

K&E Sperry Pocket-Watch Slide Rules

Peter M. Hopp C.Eng. M.B.C.S

Introduction

K&E/Sperry pocket-watch slide rules are rather special and neither the original taxonomy generated by Bob Otnes¹ nor the expanded version in my recent book² has so far been unable to answer some obvious questions relating to these devices. This is especially true with regard to numbers made and when particular examples might have been made or sold. K&E catalogues are not accurate with their illustrations of the actual devices, and so far, a collection of serial numbers for the devices has only just started to provide suggestions leading to any real conclusions.

Here I will attempt to move us forward with regard to the different types, numbers of each type, how many in total, and attempt correlating broad-brush dates to a particular serial number. This will use information from the K&E / Sperry patents, the catalogues, and serial numbers of actual devices as evidence for the ideas presented.

The Catalogues

In my book, I devised a table to show when the main types were introduced. This has been updated, corrected, and

simplified for this article to show only the pocket-watch devices, see Table 1 below:

The Early “Boucher” Devices

The five “Boucher” devices are only included here for completeness. We now know that these were “fat” Calculigraphe pocket-watch calculators, in all probability sourced from Henri Chatelain in France, and sold by K&E from 1894 to 1899 as the Model 1743½ and then from about 1900 through to 1906 as variously the Models 4022, 4022A, 4023, and 4024 depending on the type of dial supplied: silvered metal, paper, or enamelled cardboard. Note that no example of Model 4023 has been found, this may have been a complete chimera. Catalogue entries for these are highlighted in yellow above. We can be fairly certain that these devices were not serial numbered in any way, and because they were French-made Calculigraphe devices, there is actually no way of identifying those sold specifically by K&E. However, if a “fat” Calculigraphe is found with a 24 page plus covers K&E instruction leaflet for “Boucher Calculators” with a sub-heading of “Calculigraphs” [*sic*] then there is a high probability that it would have been sold by K&E.

**Table 1. Price (US\$) and Availability of Various Types of Pocket-Watch Slide Rules Sold by K&E
(Based on K&E Catalogue Information)**

Type	Rule	1893	1895	1897	1899	1901	1903	1906	1909	1911	1913	1915	1916	1921
1743½	Boucher	X	8.50	8.50	8.50									
4022	Boucher					14.-	14.-	14.-						
4022-A	Boucher					X	12.50	12.50						
4023	Boucher					X	19.-	19.-						
4024	Boucher					8.50	8.50	7.-						
4016	Sperry							20.-						
4017	Sperry							18.-	15.-	15.-	15.-	15.-	15.-	22.50
4018	K&E								13.50	13.50	13.50	13.50	13.50	20.25
Type	Rule	1922	1925	1927	1928	1930	1931	1932	1933	1934	1936	1937	1939	1941
4016	Sperry													
4017	Sperry	22.50	22.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	
4018	K&E	20.25	20.25	20.25										
X		Not available as identified												

K&E Pocket-Watch Slide Rule Patents

There are three relevant American pocket-watch slide rule patents. I do not propose to cover these in detail; patent specs are available from various web sites, particularly the ISRM web site³ for those who wish to study them more closely. We will look at them briefly, with particular emphasis on filing and award dates.

The first we have is: **Patent Number 773,235. Elmer A. Sperry. Filed Dec 21, 1903. Awarded Oct 25, 1904.**

This was filed while K&E was still selling “Boucher” devices, and awarded before K&E ever started selling any pocket-watch slide rule that carried either the Sperry or K&E names. The patent covers the use of the ‘S’ and ‘L’ dials and the geared hands and dials of the Type 4016. There are notable and perhaps surprising details we should consider:

- This is the patent whose date is marked on two distinctly different types of K&E pocket-watch slide rule, **neither** of which has a mechanism anything like that described in the patent.
- The catalogue entry illustrations for **all** K&E Sperry pocket-watch slide rule from 1906 forward only show this one patent.

The second K&E patent is: **Patent Number 1,012,660. George Lange. Filed June 24, 1908. Awarded Dec 26, 1911.**

George Lange’s patent was a long time being awarded, 3½ years elapsed from 1908, the application, until awarded in late December 2011. Only after this date could this patent be marked on calculators instead of the 1904 patent. This covers the Lange mechanism, with the very unusual and distinctive “concentric nuts”, as used on all K&E/Sperry pocket-watch slide rules, probably from when it was applied for in 1908 (i.e., before it was awarded) through to the end of manufacture and retail of pocket-watch slide rules by K&E in 1939. This begs a number of questions:

- Was this the patent that was “Applied For”?
- Why do only K&E Calculators show the ‘Patent Applied for’ notification, never a Sperry Calculator?
- Is the assumption that any Calculator with the 1911 Patent date was only sold after the patent was awarded i.e., effectively from January 1912, reasonable?

The final K&E patent is: **Number 1,671,616. Elmer A. Sperry. Filed Jan 23, 1922. Awarded May 29, 1928.**

Sperry’s final patent, which took 6 years from application to award, is perhaps the most confusing of all. It relates to the mechanism used in the Type 2 calculator that was sold for the shortest time, for perhaps one year either side of 1906, some 22 years previously. No K&E nor Sperry device has ever been found that carries any reference to this patent.

The Devices

To reduce confusion, I will continue to use the Type numbers invented by Bob and updated by myself, confirmed by K&E Catalogue numbers. Subsequently, **all** K&E/Sperry pocket-watch calculators have been found to carry a serial number. From these serial numbers, we hope to generate a chronological production timeline.

Type 2

The Type 2 pocket-watch slide rule was sold at \$20 for Model 4016, the very unusual version with the geared components and slightly cheaper at \$18 for Model 4017, the version without geared hands/dials. These two types are highlighted in red on the catalogue information table (see Figures 1 and 2).



Figure 1. K&E Sperry Figure 2. K&E Sperry Type 2

Both 4016 and 4017 carry “E.A. Sperry Calculator” and “Keuffel & Esser Co. NY. Pat Oct 25.04” markings. Both use the K&E patented “S” and “L” dials.

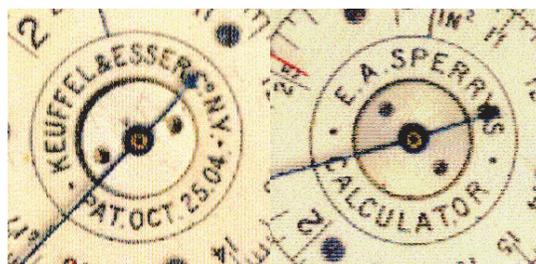


Figure 3. Details of Markings
for Type 2

Figure 4. Details of Markings

From illustrations alone, identifying whether a device is Model 4016 or 4017 is not possible; however, the two push buttons are very distinctive for identifying Type 2.

An attractive “*Directions for Sperry’s Calculator*” booklet, one example dated 1906, has instructions that are very definitely for use with a two push-button device.

The only catalogue that shows these devices is from 1906. That they only sold from 1906 until some time before the next catalogue was available, i.e., 1909, that is for perhaps 2 to 3 years at most, is very likely.

Four examples with serial numbers between 36 and 121 have been found so far. Assuming that approximately 150 devices were made, this implies a sales rate of 50 to 75 devices per year, a reasonable rate; thus, the possibilities of correlating limited time ranges with a serial number.

Differentiating Type 2 4016 and 4017 models by serial number has not been possible. Whether from ignorance or design, all owners claim to have the more unusual 4016.

Type 3a

This completely different pocket-watch slide rule Type 3a (see Figures 5 and 6) was also sold as K&E Model 4017. Continuing to use the same catalogue number as the un-gearred Type 2 version is confusing, but we have to accept the confusion. Type 3a originally sold for \$15 and is marked in green in the catalogue information table.

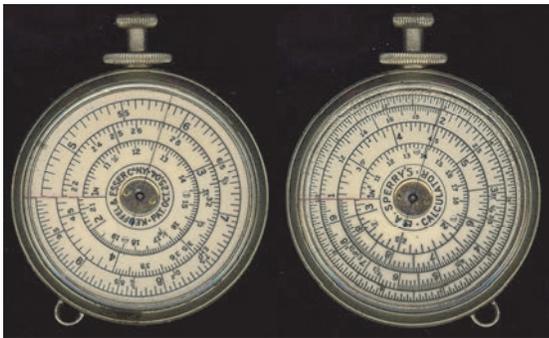


Figure 5. K&E Sperry Type 3a Figure 6. K&E Sperry Type 3a

Type 3a also carries the “E.A. Sperry Calculator” and “Keuffel & Esser Co. NY. Pat Oct 25.04” markings, and uses the K&E “S” and “L” dials (see Figures 7 and 8).

The very distinctive George Lange “concentric nuts” design makes this also an instantly recognisable and unique pocket-watch slide rule design.

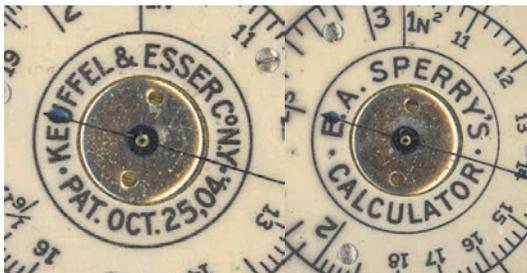


Figure 7. Details of Markings for Type 3a Figure 8. Details of Markings for Type 3a

Can we assume that the “Directions for Sperry’s Calculator” booklet was still used for this calculator? I have no information that they were amended; the scales were the same even if the mechanism was different.

According to the catalogues, these Model 4017 devices sold from 1909 through to 1939, increasing in price to \$22.50 and then to \$27.50 during that period.

Thirteen Type 3a devices with serial numbers between 237 and 579 have been found. This could imply that approximately 360 devices were made. Depending on when K&E stopped selling these particular devices, we can now begin to estimate a sales date for each serial number.

The Lange 1911 patent covers the mechanism, but the face still shows only the 1904 patent date, which is confusing.

Type 3b

At this point the reader might reasonably expect a discussion of Type 3b. However, I find that this model is better discussed later in a context that I will develop below.

Type 3c

Type 3c (see Figures 9 and 10) also carries the “E.A. Sperry Calculator” and a new “Keuffel & Esser Co. NY. Pat Dec 26.11” marking. They continue to use the K&E “S” and “L” dials (see Figures 11 and 12).

We have to assume that this device was also sold as Model 4017, simply because it carries the Sperry / K&E labelling of the Type 3a above. The later patent date does not feature in any K&E catalogue entry. Assuming that it is a 4017, it is marked in blue in the catalogue information table (see Table 1), we will return to this.

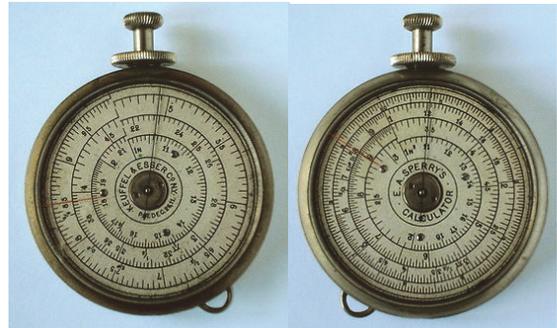


Figure 9. K&E Sperry Type 3c Figure 10. K&E Sperry Type 3c

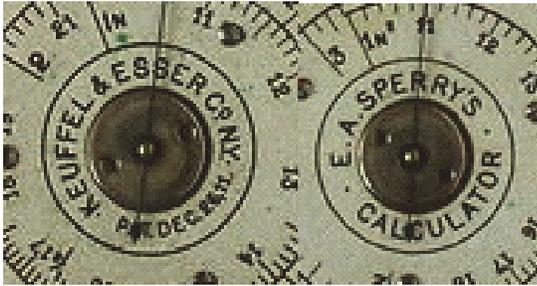


Figure 11. Details of Markings for Type 3c

Figure 12. Details of Markings for Type 3c

The very distinctive George Lange 1911 patent “concentric nuts” mechanism continues to be used.

We do not know exactly from when these devices were sold. That these were the actual devices that they were sold from 1911 patent award date through to the end of sales in 1939 may be assumed.

Seven devices with serial numbers between S650 and S978 have been recorded. If we assume that, again another 360 devices were made, this implies a sales rate of 12 per year, a somewhat lower but still not unreasonable rate and gives us another possible time period to correlate serial numbers.

Type 4a

This pocket-watch slide rule (see Figures 13 and 14) was sold as Model 4018, starting a new Catalogue Number in 1909 when it was first sold at \$13.50, slightly cheaper than the Sperry equivalent 4017, which also sold for the first time in that same year. It continued to be sold until about 1927 by which time it cost \$20.25. After this date, it no longer appeared in any catalogues. It is marked in orange in the catalogue information table above (see Table 1).

This device carries “K&E Pocket Calculator” and “Keuffel & Esser Co. NY.” markings, but this one is marked “Pat App^d. For”. It does not use the K&E “S” and “L” dials, instead it has one rotating “Mannheim” logarithmic dial and a fixed log and trig dial with tan and 2-turn sine scales (see Figures 15 and 16).



Figure 13. K&E Type 4a

Figure 14. K&E Type 4a

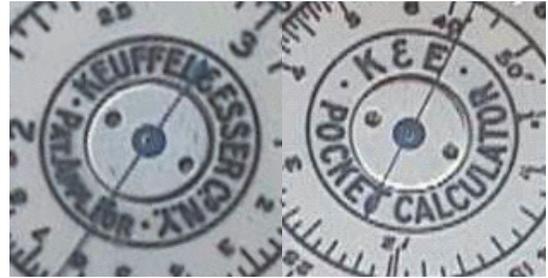


Figure 15. K&E Dial

Figure 16. K&E Dial for Type 4a

Type 4a uses the George Lange “concentric nuts” mechanism.

Four devices with serial numbers between 517 and 869 have been found. If we assume that Type 4a shared the same series of serial numbers but without the “S” prefix, then perhaps half the total numbers, say 180 devices were made. This also implies a sales rate of about 12 per year

We have no idea which patent had been “applied for”. If we assume it was the 1911 patent, which had actually been filed in 1908, this makes some sense; however, the serial numbers need some further thought. This will be further discussed.

Back to Type 3b

In “*Pocket-watch Slide Rules*”, I speculated that there should be a Type 3b slide rule with different markings. With the benefit of an additional 2 years of new information, I now realise that this scenario is entirely unlikely.

However, during my studies I have identified examples of what is a genuine Type 3b calculator. These devices may yet help to provide answers some of our questions.

These Type 3b devices are effectively a variant of Type 3a with the usual markings of a Type 3a, i.e., they carry the “E.A. Sperry Calculator” and “Keuffel & Esser Co. NY. Pat Oct 25.04” markings, and they use the K&E “S” and “L” dials (see Figures 17 and 18). The design is the usual George Lange “concentric nuts”. However, engraved in one side of the case they also have “Pat Dec. 26 ’11” marked (see Figure 19). We still have to assume these were sold as Model 4017.



Figure 17. Details of Markings for Type 3b

Figure 18. Details of Markings for Type 3b



Figure 19. Engraved Patent

Two devices with the serial numbers 541 and 579 have been found.

The Known Serial Numbers

As usual, when I start discussing serial numbers this includes a very unsubtle plea for owners of these devices to send me numbers and types so that we can produce an even better and more comprehensive story with credible dates. Everyone will benefit when we are able to date these devices more accurately and reliably.

The following Table 2 should allow us to draw some conclusions from the numbers we have recorded so far.

Possible Serial Number Usage

With the information we now have, we can make an attempt at assessing how these serial numbers might have applied and when devices were sold during their life span. We can then try to draw conclusions from what we see.

The gap in serial numbers between Type 2 and Type 3a devices implies that there may have been a clean cut-off between the two types. This needs confirmation, and an estimate made for last serial for Type 2 and first serial of Type 3. Types 3 and 4 appear to have been in one contiguous series, albeit with a prefix for the Type 3c devices.

Conclusions

From the range of the serial numbers gathered to date, we can reasonably speculate that it is entirely possible that only approximately one-thousand Sperry / Lange / K&E pocket-watch calculators were ever made. This is based on the assumption that all calculators were contiguously serial numbered and that a prefix was used with some numbers within that series covering the later Type 3c calculator. In addition, within that series Type 4 (K&E) calculators used some of the later numbers but without an 'S' prefix.

As a first working approximation, we can now estimate: Type 2: 150 devices, Type 3a: 300 devices, Type 3b: 50 devices, Type 3c: 250 devices and Type 4a: 250 devices; Total: approximately 1000 devices made.

A few more serial numbers will allow much better estimates of the manufactured quantities of the various types to be

made, and improved estimates of dates associated with a particular serial number.

We have used fewer than 30 serial numbers to come to these conclusions (< 3% of the estimated population). **If** it is found that the K&E calculator (Type 4) actually had its own separate number series – I would suggest that we would need to find at least three examples of Type 4 calculators, which have a repeated serial number with one of the Sperry Type 3a/3b calculators. One duplicate could be interpreted as a mistake; two as a coincidence, but three duplicates is credible as an indication for a second separate number series. So far, there is no duplication. A second number series would add perhaps another 300 calculators to the estimated total made and sold.

I have postulated when particular types of a calculator might have been first and finally sold; thus, we can estimate the serial numbers for a particular time period.

More serial numbers added to the lists will give this more veracity, but I would venture that my postulations are generally accurate plus and minus two or three years. If any reader has a different take to these ideas, I would be delighted to hear the evidence.

I “begged a number of questions” at various points through this article:

- *Was this the patent that was “Applied For”?* Almost certainly not. There is no relevance to Lange’s patent specifically for the K&E calculator individually. I believe that K&E may have tried to separately patent their K&E calculator (the Type 4, Model 4018) and that is why it is the K&E Calculator, and only the K&E calculator (see next question) which show the “Pat. Appd. For” marking. The K&E Calculator is very different from its Sperry cousins, it only has one rotating scale and it carries “Mannheim” and Trig scales. It makes some sense that K&E would have tried to patent this separately, and in all probability actually had little chance of succeeding, as there was little new in either the mechanical design (already covered by the Lange patent) or the scale set.
- *Why is it only K&E Calculators that show the ‘Patent Applied for’ notification, never a Sperry?* See above.
- *Is the assumption that any Calculator with the 1911 Patent date was only sold after the patent was awarded i.e., effectively from January 1912 reasonable?* Yes, I believe so, as evidenced by the discovery of the Type 3b calculators, which have both patents marked.
- *No K&E or Sperry device has ever been found that carries reference to this [last] patent.* I have not been able to find any rational explanation as to why Sperry (and one has to assume that K&E were complicit in this) should ever have gone to the bother and expense of filing this third patent. It is a patent for ideas that were used on a calculator

- 16 years previously (22 years after the patent was awarded). This is particularly true as in between K&E had made all their pocket-watch calculators to the design patented by George Lange in 1908, 14 years before filing, and 20 years from final award of this third patent.

I begged a question or two relating to the “*Directions for Sperry’s Calculator*”. I cannot answer these as I have only seen the 1906 edition of the booklet. Perhaps readers can confirm that later booklets were different and applied more specifically to the Lange mechanism with its concentric nuts, rather than the two button devices. Incidentally all K&E pocket-watch devices were advertised and priced in the catalogues as ‘with Directions’; this makes the apparent rarity of the instructions somewhat unusual.

Nothing we have found so far allows us to even speculate as to who made these devices. Joe Soper’s excellent book⁴ makes absolutely no mention of pocket-watch slide rule devices. A conversation with Mr. Gerd Keuffel, great grand-son of the founder, during the IM 2011 meeting elicited his opinion that K&E was unlikely to have made any

of these devices themselves, the founders were well known to have visited Europe on a regular basis looking for items that K&E could market.

I would love to see the insides of a K&E calculator to compare with a Sperry/Lange device – are they the same but just simpler? I am not sure this would actually add an awful lot to the sum of our knowledge, but knowing is simply a sop to my wish to see the insides of every calculator type I can! The need to know is probably something Freudian in my make-up.

Acknowledgements

The Clark McCoy collection of K&E catalogues on the web⁵ remains a pre-eminent source of information on anything relating to the make, my thanks to Clark for making it available to all us collectors. I must thank all the very kind owners who let me have serial numbers, also e-Bay! In addition, particular thanks to Ed Chamberlain who let me have scans of the 1906 edition of “*Directions for Sperry’s Calculator*”, Bob Otnes who let me have pictures of his early device, and Jim Bready a later device.

References

1. Otnes, Bob, *Elmer A. Sperry and his Calculator*, Journal of the Oughtred Society, 6:2, Fall 1997, p19.
2. Hopp, Peter M., *Pocket Watch Slide Rules*, Astragal Press, 2011. ISBN 978-1-031626-31-6
3. (International Slide Rule Museum) <http://www.sliderulemuseum.com/>
4. Soper, Joseph L., *K&E Salisbury Division Slide Rules*, published by the Oughtred Society, 2007. ISBN 978 0 0791477 5
5. <http://mccoys-kecatalogs.com>

Table 2. K&E / Sperry Serial Numbers and Type Transitions

<i>Serial No.</i>	<i>Type</i>	<i>Notes</i>	<i>Comment</i>
			With the numbers found to date, that there was a clean break between Type 2a/b and Type 3a is very likely. We do not know what that serial number is.
36	2a		Note that all owners claim that their device is a Type 2a (4016) and not a Type 2b (4017). Only more accurate data recording will correct this. The transition point is so far unknown, but assuming 3 years manufacture and approximately 150 devices in total, we have about 50 made and sold per year.
51	2a		
82	2a		
121	2a		
237	3a		Our range of numbers is interesting. If a contiguous series of numbers was used we find that some numbers for the Type 4a (Pat App ^d For marking) became interspersed with Type 3a (Pat 04) and late Pat 04 (Type 3b) devices.
260	3a		
275	3a		
311	3a		
353	3a		
361	3a		
378	3a		
404	3a		
419	3a		
438	3a		
500	3a		
517	4a		
541	3b	Pat DEC 26’11	
548	4a		
579(6)	3b	Pat DEC 26’11	If we assume that Type 3a devices were sold from about 1908, i.e., when the second patent was filed, and after the Type 2 was stopped, we have 4 or 5 years of sales during which time possibly 300 devices were sold, i.e., 60 - 75 per year, a very large number indeed, even compared with Type 2!
S650	3c		
			Type 4a. K& E Calculator. Serial Numbers recorded to date imply that these were contiguously numbered with all other pocket-watch types. These were sold from 1909 to 1927, 18 years, and 180 devices, 10 per year, which, to a first approximation, may be reasonable.
			The numbers for Type 3c, those marked Pat Dec 26’11, again we have to assume that they

680	4a		were a contiguous number within the series but with the additional distinguishing prefix "S". The serial 788 device listed is a query; it is apparently marked Dec 26'11 on the face, so on this basis it should have a prefix "S". Device numbered S821 might have been misread as S824. These are minor easily clarified detail points, which do not affect the logic.
S714	3c		
S772	3c		
788	3c	Missing 'S'?	
S824 (S821?)	3c		
869	4a		Assuming that Type 3c devices were sold from the end of stock of the Type 3b, we can assume they were sold from say mid to late 1912 to the end of the type in 1939, a total of 27 years, during which over 300 were sold, but shared serial numbers with 4a, say 12 per year. This now does not seem sensible, particularly when compared with the 3a / 3b types above, which sold in considerably larger numbers, but is similar in scope to Type 4a.
S915	3c		
S978	3c		

Table 3. Possible Sperry & K&E Serial Number chronology

Year	Serial Number	Sperry Type	Other comments	Serial Number	K&E Type
1903	n/a		Dec 21, 1903 Patent 773,235 filed		
1904	n/a		Oct 25, 1904 Patent 773,235 awarded		
1905	n/a				
1906	36	2	Only year Sperry 4016 & 4017 in catalogue		
1907	51, 82	2			
1908	121	2	June 24, 1908, Patent 1,012,660 filed		
1909	237, 260, 275	3a	First Sperry / Lange 4017 & K&E 4018		4a
1910	311, 353, 361, 378	3a			4a
1911	404, 419, 438	3a	Dec 26, 1911, Patent 1,012,660 awarded		4a
1912	500, 541	3b		517, 548	4a
1913	579	3b/3c			4a
1914		3c			4a
1915	S650	3c		680	4a
1916		3c			4a
1917		3c			4a
1918		3c			4a
1919		3c			4a
1920		3c			4a
1921	S714	3c			4a
1922		3c	Jan 23, 1922, Patent 1,671,616 filed.		4a
1923	S772	3c			4a
1924		3c			4a
1925	(S)788	3c			4a
1926		3c			4a
1927	S824	3c	Last appearance of K&E 4018 in catalogue	869	4a
1928		3c	May 29, 1928. Patent 1,671,616 awarded		
1929		3c			
1930		3c			
1931		3c			
1932		3c			
1933	S915	3c			
1934		3c			
1935		3c			
1936		3c			
1937		3c			
1938	S978	3c			
1939		3c	Last catalogue appearance of the Sperry Lange 4017		