph courtesy J B Hawkins Antiques



9.

Arnold's receipted invoice for Banks no. 5 is of great importance to the history of timekeeping technology. Arnold refers to his invention in this receipt simply as: "A Poket [sic] Time Keeper No 5", no mention of a dumb repeating or portability, or even that it was fitted with his unique pioneering pivoted detent escapement; Banks Papers, State Library of NSW, Sydney <http://www2.sl.nsw.gov.au/images/banks/digitised/30084.jpg>



10.

John Cobb's invoice to Joseph Banks (detail), 'To a mahogany Solid Chest of Drawers with a Secretary Drawer upon top with Strong lifting handles etc, complete £12 - 5s.' [No. 1?]
 'To another Chest of Drawers of less size.....' [No. 2?]
 Mitchell Library, Sydney <http://www2.sl.nsw.gov.au/images/banks/digitised/30251.jpg>
 Banks was a very rich young man, receiving a large annual income from his agricultural estates. In 1791, for instance, he received over £7,000 in rent from his 403 tenants on his Lincolnshire, Revesby Abbey Estate of 14,300 acres. The discovery of Cobb as his cabinet maker suggests that Cobb also fitted out the Herbarium in his Soho Square Library. The specimens were stored in the cabinets now in the Natural History Museum, London. J B Hawkins Antiques sold a set of 12 to Warren Anderson, later auctioned by Bonhams, Sydney 25/26 June 2010, lot 591.

On Cook's second voyage, the Arnolds performed badly. The Kendall chronometer K1 went well, but at 450 guineas it had taken three years to build and had been at Greenwich for adjustment and testing for a long time prior to departure. This was the first occasion that timekeeping machines were taken on a voyage of discovery for purposes of navigation at sea. Two of the three Arnold instruments survive in the Royal Society, London (plates 3-4); Kendall's K1 is in the National Maritime Museum, Greenwich.¹³

After the setback over the *Resolution*, Banks turned his attention to a private voyage of exploration to Iceland.¹⁴ On 22 July 1772, he chartered the 190-ton brig *Sir Lawrence* for five months for his scientific endeavours, taking most of his party previously intended for the Pacific. The principal omission was the artist Johan Zoffany who was released from his contract, Banks paying him £300 for the lost opportunity.

Upon Banks' return from Iceland, the proposed voyage of his close friend Phipps to find a north-west passage to

the Pacific Ocean from the Atlantic was to occupy much of his time. He gave Phipps a long list of instructions, in part asking him to bring back an example of the fabled polar bear:

... if it is possible to bring them home alive a young white bear I should be glad of ...¹⁵

Could the four pages of requests and instructions from Banks be considered as a form of contra against the loan, gift, or use of his Arnold pocket time



11a + 11b.

Secrétaire/chest of drawers made for Banks and detail of the number, with unusual solid mahogany drawers and linings, matching the invoice description. Formerly J B Hawkins Antiques

keeper arranged through the Board of Longitude? This instrument, so carefully kept and maintained at the well-regulated Banks' residence in Soho Square, appears to vanish from the records.¹⁶

We know that Phipps carried a "Pocket Time Keeper" by Arnold on the voyage to the Pole in 1773, and that he had an understanding of its inventive mechanism, information possibly supplied by Banks. Arnold had no time to rate properly or test the last two of his three wooden-cased, marine timekeepers delivered to Cook in 1772. The fourth, now fitted with gimbals, was re-allocated by the Board of Longitude from Cook to Phipps, and Arnold supplied a fifth, through the Board, to Captain Lutwidge of the *Carcass*, the second vessel on the Phipps' expedition.

Arnold stated in 1780 that the Phipps 'Pocket Watch' was the property of the Board of Longitude and had cost 63 guineas. This poses an interesting question: had Banks given or sold, through Maskelyne, his Arnold pocket timekeeper to the Board of Longitude, which then lent it to Phipps? Arnold is certainly indulging in obfuscation over his marine boxed timekeepers,¹⁷ all four

of which performed badly with Cook and Phipps, while taking credit for the pocket timekeeper, now published and described by Phipps as his star navigational instrument.

Banks and Phipps were in close written contact over this voyage; they were long-time friends, working and committed Fellows and Council Members of the Royal Society and Banks understood, from experience, the importance to navigation of his personally commissioned timekeeper, a field in which Phipps was a recognised expert.

The fact that the watch was not commissioned or owned by Phipps on the voyage may be confirmed by Arnold's comments in *An Answer from John Arnold to an Anonymous Letter on the Longitude*, published in 1782, regarding this timekeeper:

The Rev William Smith (now in England) bespoke, by letter from the East-Indies a Pocket Time-piece; His Mother or Mother -in-law came to me, and desired it might be sent to the Country to be tried before payment, by a wheelwright in Northamptonshire, which I refused to allow...

This was Arnold's reply to an unknown person, in Arnold's words, an "Anonymous Assassin" who had attacked his integrity over, in part, the Phipps timekeeper thus:

... the Time-Piece so Highly recommended by Capt. Phipps, now Lord Mulgrave, in his Voyage towards the North Pole, was made by order of a Gentleman abroad, whose Agents in England were authorised to receive and pay for it; but after it was made, as he [Mr Arnold] understood they intended putting it on trial a few weeks before they sent it out, he refused to let it go; which added as little to its credit, as to the honesty of the artist.

I suggest that the 'Gentleman abroad' and the 'Rev William Smith' are one and the same; a smoke-screen to keep the powerful Banks out of this very personal controversy. By now Sir Joseph Banks, he was a most influential President of the Royal Society and a leading promoter of Arnold's work, yet he had left the Cook's second expedition in a huff before it sailed, with considerable loss of face.



12.



13.



14a.

12.

John Arnold, no number marine timekeeper, from Cook's second voyage, Royal Society No 37, back plate showing the compensation bar, isochronal curb and plain first type of balance in untouched, original state, winding square arbor uncut, the winding square large and full length. Photograph courtesy The Royal Society

13.

John Arnold No. 3 marine timekeeper, the balance original with slightly improved design the small added timing screws, possibly later, full length winding square, arbor uncut. Cook, Royal Society No 36. Photographs courtesy The Royal Society



14b.

14a. John Arnold unnumbered marine timekeeper. Engraved ring to balance rim and plain foot to cross bars

14b. John Arnold No 3, timing screw, possibly a later addition, one of a pair hidden under the balance cock

14c. John Arnold No 3, plain ring to balance rim and capital to foot of cross bar

If Arnold was unable, through a lack of time, to complete the fourth contracted machine for Cook's second voyage he would seem unlikely to be inventing, without input or payment from the client, a pioneering timekeeper for someone he had never met, in a distant clime, via his mother or mother-in-law. Furthermore, it makes no sense that Arnold would not publicise his bespoke, important, commission unless Banks and his failure to participate in the highly successful Cook voyage was a subject that no one was prepared to canvass at this time.

On the 1773 Polar voyage, the Arnold pocket timekeeper, kept in the Phipps' pocket at a more constant temperature, proved more accurate than the specifically commissioned Kendall K2, which had cost the Board of Longitude 200 guineas in March 1772. More importantly for Arnold, it was also more accurate than his two boxed, marine timekeepers, one of which was probably marine no 5 (plate 20).



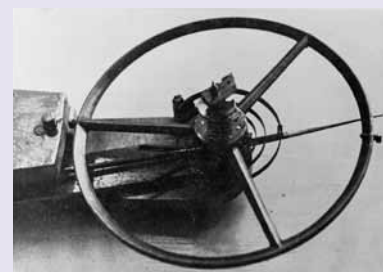
14c.



15. Arnold 9/61, engraving of the three initial capitals: J, I and N. There is a more even and competent circular tail to the scroll for the J and I, with wider and bolder shadow emphasis to each scroll in the same place, towards the end of the scroll. The scroll of the N is weaker, more oval in shape, with the emphasis or bolder engraved section in a different part of the curve towards the middle of the scroll. Therefore I suggest that “No 9/61” was engraved later by a different hand



16. Poor quality engraving of Arnold’s Royal Society marine chronometer no. 3.



17. Royal Society John Arnold No 3. The balance showing the timing screws in the balance rim. Photograph Mercer, plate 26

Phipps refers to his pocket timekeeper on page 14 of the introduction to his account, *A Voyage towards the North Pole*, published in 1774:

I had also a pocket watch constructed by Mr Arnold by which I kept the longitude to a degree of exactitude much beyond what I could have expected ...

In the Appendix on page 212 his mechanic on the voyage Israel Lyons gives the following snippet, which begs the question of who placed the instrument for rating at Greenwich – Banks, Phipps, Lyons or Maskelyne:

An Account of the Astronomical Observations and Timekeepers ... Captain Phipps’ pocket watch, made by Mr Arnold, when compared with the regulator at Greenwich, May 26th, was 24 seconds too slow, it was then found to lose twelve seconds and a quarter a day ...

Lyons continues with a mechanical description of the watch, its jewelling and pallets.

After the voyage, this pocket timekeeper does not seem to appear in the records of the Board of Longitude. Is it therefore possible, bearing in mind the monogram and the glowing tributes bestowed upon it by Phipps, that he acquired his now famous navigational instrument directly from Banks – or had Banks given it to the Board which then

allowed Phipps to keep possession?

Arnold’s success with the Phipps pocket timekeeper saw an immediate demand for this type of instrument and a rapid falling away in orders for the boxed marine alternative, all of which had performed badly. This is, I suggest, evidenced by the number of survivors, pocket over marine, tracked down by Mercer.

In 1775, Arnold took out his first patent to protect two more notable advances in accurate timekeeping; his helical balance spring and a modified form of three-arm balance with timing screws (**plates 20–21**).

I suggest the Phipps pocket timekeeper now numbered 9/61 was receipted by Arnold to Banks as No 5 in April 1772 as it was then the proposed fifth timekeeper Arnold supplied to Cook’s second voyage. To this point, this bold claim is evidenced only by the proven close association of Banks with Phipps.

Later improvements to the original movement

What evidence can be deduced by close examination of the movement to date its construction to 1772 rather than, if sequentially 9/61, 1778/9?

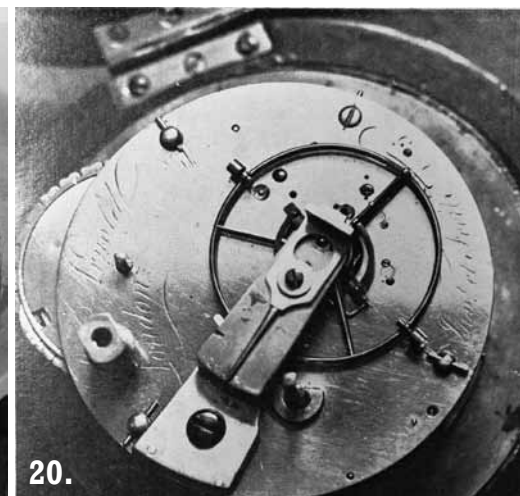
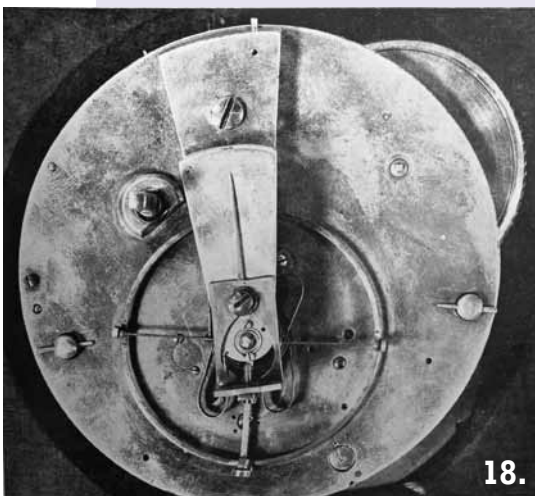
- Firstly the watch was originally fitted with a pivoted detent escapement.
- Secondly the winding arbor has been cut and a protective support fitted to take Arnold’s second larger improved three-arm balance with timing screws

of circa 1775. The increased size of this balance with its external fittings caused the winding square to be turned down and re-squared for a smaller key and the containing arbor turned off. As this larger balance was under the winding key, it was protected by the fitting shown which is cut to allow the balance to turn without interference from the key.

- Thirdly the watch was later fitted with a double (SS) balance, circa 1779.

It is at this point, I suggest, that the watch was numbered 9/61. The watch was further improved with the addition of Arnold’s helical balance spring in gold and Arnold’s other great technical advance, the spring detent escapement patented in 1782.

In summary, this instrument had been fitted with three different balances, two different escapements and two types of balance spring in its first ten years, such was the march of technical progress in Arnold’s workshop. I suggest that Arnold fitted his technical improvements, as evidenced by this movement, as and when they came to



18.

Chamberlain Collection, no number, pivoted detent marine timekeeper. This appears to be the first pivoted detent marine chronometer, made circa 1773/4. As with 9/61, the (SS) balance replaces two earlier balances. The photograph shows the clearly cut arbor from above. The unprotected key, if it could get any lower, would nearly touch a wider second balance the original first balance would not have needed the arbor to be cut. This photograph encapsulates my proposition of three balances as applied to 9/61. Photograph Mercer, plate 48

19.

Another view of the cut arbor in plate 18, to take a wider balance now replaced with a later (SS) balance. Photograph Mercer, plate 49

20.

Arnold marine chronometer no 5. The balance as illustrated in Rees has recently been made to fit. It is the large size second type balance, taking up the space in the cut away rim round the winding square arbor. The smaller, original balance would not have required the winding square arbor to be cut. Photograph Mercer, p 46 and plate 54

hand and before Phipps' retirement from the Navy in 1783, Phipps and his now famous working chronometer being one of Arnold's best forms of advertising.

What evidence may be gleaned from surviving early Arnold timekeepers to further the above statements?

The earliest Arnold pocket timekeepers seem to approximate to a substantial 73mm in diameter, a size needed to take Arnold's new pivoted detent escapement with its original, plain, uncompensated, three-arm radial balance (**plates 12–13**). Rees, in his *Cyclopaedia*,¹⁸ states that this balance was fitted to 10 to 12 chronometers without stating the type, marine or pocket.

The only known surviving, untouched example of this balance is now in the collection of the Royal Society, London (**plate 12**). It was fitted to the presumed Cook second voyage, unnumbered, marine timekeeper with a gravity see-saw escapement. Arnold later improved this type of balance by adding small timing screws, as fitted later to the original three-arm balance of the Cook see-saw marine timekeeper, Arnold No 3 (**plate 14b-c**). Adding these first small timing screws did not require the arbor to the winding mechanism to be cut away.

I suggest that Arnold, finding a marked improvement in timekeeping using timing screws, designed and patented a second version of the three-arm balance, an example of which he applied to the also unnumbered, but possibly first, marine chronometer fitted with his pivoted detent escapement (**plates 18–19**). This new

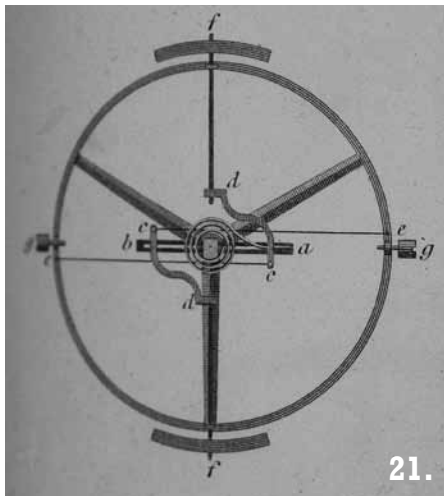
balance with its external timing screws must have been larger than the original simple brass balance, for when used on existing machines the arbor holding the winding square had to be cut.

Marine chronometer no. 5 exhibits a similar alteration to take a second, larger balance that has also required a cut into the arbor. This instrument now accommodates a modern interpretation of the three-arm balance with timing screws and weights based on the illustration in Rees' *Cyclopaedia* and the Arnold 1775 patent (**plates 20–21**). No original example of this 1775 three-arm balance, improved by Arnold using large timing screws and weights outside the rim of the balance, appears to survive.

On 30 December 1775, Arnold obtained his patent for this improved balance, importantly illustrated by Rees from an actual example in Pearson's possession (**plate 21**). Arnold must have cut the arbors on all his existing timekeepers, marine or pocket, if they were fitted with this technical improvement which he noted in the Patent "is applicable to timekeepers for the pockets or otherwise."

Therefore a cut-away arbor is a clear indicator of a time keeper, constructed no later than 1775, that has been improved by the use of this larger balance as illustrated by Rees (**plate 21**).

Pocket timekeeper 9/61 with its cut away arbor can be discussed in this context, for it must have been fitted with a plain, simple, three-arm balance when originally made for Banks. Arnold replaced this



21.

with his larger three-arm 1775 patent balance with external timing screws and weights in or slightly after 1775. This required the arbor to be cut and the balance, as a result, protected from the winding key by a bracket. The current, smaller 4th (SS) type of balance must have been fitted circa 1779 when, I suggest, that the instrument was given its current number 9/61 (plate 23–24).

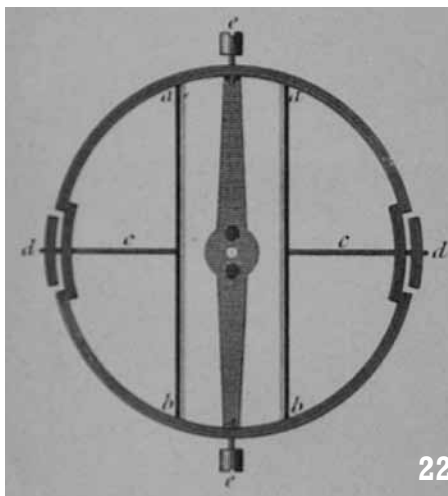
As Baron Mulgrave in 1785/6, Phipps had his portrait painted by Thomas Gainsborough, with the published volumes describing his voyage on the chair beside him. He wears a noticeably large pocket watch with seals in his right trouser pocket (plate 29).

The number 9/61

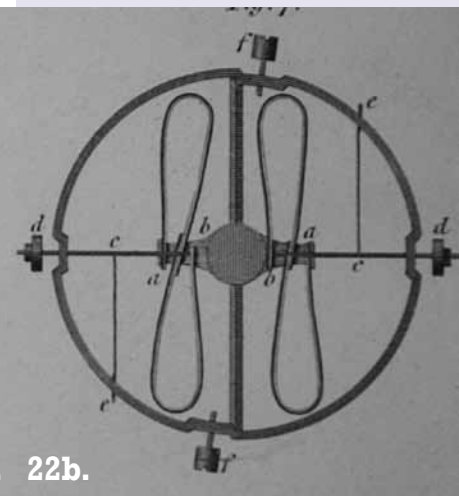
The movement of Lot 98 is now numbered 9/61. What is the significance of this?

Arnold's most famous surviving, untouched, well documented, most accurate, precision, pocket timekeeper is the gold-cased and hallmarked, No 1/36 of 1778/9, now in the National Maritime Museum, Greenwich (plates 2 & 6). This "chronometer" was the first of Arnold's pivoted detent escapements fitted with a helical balance spring and Arnold's third type of balance, the compensated double (TT). The number 1 indicates it is the first with a (TT) balance of the earliest type, and the 36th portable timekeeper he had constructed.

Alexander Dalrymple, like Banks a great supporter of Arnold through his connections in the East India Company,



22a.



22b.

published *Some Notes to those who have Chronometers at Sea* in 1779, possibly with 1/36 in mind, for in a footnote he writes:

The Machine used for measuring Time at SEA is here named CHRONOMETER, my friend Mr Banks agreeing with me in thinking so valuable a machine deserves to be known by a name, instead of a Definition. The name Time-Keeper is only proper to a perfect Chronometer.

Of the five boxed marine timekeepers made to a commercial price of 60 guineas each, which Arnold supplied to both Cook and later Phipps in 1772/3, all except the first Cook, Royal Society 37, (plate 4) appear to have been physically numbered. As with the last, a number may not have been inscribed on Arnold's first pocket timekeeper for Banks with its pioneer bespoke pivoted detent escapement that made it pocket portable. Arnold certainly received this instrument in April 1772 to Banks as "No. 5".

Why? The answer may be found in the proposed four boxed, marine timekeepers that Maskelyne ordered for Cook. Banks and Arnold would have reasoned that this was the fifth timekeeper for the voyage hence no 5, the last of the time keeping machines to be supplied by Arnold for Cook's imminent second voyage of 1772.

This matter is further complicated because Arnold made an extant boxed marine timekeeper physically numbered 5 (plate 20).¹⁹ This is probably the extra

21.

Rees' *Cyclopedia* plate depicting this second type of Arnold balance with the large outside timing screws and weights causing the arbor to be cut. http://en.wikipedia.org/wiki/Rees's_Cyclopedia

22a.

(TT) balance from Rees' *Cyclopedia*

22b.

(SS) balance from Rees' *Cyclopedia*, with recessed timing screws

Arnold marine boxed timekeeper that went with either Phipps or Lutwidge on the 1773 voyage to the Pole. We have accounted for Arnold's no 1 (unnumbered), no 2 and no 3 with Cook in 1772, the Cook that never made it no 4, and no 5 with Phipps in 1773 seems logical.

I suggest that when Phipps took the Banks/Arnold "Pocket Time Keeper" to Arnold for updating in about 1779 with the latest (SS) balance, an improvement on the larger three-arm balance with external timing screws, it was given the Arnold sequential number 61, the 9th such timekeeper to be fitted with Arnold's compensated bimetallic balance, be it (TT) or, in this case, the slightly later and improved version the (SS). No 9/61 would have paid a return visit for Arnold to fit his newly invented spring detent escapement after he had applied for his next patent in May 1782; the evidence



23.

23.

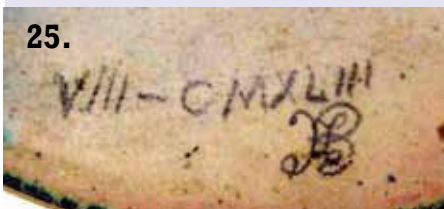
Arnold 9/61, detail of the cut arbor and key protector which stops the winding key hitting the balance; this protector covers the original engraving. Arnold has cut the arbor down flush with the plate, turned off the winding square and re-squared it smaller to take the larger second type of balance as illustrated in plates 7 and 8 above. The (SS) balance is the third balance fitted as it clears these alterations easily. Photograph courtesy J B Hawkins Antiques

24.

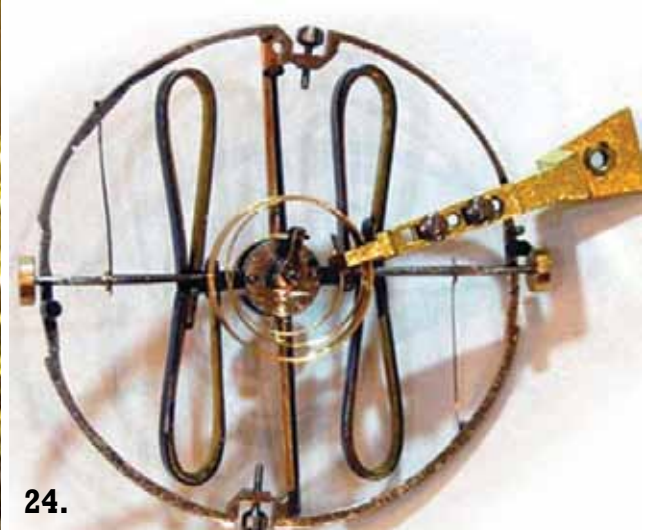
Arnold 9/61, detail of the (SS) balance with inset timing screws. Photograph courtesy J B Hawkins Antiques

25.

Arnold 9/61, the enameller's marks to the rear of the dial. This dial is numbered VIII, which is of interest as a block of numerically close non-sequential pocket timekeepers survive: 11/60, 9/61, 14/62, 20/63, 16/64, 17/67, and 21/68. Photograph courtesy J B Hawkins Antiques



25.



24.

for removing the pioneer pivoted detent remains in the watch.

John Arnold's signature engraved to the movement of 9/61 (**plate 26**) is by the same hand and of the same form as that found on the early pocket timekeepers 11, 17, 28, 29, 1/36, 38, 13/40, 5/42, 45, 9/61 and 16/64, all these series numbers are placed below "Inv. et Fecit" (**plate 27**).

This is the first and seemingly standard version of the John Arnold signature and number placement. These signature tunes are not found on later pocket timekeepers, when the sequential numbers come before, or mainly after, and not below "Inv. et Fecit" and the shape of the J is altered.

If 9/61 was originally unnumbered when supplied to Banks – being Arnold's latest invention hence not as yet part of a series – the blank space below "Inv. & Fecit" could be filled with a sequential number. With this in mind the N of No appears to be engraved by a different hand (**plate 15**).

The dial of 9/61 has the early spot or dot minute divisions to the chapter ring and the second's ring through which it passes, a design seen on the Cook 1772 chronometers, now the property of the Royal Society (**plates 3–4**). The pocket chronometer 1/36 of 1778 has exactly the same layout but the spots are replaced with more accurate and precise lined divisions.

The enamel dial is numbered VIII to the rear (**plate 25**), coded and monogrammed by an unknown enameller. The art of making watch dial 'copper' was a separate craft within the industry, as was that of the dial enameller and the watch dial painter. These three skills are described in some detail in Rees' *Cyclopaedia* under

"enamelling". Adding a number to the dial would require it to be painted on and refired but not re-enamelled; was this the VIII-th such altered dial, hence 9/61? The dial still retains the extended squiggle on the foot of the J for John, a feature of early pocket timekeeper dials.

Conclusion

The evidence exhibited by the improvements to this movement would suggest that this is a very early instrument. The monogram is that of The Hon. Constantine John Phipps, a close personal friend of Joseph Banks who commissioned from Arnold the world's first pocket timekeeper – or as we know it today, chronometer – in 1772 for his proposed second voyage to the Pacific with Cook. Banks withdrew at the last minute. Did he then lend his untried personal timekeeper for its first sea trial to Phipps for his Polar voyage less than a year later, where it performed with great success?

Now with spring detent, this timekeeper - on the evidence provided by the alterations to the movement - was originally fitted with Arnold's pivoted detent escapement. The escapement has subsequently been provided with three different balances: the original three-arm radial balance of 1772; the larger second type three-arm radial balance with timing screws (**plate 21**) that has caused the alteration to the winding square arbor circa 1775; and the current (SS) balance of circa 1779.

The first naval working timekeepers, for example K1 and K2, are cased in silver. Phipps left the Royal Navy at the end of the American War of Independence in 1783, his ship, HMS *Courageous*, being

paid off. The timekeeper in its silver case, a fact suggested by the initial price to Banks and the fashion of the times for a working machine, was then over 10 years old. I suggest that in 1790, Mulgrave had his timekeeper re-cased in gold and engraved with his monogram and coronet to celebrate his recently acquired English peerage. The 1789 date letter can be explained by the fact that it was not changed until 30 May 1790.

If I am correct, then this much-travelled and greatly treasured, dumb, half, quarter repeating²⁰ gold-cased timekeeper then moved with Phipps (plate 28) to a safer haven, a bench in the House of Lords.



26.

Arnold 9/61, the fine early Arnold signature under his later improvements

27.

Arnold 9/61, with the winding protector removed to show the timing screw clearance and the engraving subsequently covered by the balance wheel protector. The new spring detent fitting covers the engraving of "Fecit"

Timeline for Banks' Arnold No 5

3 April 1772:	Joseph Banks pays John Arnold £100 for the bespoke "Pocket Time Keeper No 5" fitted with Arnold's newly invented pivoted detent escapement. This instrument provided the portability needed for pocket use on Cook's second voyage in HMS Resolution.
22 July 1772:	Banks probably takes No 5 to Iceland, along with his other instruments previously intended for Cook's voyage.
June 1773:	Phipps takes a borrowed Arnold pocket time keeper on his search for the North West Passage. Two alternatives: Banks No 5 or, as Arnold later suggested in 1780, a £63 version supposedly supplied by the Board of Longitude.
c 1774/5:	On Phipps return, Arnold alters the time keeper by adding timing screws to his newly invented and improved larger three-arm balance. Hence the winding arbour has to be cut – a clear indicator of a pre-1775 instrument.
c 1779:	The three-arm balance updated with Arnold's newly invented double (SS) balance and the watch dial renumbered 9/61.
c 1782:	The escapement changed to spring detent and a gold helical balance fitted.
1789:	Phipps retires from Navy and has his Time Keeper cased in gold before 29 May 1790, when the annual London date letter changed. The gold case was engraved with his monogram, "JMC", below a baron's coronet for his newly received English title of Baron Mulgrave.
1792:	Phipps dies and his brother Henry Lord Mulgrave inherits watch, with the same baron's coronet.
1812:	Henry becomes Earl Mulgrave, engraves his earl's coronet above his brother's monogram by hammering the case and removing the baron's coronet, re-engraving an earl's coronet.



28.

Arnold 9/61,
the ½–¼ repeating
mechanism of 9/61

NOTES

- 1 Sotheby's London, 6 Nov 2012, lot 98.
- 2 A. M. Lysaght, *Joseph Banks in Newfoundland and Labrador, 1766: His Diary, Manuscripts and Collections*, p. 260: Letter to Joseph Banks, written on 4 July 4 1773 on the *Racehorse* off Spitsbergen, Phipps signs himself, 'Yours J. C. Phipps', although Constantine was his first name.
- 3 A Baron's coronet is the only coronet in the peerage that may be changed to an Earl's, by altering the four balls on the Barons' coronet to four strawberry leaves, interspersing these with three stalks topped with pearls and adding others to either side, a fairly simple job for a competent engraver. The back of the case has been hammered, indicating that it has been altered.
- 4 The Dawson Turner Collection, *Copies of the Correspondence of Banks in 20 Volumes, The British Museum Natural History Library*, vol 7 p 169, letter dated Whitehall, 19 Oct 1790.
- 5 Vaudrey Mercer, *John Arnold & Son*, p. 24, the order was placed on 28 November 1771.
- 6 John Arnold, *An Account kept during Thirteen Months in the Royal Observatory at Greenwich..... Published by Permission*

of the Board of Longitude, published in 1780, in which he praised the accuracy of his pocket chronometer 1/36. A footnote states that to date the Board had made the following payments, making no mention of the regulators:

Before 1779, at different times	£700
Delivered by order of the Board of Longitude,	
1 Box Timekeeper for Admiral Harland in 1770	£63
1 ditto for Captain Cooke	£63
2 ditto for Captain Furneaux	£126
1 ditto for Captain Luttwidge [Captain of Phipps' 2nd ship]	£63
1 Pocket Watch for Hon Captain Phipps (now Lord Mulgrave)	£63
	£322
1779 Cash received	£500

Arnold has made three mistakes relating to Cook and Phipps. Firstly, regarding the Pocket Watch, as the Banks pocket time keeper cost £100, the Phipps example should have cost more than £63 (60 gns), the price of a marine time keeper. Secondly, Arnold supplied two boxed marine time keepers through the Board to Phipps to include No.4 that did not travel with Cook. Both performed badly on the *Racehorse/*

Carcase; here he admits only to one. Thirdly, he has, I suggest, deliberately confused the issue of the Phipps Pocket Watch with the marine time keepers by pricing them all at 63 gns. I suggest that this is an example of Arnold being somewhat casual over the facts when they do not suit his interests.

Vaudrey Mercer in his *John Arnold & Son* was unaware of the receipt for the Banks pocket time keeper No.5 of 3 April 1772 in the Mitchell Library, Sydney. He states that Arnold probably made his first pocket chronometer with a pivoted detent escapement in 1772; in this, he seems to be correct. He also correctly notes that Phipps tried an Arnold pocket chronometer with a pivoted detent escapement on his voyage in 1773 (p ix). It would seem illogical that by the end of 1772, Arnold had not seen his pivoted detent escapement in the Banks pocket timekeeper as an improvement over his see-saw gravity for Cook, as a result he fitted it into the ships' marine time keepers 4 [location unknown] and 5 for Phipps. Marine No 5 still retains the original pivoted detent escapement. Mercer dates the introduction of the double S balance to 1780 and lists pocket watches 16/64, 17/67, 21/68, 23/78, and 33/87 as so fitted, with about 40 so constructed or altered between 1779 and 1782. He is using information taken from the 'Compensation' entry in Rees *Cyclopaedia*. Interestingly he omits timekeeper 9/61 from this list, which upsets this Arnold numbering system. Mercer dates the first spring detent chronometers to 1781; nos 75 and 33/87 and that gold helical balance springs were in constant use by 1784.

7 H.B. Carter, *Sir Joseph Banks*, p 101. The party was Banks, Solander, four artists (one of which was Johan Zoffany), two secretaries, eight servants and assistants to include two horn players. Cook states that Banks had spent £5,000 on the project.

8 Some of the accounts Banks paid to equip himself suitably prior to his proposed second voyage with Cook are found in the Mitchell Library, Sydney. They are nearly complete.

9 Mercer, *op cit* p 107, also note 6 above.

10 Warren R Dawson, ed, *The Banks Letters*: p 183, July 1784 ... obtains Arnold chronometer in silver case for Thomas Bugge in Denmark.

pp 384-388, January 1785 ... asked by Sir William Hamilton to obtain watch by Arnold for the King of Naples, Banks does and pays for it ... reimbursed £127 by Hamilton. p 646, August 1785 ... the chronometers ordered by the Empress [Russia] from Arnold ... Banks is therefore urged to press for delivery and to send a report on the chronometer on trial at Greenwich, for the Empress knows Banks will have more weight with Arnold.

p 22, March 1792 ... John Arnold writes to thank Banks for the 'handsome manner in which he spoke of him which led to his petition being presented to Parliament'. Banks never seems to mention his pocket timekeeper No 5.

- 11 J C Beaglehole, ed, *The Journals of Captain James Cook, Vol II, The Voyage of the Resolution and Adventure 1772–1775*, p 7.
- 12 *Ibid* p 17. 'One of the principal reasons for the voyage was to test the Arnolds against Kendall's K1. As a result, Cook explains how the instruments were kept under lock and key and the Commander, First Lieutenant and the Astronomer on each vessel had keys. All had to be present on winding, a lot of reward money depended on the outcome.'
- 13 Derek Howse, "Captain Cook's Marine Timekeepers Part I, The Kendall Watches", *Antiquarian Horological Society Journal (AHSJ)*, Sept 1969, pp 190–205; "Part II, The Arnold Chronometers", *AHSJ*, Dec 1969, pp 276–280. A masterly description of the horological events leading up to the two voyages of Cook and Phipps. The Royal Society has in its possession from this voyage, Arnold no number and Arnold no 3. Howse notes that the three mahogany cases for the Arnolds were purchased from R Melvill for 7gns on 30 May 1772. Cook departed on 13 July; it was, indeed, a close-run thing.
- 14 Carter, *op cit* pp 104–115.
- 15 Lysaght, *op cit* pp 59–63. Contains a good biography of Phipps, and an important four-page letter from Banks to Phipps of May 1773, *Instructions sent out with Captain Phipps on his Northern Voyage*, in Banks' own hand, he finishes: 'God bless you & send you to the Herring Hall or the source of the migration of macerel & thence home to your ever affect but never emulating J Banks.' pp 256–259.
- 16 Banks took to Iceland his portable equatorial instrument intended for use with Cook, purchased from Jesse Ramsden for £63 on 29 June 1772 (Carter, p 105). Banks was drawn using it on a wooden stand by John Cleveley Jnr. (Carter, p 111). Carter, *op cit* p 372, mentions that "in 1801, Flinders took, for his proposed circumnavigation of Australia, Arnold's nos 82 and 176, also a pocket chronometer as a personal gift from Banks..., possibly this is Arnold No 5 purchased nearly 30 years before in high hopes for the Cook second voyage.' I consider this unlikely. Arnold 176 is now in the Vancouver Maritime Museum, see *Australiana* vol 8 no 4, Nov 1986.
- 17 Ann Savours (Mrs Shirley), "A very interesting point in geography": The Phipps Expedition towards the North Pole" *Arctic* vol 37 no 4, Dec 1984, pp 402-428. A good account of the voyage, she gives the Board of Longitude's instructions to Israel Lyons, the appointed astronomer: '... have thought fit that two Watch Machines (one made by Mr Larcum Kendal and the other by Mr John Arnold) should be sent out for trial in the said sloop under the care of Mr Lyons and that another Watch Machine (made by the said Mr Arnold) should be sent out for trial in the *Carcass* [Lutwidge]...' Lyons had taught botany to Joseph Banks and was entrusted with all the instruments by

the Board of Longitude. The directions from the Royal Society have been misplaced. This account conflicts with Arnold's version (note 6 above) as the Board's instructions clearly discuss two Arnold marine time keepers (Watch Machines). No mention is made of the Phipps pocket time keeper in these instructions.

- 18 I suggest that between 1772 and 1774, Arnold's marine wooden boxed time keepers were sequenced as a series and numbered between 1 and 10. They would have commenced life with Arnold's experimental three-arm radial balance, some later updated by his second type of balance illustrated in his *Cyclopaedia* by Rees, who gives the diameter as 2.4 inches. This, unfortunately for the latter day historian, appears to be a printing mistake; one could suggest 2 ¼ inches but this still seems too large even for marine timekeepers. The writer, believed to be William Pearson (1767–1847), compiled this entry, published in 1807, stating that this measurement was taken from, 'a balance in his possession'. (Rees *Cyclopaedia*, un-paginated, vol 9, alphabetical entry under 'Compensation', subsection, Arnold).

How accurate is this information? The main players still with background knowledge of this rapidly evolving technical field were all still active. From the extent of the detail, John Arnold's son, apprentice and later partner may have provided the information regarding his father's escapements and the numbers made with differing balances; Maskelyne was still in control of the Board of Longitude and Banks at the Royal Society; Pearson, the possible author of the Horological entries was a co-founder of the Royal Institution and the Astronomical Society, and a teacher of astronomical matters.

- 19 Mercer, *op cit*, p 45, discusses this machine and illustrates the movement at plate 54. He commences with it being an original spring detent and he then corrects this statement to an unaltered pivoted detent of circa 1775. I suggest that it is earlier.
- 20 *Ibid* pp 79-80, notes that Arnold advertised in 1791, some 20 years later:

Pocket Chronometers		
of the best kind in gold		120 gns ...
Ditto ditto in silver		100 gns ...
Ditto Repeaters in gold		150 gns ...

This suggests that Banks' 'Poket timekeeper' no 5 was the best kind in silver. A repeater would have cost an extra 30 gns; would Arnold have charged less some 20 years earlier and priced this, the first pioneer commission, so as to get the order from such a influential and powerful man?

- 21 The annual London date letter was changed by Goldsmith's Hall on St Dunstan's Day, 19 May. After the Restoration of Charles II, it was changed on 29 May until 1973, when the date letter changed on 2 January.



29.

After Thomas Gainsborough, print of the portrait of Phipps/Mulgrave, wearing a noticeably large pocket watch and seals in his right trouser pocket