

Reckon on it!

A very British trait

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As soon as currencies were established, bartering fell out of fashion and multiplication skills were needed to succeed in business. However, for over a century the calculating aid of choice for trade and commerce was the Ready Reckoner and not the slide rule.

Introduction

After the momentous crash of the financial and money markets in 2008 it is ironic to be thinking back to a time when trade and commerce was dominated by someone's ability to do simple mental arithmetic and longhand calculations. Possibly until cheap electronic calculators became readily available in the early 1970's, multiplication was a chore and often error-prone. Imagine the diligence needed to calculate longhand all the invoice lines on a long bill of sale based on imperial rather than metric weights and measures?

Clearly when he invented the logarithm in 1614 John Napier (1550-1617) revolutionised the way calculating was done. Before logarithms the time-consuming enormity of some calculations took literally years to finish. Arguably without Napier there would have been no:

- Algorithmic Tables
- Ready Reckoners
- Slide Rules
- Mechanical Calculators
- Electronic Calculators

From this list, Ready Reckoners¹ rarely get mentioned. In their heyday each of the calculating aids listed had universal appeal. But unlike most of its more famous peers, Ready Reckoners did not rely on repeated additions to do their multiplication [1]. For a time they enjoyed popularity all over the world - only going out of fashion when more and more countries went metric and decimal.

What are Ready Reckoners?

Unlike most calculating aids, Ready Reckoners do not rely on logarithms and are exclusively a printed aid. According to the Oxford Compact English Dictionary [2] a Ready Reckoner is: "a book, table, etc. listing standard numerical calculations or other kinds of information."

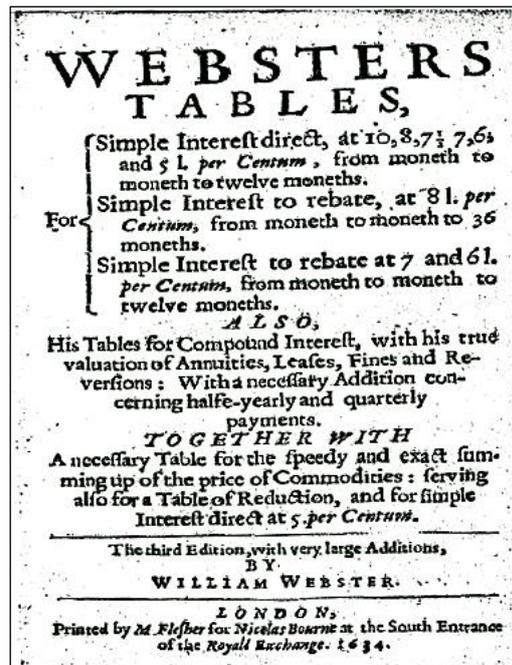
2/9				TWO SHILLINGS & NINEPENCE.				2/10							
No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.	No.	£	s.	d.
1	0	2	9	51	7	0	3	101	13	17	9	156	21	9	0
2	0	5	6	52	7	3	0	102	14	0	6	200	27	10	0
3	0	8	3	53	7	5	9	103	14	3	3	224	30	16	0
4	0	11	0	54	7	8	6	104	14	6	0	240	33	0	0
5	0	13	9	55	7	11	3	105	14	8	9	250	34	7	6
6	0	16	6	56	7	14	0	106	14	11	6	256	35	4	0
7	0	19	3	57	7	16	9	107	14	14	3	272	37	8	0
8	1	2	0	58	7	19	6	108	14	17	0	280	38	10	0
9	1	4	9	59	8	2	3	109	14	19	9	300	41	5	0
10	1	7	6	60	8	5	0	110	15	2	6	350	48	2	6
11	1	10	3	61	8	7	9	111	15	5	3	365	50	3	9
12	1	13	0	62	8	10	6	112	15	8	0	400	55	0	0
13	1	16	10	63	8	13	3	113	15	10	9	450	61	17	6
14	0	2	10	51	7	4	6	101	14	6	2	156	22	2	0
15	0	5	8	52	7	7	4	102	14	9	0	200	28	6	8
16	0	8	6	53	7	10	2	103	14	11	10	224	31	14	8
17	0	11	4	54	7	13	0	104	14	14	8	240	34	0	0
18	0	14	2	55	7	15	10	105	14	17	6	250	35	8	4
19	0	17	0	56	7	18	8	106	15	0	4	256	36	5	4
20	0	19	10	57	8	1	6	107	15	3	2	272	38	10	8
21	1	2	8	58	8	4	4	108	15	6	0	280	39	13	4
22	1	5	6	59	8	7	2	109	15	8	10	300	42	10	0
23	1	8	4	60	8	10	0	110	15	11	8	350	49	11	8
24	1	11	2	61	8	12	10	111	15	14	6	365	51	14	2
25	1	14	0	62	8	15	8	112	15	17	4	400	56	13	4
26	1	16	10	63	8	18	6	113	16	0	2	450	63	15	0

¹ Some maybe more familiar with the French term: "Barème".

The term "Ready Reckoner" was probably first coined by an Englishman: Daniel Fenning (1714/15-1767) [3]. Fenning was a schoolteacher well-known for his spelling and language aids. He was also a prolific author of textbooks. In 1757 he published: "*The Ready Reckoner, or Trader's Most Useful Assistant*". However, Fenning probably got his inspiration from tables for simple and compound interest published well over a century earlier by Englishman William Webster.

Besides being a book of tables "Reckoner", like the German "Rechner", can also mean an expert at calculating.

Fig. 1: Front page of Webster's Tables 1634 [3]



Why did Ready Reckoners become popular?

For nearly 400 years the slide rule and pinwheel mechanical calculators made complicated multiplication, and to a lesser extent division, easy. It is less well-known that such calculating aids were ill-suited to the demands of everyday trade and commerce involving imperial and non-decimal units. It is easy to forget that currency decimalisation² is, for many countries, a relatively recent change and even today, not universal.

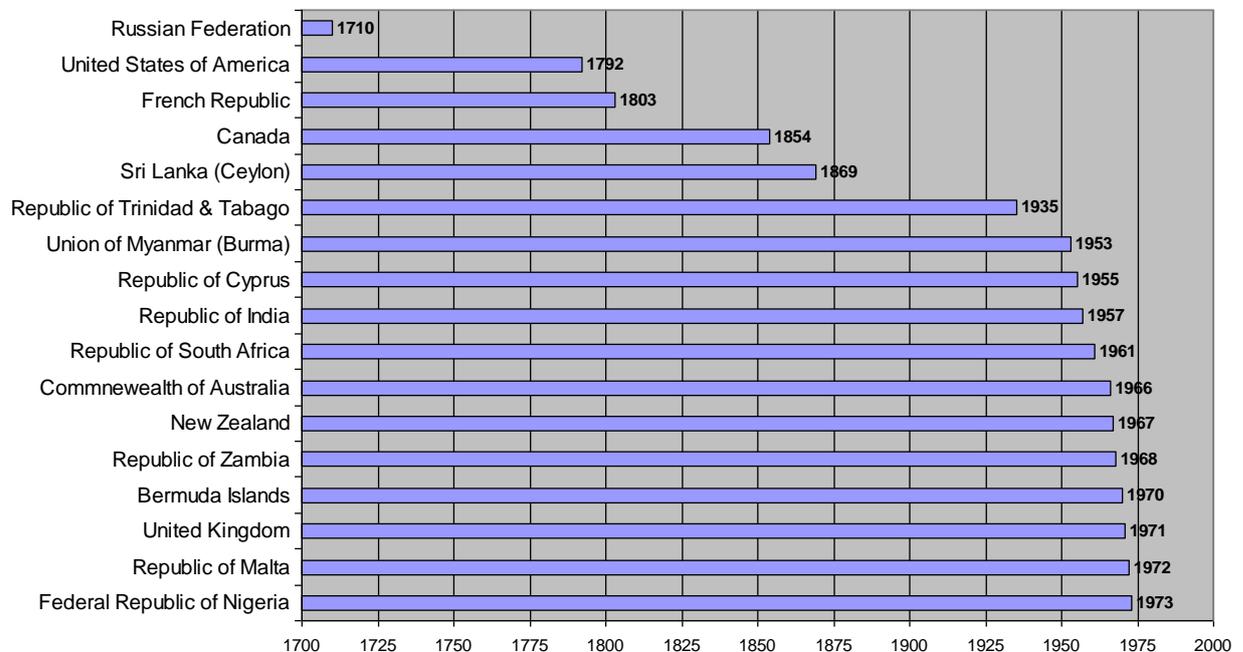


Fig. 2: Examples through the decades (for those needing it) of the advancement of currency decimalisation across the world

² The process of moving to a numerical base ten (decimal system) for managing a currency.

Surprisingly some non-decimal units of currency still exist. The Islamic Republic of Mauritania still has *1 Ouguiya = 5 Khoums* and The Republic of Madagascar still has *1 Ariary = 5 Iraimbilanja*. But non-decimal currency units may never disappear altogether as thanks to J.K. Rowling we now have the UK Wizard currency of *1 Galleon = 17 Sickles = 493 Knuts!*

In the 19th and 20th centuries, besides obviously needing to combine high precision, speed and accuracy, any calculating aid for commerce had to be capable of handling imperial units. It also had to be cheap enough so they could be used daily by an army of shop assistants and clerical workers - "*100 Ready Reckoners can be purchased for the price of one such calculating machine*" [4].

The complicated calculations (answers at the end) they might have faced every day are:

- In a haberdasher or drapers
3 yards, 1 foot and 3 inches of finest woven silk @ 2 shillings and 9 pence a yard?
- In an ironmonger
1¼ pounds of 2 inch wrought iron nails @ penny ha’penny (1½ pence) an ounce?
- In the chancery of a wealthy landowner
annual rent due on a plot of farming land 1 furlong by 2½ chains @ 30 pounds an acre?

Imperial units existed for length, area, volume and mass. The first unit of length dates from 5000 years B.C. [5]. The *Megalithic Yard*, famously used to build the Great Pyramids of Giza, was 829.1 mm long. Until the start of metrication³ in the 18th century there was a plethora of imperial units and exotic names for such units. For example, the English foot was widely used but it was one of more than 300 units just for measuring length [6]. This continued until the British Weights and Measures Act was passed in 1824. Thanks to the extent of the British Empire at the time (see Fig. 6) the act indirectly introduced the same standard for imperial units to many parts of the globe.

<i>Unit</i>	inch	foot	yard	chain	cm	m	km
Thou	1/1000				0,0025		
Mil	1/1000				0,0025		
Line	1/10 or 1/12				0,2540		
Barleycorn	1/3				0,8460		
Inch	1				2,54		
Nail	2 ¼				5,72		
Palm	3				7,62		
Hand	4				10,16		
Link				1/100	20,12		
Span	9				22,86		
Foot		1	1/3		30,48		
Pace		2,5			76,20		
Yard		3	1		91,44		
Ell (English)	45				114,3	1,14	
Fathom		6	2		182,9	1,83	
Ell (Scots)= 37 sc.in.	72,2	6	2		182,9	1,83	

³ The process of converting from an imperial (non-metric) to a metric system for weights and measures.

<i>Unit</i>	inch	foot	yard	chain	cm	m	km
Perch or Rod or Pole		16,5	5,5	1/4	502,9	5,03	
Rope		20			609,6	6,10	
Chain (100 links)		66	22	1	2.011,7	20,12	
Cable (1/10 n.mile)		608	202,7		18.531,5	185,31	
Furlong		660	220	10	20.117,0	201,17	
Mile (statute)			1760	80	160.934,0	1.609,34	1,6
Mile (nautical)		6080	2027		185.315,0	1.853,15	1,9
League			5280		482.803,0	4.828,03	4,8

Fig. 3: **British Imperial Linear Units of Measurement Post 1824** [5]

<i>Units</i>	x		Pint	Gallon	cu.in.	centilitre	litre
1 minim	1/60	fl.drachms	0,001		0,029	0,47	
1 Scruple (fluid)	20	Minims	0,017		0,576	9,43	
1 cu.in.			0,029		0,995	16,30	
1 Drachm (fluid)	60	Minims	0,050		1,733	28,40	
1 Ounce – fluid	1/20	Pint	0,050		1,734	28,41	
1 Gill or Noggin	8,7	cu.in	0,250		8,668	142,03	
1 Quartern	1/4	Pint	0,250				
1 Pint	4	Gill	1				0,57
1 Quart	2	Pint	2				1,14
1 Pottle	2	Quarts	4				2,27
1 Gallon	4	Quarts	8	1			4,55
1 Peck	2	Gallons	16	2			9,09
1 Bucket	2	Pecks	32	4			18,18
1 Bushel	4	Pecks	64	8			36,37
1 Firkin	9	Gallons	72	9			40,91
1 Kilderkin	2	Firkins	144	16			81,83
1 Bag	3	Bushel	192	24			109,11
1 Barrel (wine)	31,5	Galons	252	31,5			143,20
1 Barrel (beer)	36	Gallons	288	36			163,66
1 Hogshead (wine)	52,5	Gallons	420	52,5			238,67
1 Quarter / Seam	8	Bushel	512	64			290,95
1 Puncheon	70	Gallons	560	70			318,23
1 Chalder / Chaldron	4,5	Quarter	2304	288			1.309,27
1 Last	640	Gallons	5120	640			2.909,49
1 Gallon (U.S. dry)					268,80		
1 Gallon (U.S. liquid)					231,00		

Fig. 4: **British Imperial Liquid & Dry Capacity Measures Post 1824** [5]

The French Republic started the change from imperial to metric in 1799 but it took several decades to complete the change. Over the years many countries followed France's example. Some opted for a "big bang" change-over whereas others choose to have a period when both the new metric units were allowed alongside their old imperial counterparts. By 1980 most (but not all) parts of the world had made the change to metric (see Fig. 5). Although "folk-lore" means some old and much loved imperial units, like the British "pint of beer", are still in everyday use.

A ready market for Ready Reckoners

At its peak, at the beginning of the 20th century, the British Empire was the foremost global power and was a major political, linguistic and cultural influence on at least a quarter of the world's population of the day. Consequently the market for Ready Reckoners was worldwide and for many publishers a truly global business. Based on on-line catalogues and relying on classifications like "Ready Reckoner", "Barème", etc (but excluding simple tax tables) a picture of publication numbers of the day over the decades emerges.

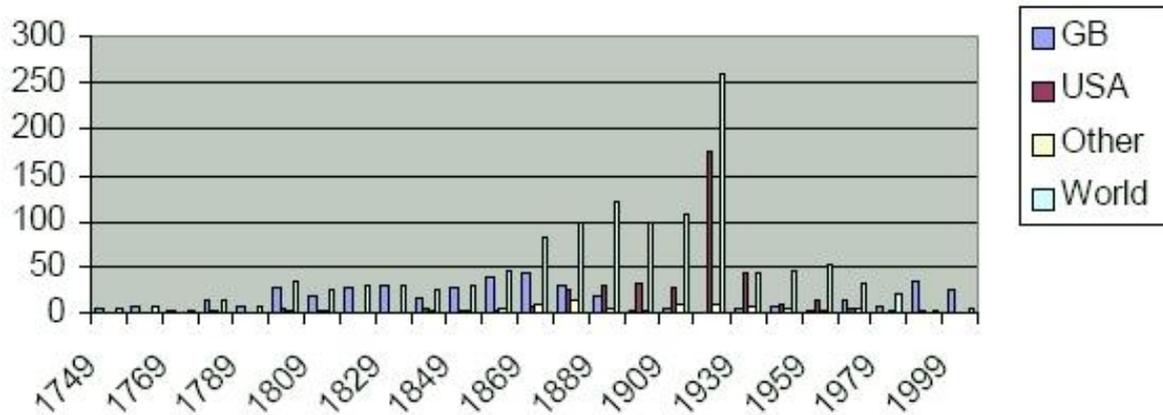


Fig. 7: **Number of new Ready Reckoners titles published worldwide per decade from 1749** [3]

Understandably in countries not "blessed" with a rich history of imperial units, there was less demand for specialist Ready Reckoners. But locally printed calculating aids did exist outside the USA and GB.

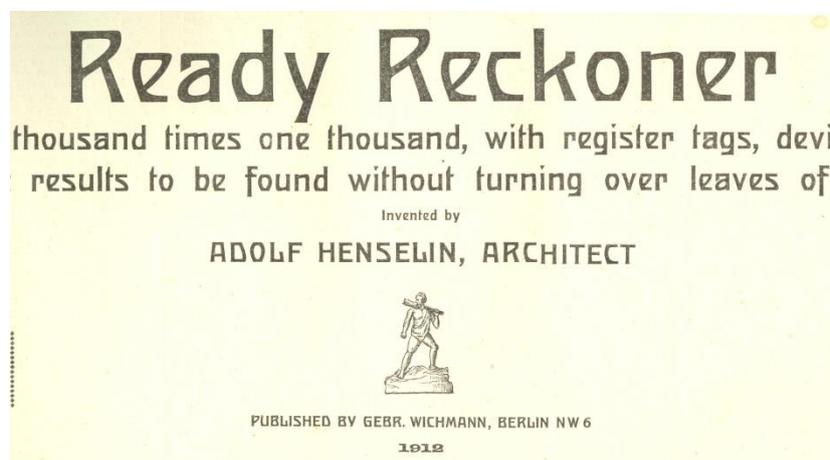


Fig. 8: **Early 1912 German 390x160x12mm Wichmann Ready Reckoner**

In countries not part of the British Empire, such as Germany and Sweden, the Ready Reckoners published locally were basic multiplication tables, or for currency/date/time related calculations or for units particular to a specialist trade.

Two well-known, 20th century examples are from the Swedish Mult-Divi AB and the German Continentale Büro-Reform (CBR) - including the special CBR edition with the addiator in the back of the book.

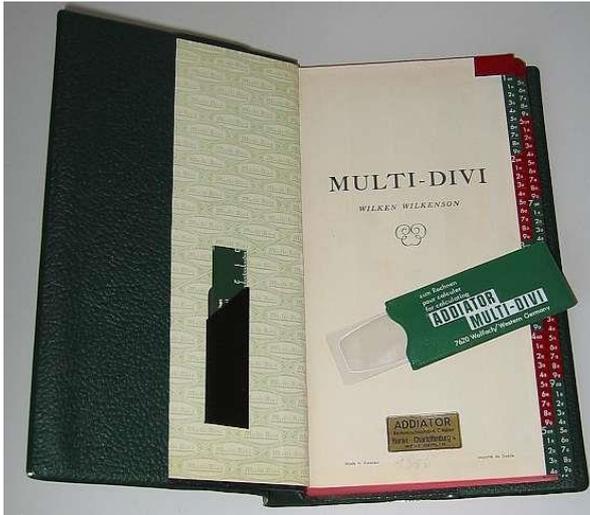


Fig. 9: (i). **Multi-Divi by Wilken Wilkenson**
(ii) **CBR Universal Calculator by Jean Bergmann**

So not unsurprisingly, the most prolific publishers of Ready Reckoners were in Great Britain or the United States. Although the American publisher Delbridge, based in St. Louis, is credited with publishing the most titles [3], this is misleading. Delbridge astutely “re-cut and diced” the same Ready Reckoner many times, just suffixing the name of a particular trade or group of users so it became a “new” title. Therefore if this practice is discounted, the Scottish company of Gall & Inglis, with well over 140 known different volumes, was the most prolific 20th century publisher of Ready Reckoners - see the *Appendix*.

Gall & Inglis – a publishing dynasty

Gall and Inglis was an Edinburgh based Scottish firm of printers and publishers. The firm was founded by James Gall (1784-1874) in 1810 and it stayed a family business for 150 years [8]. In the 1820’s, based on books for the blind he had seen in France, James Gall designed a font, *Gall type*, for both the partially sighted and the blind [9]. He thought that by creating an embossed font that was also recognisable to the sighted, it would remove some of the stigma of having to have special books for the blind. Regrettably because the resulting embossing proved so dense, the font never caught on and only a few books were ever printed in Gall type.

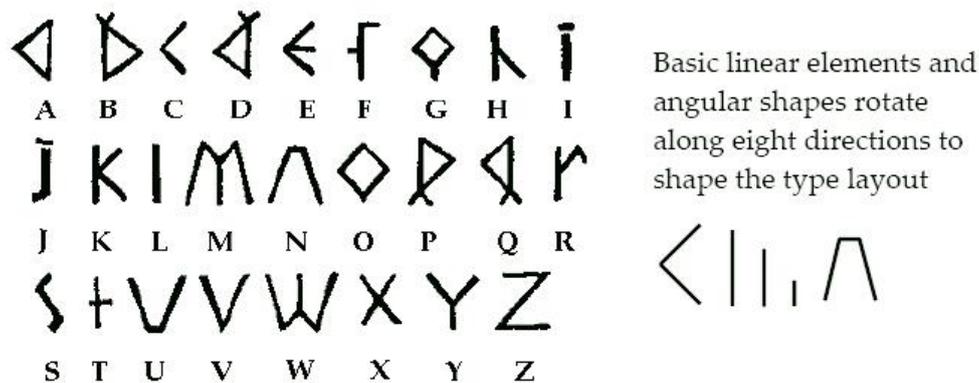
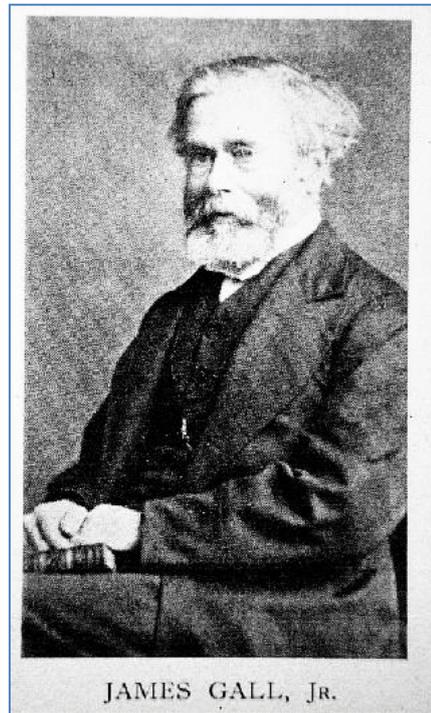


Fig. 10: **Example of “embossed” Gall type font**

In 1838 James Gall Jnr (1809-1895) joined his father in the publishing business. Understandably for the time, many of the early Gall & Inglis publications had a strong religious flavour. But James Gall Jnr proved to be an excellent cartographer. Surprisingly for a man who later left the business to become a church minister, he had a passionate interest in astronomy. So before he joined the church in 1847, he was responsible for titles like the "*Easy Guide to the Constellations*" and the "*People's Atlas of the Stars*" being published alongside Gall & Inglis' traditional religious texts [10].

The Rev James Gall Jnr and his wife, Mary Campbell, had a son and a daughter. Their son, James (1834-1900) initially joined the business but soon after, for reasons of ill health, he emigrated to Jamaica where he lived until he died [9]. So his place in the business was taken by the Rev James Gall Jnr's future son-in-law. Robert Inglis (1819-1887). He married their daughter, Elisabeth, in 1840. He extended the firms list of existing publications with the works of the classic poets: Scott, Burns, Wordsworth, etc. But when the time came to hand on the family business, as there was no one available from the Gall male line, the business was passed on through the Inglis male line. Interestingly the Gall family name was kept alive by Robert and Elizabeth giving both their sons a middle name of "Gall" - a tradition later passed on to their grandson [11].



JAMES GALL, JR.

By the late 1880's, from an interesting starting mix of religion, poetry and astronomy (star atlases and maps remained part of their portfolio to the end), publishing Ready Reckoners became the mainstay of the business and "*Gall & Inglis (Reckoners) Limited*" was formed. By now Robert and Elisabeth's eldest son, James Gall Inglis (1864-1939), had joined the business. Later, in 1888, his younger brother, Henry (Harry) Robert Gall Inglis (1869-1939) also joined the business. Deceivingly (see "*Best of Both Worlds*") he only appeared to play a minor role in the business, concentrating on maps and road atlases. James Gall Inglis married Charlotte Hill Kinmont in 1905. Their only son, Robert Morton Gall Inglis (1910-1975), was the last family member to head up the business. Besides taking care of the flourishing Ready Reckoner and maps side of the business, he also shared his father's interest in astronomy. So he continued his father's famous collaboration with A.P. Norton (1876-1955) on the "*Star Atlas*⁵" and published other astronomy related titles. He and his wife Vera Johnstone had two daughters, Evelyn and Jean, but no sons. Robert Morton Gall Inglis died suddenly from a coronary thrombosis in 1975. But two decades before his death he sold off the family business.

The company only had a short life under its new owners as they finally wound it up in 1960. However, Gall & Inglis (Reckoners) Limited must have continued as a trading entity as some reprints dating from the late 1960's and early 1970's are known to exist. For example, Neill and Co. Ltd. of Edinburgh and Martins Ltd. of Berwick, reprinted and published "*The Ideal Decimal Coinage Reckoner*" in 1969.

⁵ Affectionately known as "*Norton's*" - even today, after eighty years, it has not been superseded.

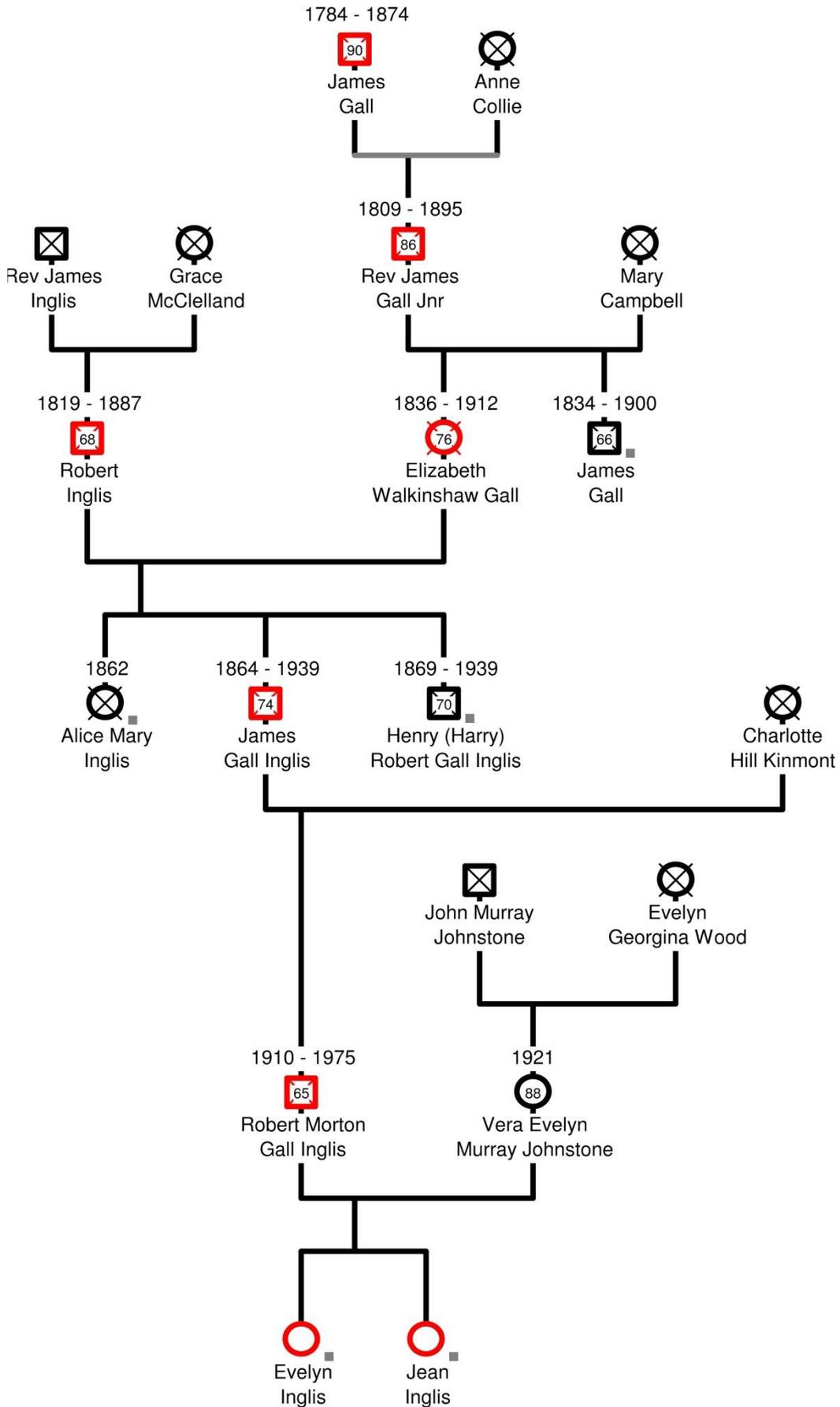


Fig. 11: The Gall & Inglis family tree – main lineage shown in red

Gall & Inglis – the publishing years

Because of the inevitable reprinting and reissuing of Ready Reckoner titles, the year of publication was often not part of any preface or colophon. The *Appendix* is a tabulated inventory of all the known series and the volumes or titles in each series. Sadly it is incomplete because apart from a single copy from 1958 [12], no early Gall & Inglis catalogues could be traced. But even so it shows how clever Gall & Inglis were in devising so many different Ready Reckoners for all sorts of guilds and branches of trade and commerce.

Although imprecise, the Gall & Inglis dynasty itself offers a rough time-line aid to the publication eras. The earlier series' carried the family name of "J. Gall Inglis". Whereas the later series', post 1940, carried the family name: "R.M.G. Inglis" or just "Gall & Inglis (Reckoners) Ltd." But perhaps a more unexpected clue is an even better guide to the probable publishing dates.

The Gall & Inglis main operating base was always Edinburgh but they also had a London office. The role and nature of the London office, apart from possibly acting as a distribution centre, is unknown. However, as the addresses of both locations were usually printed on the flysheet, they provide a handy time-line and range of possible publication years:

- **For Edinburgh**
 - 1857-1878 6 & 8, George Street
 - 1878-1924 20, Bernard Terrace
 - 1924- end 12, Newington Road
- **For London**
 - 1872-1875 30, Paternoster Row, E.C.4
 - 1875-1909 25, Paternoster Square, E.C.4
 - 1909-1930 31, Henrietta Street, W.C.2
 - 1930- end 13, Henrietta Street, W.C.2

In particular, the Edinburgh address of Bernard Terrace and the London addresses in Henrietta Street are good dating guides. For example, any undated Ready Reckoner listing the London address as 13, Henrietta Street must have been published after 1930.

Clearly before metrication and decimalisation the Gall & Inglis Ready Reckoners would have been exported to many of the countries making up the British Empire. There is also some evidence that Gall & Inglis (Reckoners) Ltd., as a trading entity, continued to use established channels to export their titles even after the family business was sold on. For example, Australia went decimal on February 14th 1966. But two years before, in collaboration with Rigby⁶ Limited of Adelaide, R.M.G. Inglis published an "*Australian Dollar Ready Reckoner and Percentage Reckoner*". Gall & Inglis did this despite there being at least one native Australian publisher of Ready Reckoners: Broomhall.

⁶ Founded in the 1950's, Rigby was a major Australian printer/publisher specialising in books for schools.

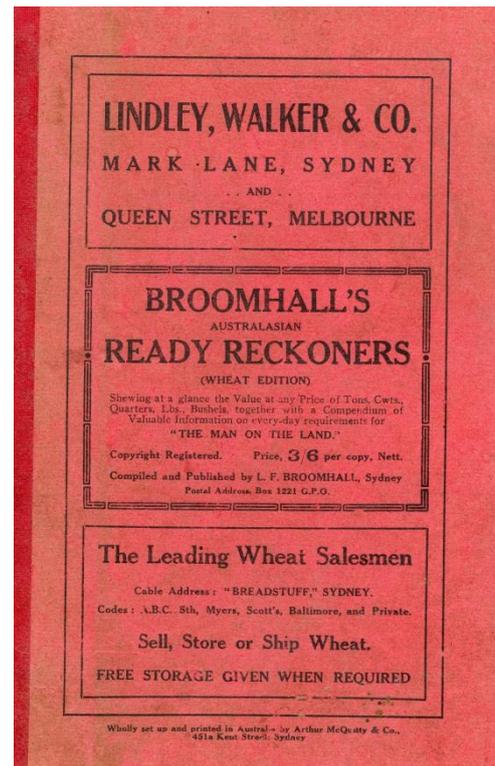
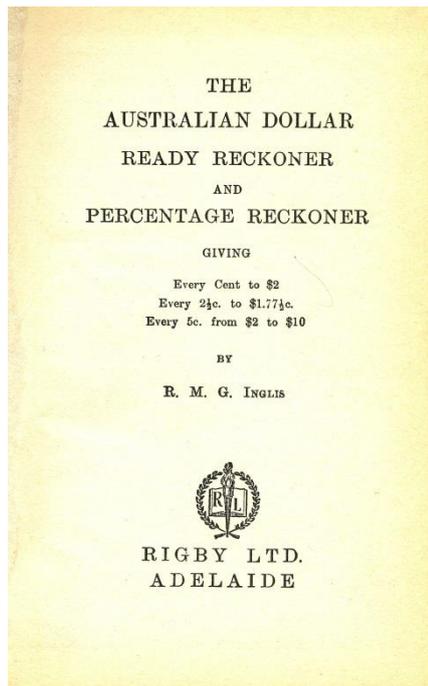


Fig. 12: (i) Gall & Inglis 1966 Reckoner
(ii) Broomhall's 1914 Reckoner

Response of slide rule manufacturers

By the start of the 20th century the failings of the popular rectilinear slide rule when calculations involved imperial units, fractions or non-decimal units had not gone unnoticed by slide rule manufacturers⁷. This is why many initially glued a variety of paper tables (later sometimes photo-etched into PVC) with conversion factors onto the back of their simplex rules. Having the right conversion factor to hand helped but it still did not simplify the long-winded series of error-prone settings needed, for example, to do longhand calculations with imperial units. Slide rules for calculating with fractions are virtually unknown [13].

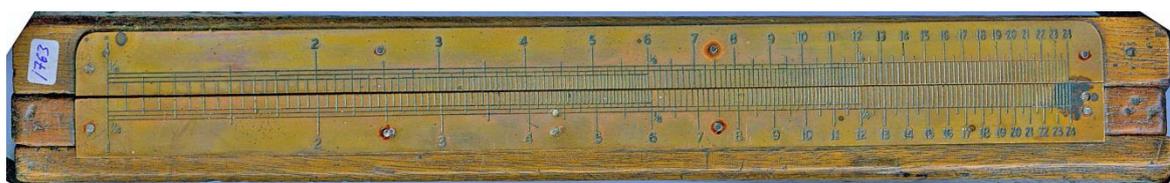


Fig. 13: Home-made 330x47x20mm hexadecimal copper on wood fraction rule [14] – see also "*Best of Both Worlds*"

Naturally manufacturers based in Britain had an extra "home-grown" incentive to come up with something better than a table of conversion factors. For example, around the 1920's (possibly later), F. Robson & Co.⁸ of Newcastle on Tyne produced a large boxwood slide rule for the steel trade with imperial length (feet and inches) and mass (pounds and hundredweights) based scales.

⁷ Since the 1760's instrument makers did include an imperial foot scale divided into 100 units for calculations involving surface areas and volumes as an edge scale on the majority of Coggeshall rules.

⁸ Little is known about the company or the period in which it made slide rules.

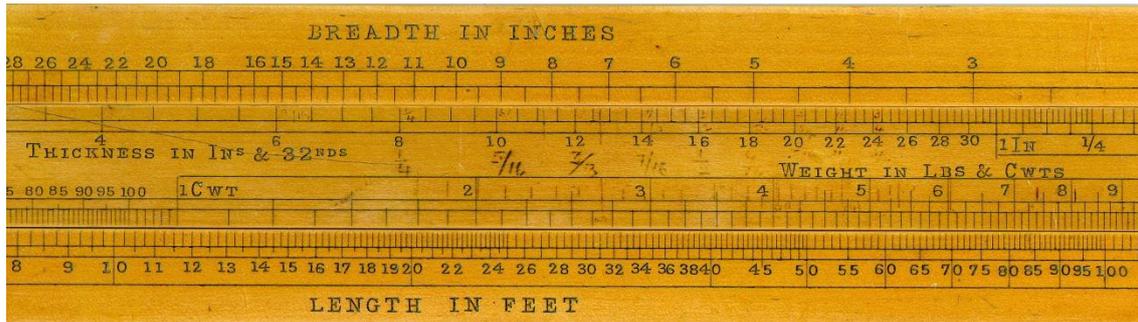


Fig. 14: **F. Robson & Co. 476x42x6mm boxwood rule for the Steel trade**

Much later, probably in the 1950's, Blundell Harling produced a plastograph⁹ steel weight calculator (for Lbs, Qrs, Cwts and Tons¹⁰) for steel stockholders James Austin & Sons Limited of Dewsbury.

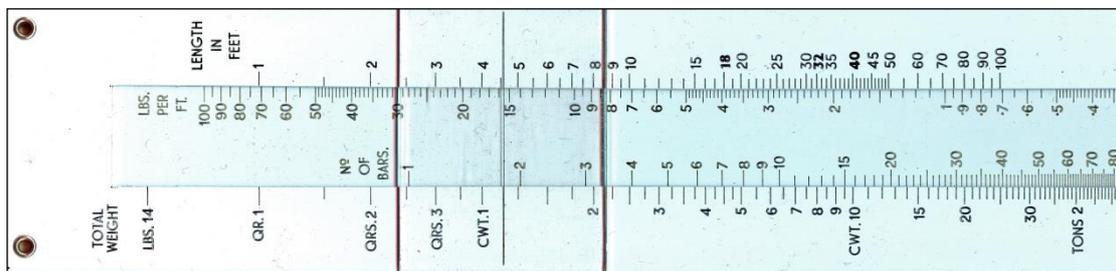


Fig. 15: **Blundell Harling 252x42x4mm plastic Steel Weight Calculator**

As decimalisation did not come to the UK (and Republic of Ireland) until February 15th 1971 many manufactures (especially in the UK) carried on designing clever solutions for calculating with the pre-decimal currency. For example, the Unique Monetary rule with the M1/M2/M3 sterling (£ s d¹¹) based scales and the equally innovative¹² M1 to M4 sterling based scales Blundell Harling added to one of their popular Academy range of rules [15].

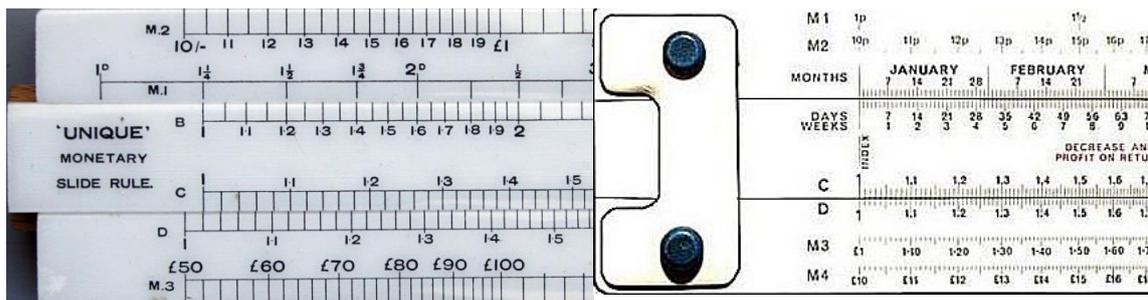


Fig. 16: **Unique 290 x 36 8mm wood/celluloid Monetary rule [16] and Blundell-Harling 342x49x3.5mm plastic 503D Commerce rule [15]**

However, apart from rare exceptions like the London-based optician R.B. Bates around 1820 naming his specialist slide rule the "*Bates Ready Reckoner*" [17] and the Keuffel & Escher prototype structural slide rule [18] from the early 1900's,

⁹ BH name for the engraving, laminating and gluing construction method used for plastic rules – rivets were added as a precaution in case the gluing came unstuck [15].

¹⁰ Abbreviations for imperial units of weight: a pound, a quarter, a hundredweight and a ton.

¹¹ British pre-decimal abbreviations for: pounds (£), shillings (s) and pence (d).

¹² So much so that Blundell Harling applied for a patent (application no. 6225) on it in 1967.

most other leading slide rule manufacturers opted to compete with Ready Reckoners by selectively adding conversion factors as gauge marks [19]. However, it was the German manufacturer, Nestler, who in 1913 introduced the ground-breaking¹³ "System Kaufman" model 40 – the first specialist slide rule designed for merchants [20]. In the same year the American company of Hutton started selling a very similar (possibly made by Nestler) rule [21]. From 1931 Nestler added two extra scales to the early design and over the coming years developed a family of System Kaufmann slide rules. In 1961 it was superseded by the Mercur model 0401.

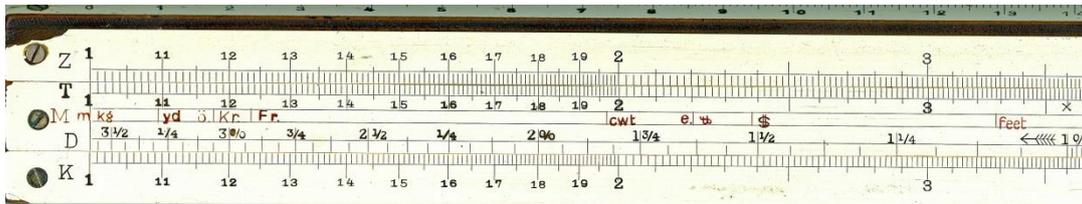


Fig. 17: **Nestler 275x31.5x9.4mm model 40 (early design) mahogany rule for merchants**¹⁴

In response, other manufacturers started designing new innovative scales. Most of these were incorporated into new rectilinear slide rules in their specialist range. This innovation certainly did not go unnoticed by Nestler's great German rival; Faber-Castell (F-C). In 1923 (revised in 1929) F-C responded with the impressive (size and design) "System Rohrberg" Columbus model 342 [22]. It came with a specially written instruction book. Through the Columbus, Disponent and Bivius series' F-C continued making slide rules for merchants until 1975.

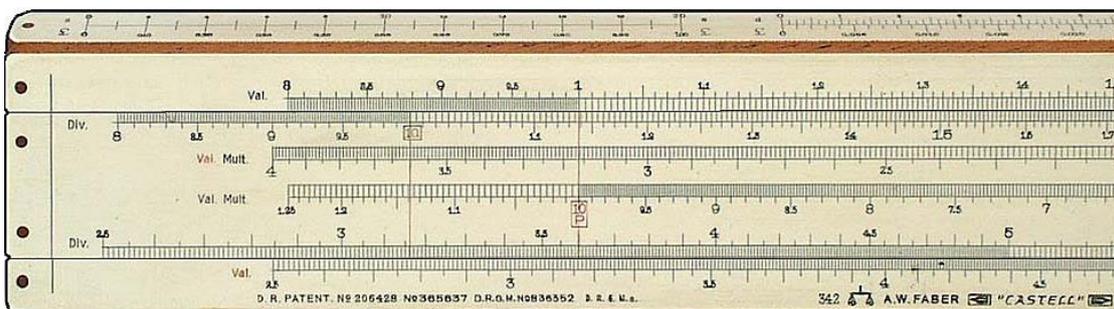


Fig. 18: **Faber-Castell 385x50x12.8mm model 342 pearwood System Rohrberg (1929 design [23]) rule**

Curiously it was Reiss and not the last of the "Big Three" German manufacturers, Dennert & Pape (D&P), which followed the trend set by Nestler and F-C. In 1918 D&P did offer a Valuta C43 model specifically for currency based calculations but it was only two decades later that they, as part of their Aristo Kaufmann (System Dr. Stender) range, really started producing specialist slide rules for merchants. Whereas the Reiss Stellfix K (model 1143) slide rule¹⁵ for merchants, with a frameless "free view" Phoenix cursor, dates from the early 1920's [24].

It falls outside the scope of this paper but it would be interesting to compare the different innovative design options chosen by the various German manufacturers to increase slide rule sales for trade and commerce.

¹³ Nestler were granted a patent, DRGM 564 729, for it.

¹⁴ In 1922 the Dutch office supplies company, Ahrend, included the Nestler 40 in their assortment of slide rules as the *Ahrend 771*.

¹⁵ Started in 1912, the Stellfix range of mahogany and celluloid rules was renowned for its use of extended root scales and frameless cursors. In the 1920's the Dutch office supplies company, Ahrend, included the Reiss Stellfix K in their assortment of slide rules as the *Ahrend 677*.

Best of Both Worlds

However, in true Darwinian fashion the Ready Reckoner was not the “swansong” of the printed calculating aid. Possibly in response to customer requests, some Ready Reckoners evolved into Tabular Calculators and even “hybrid” Calculator Books. The following classification scheme shows how Ready Reckoners and their contemporaries evolved.

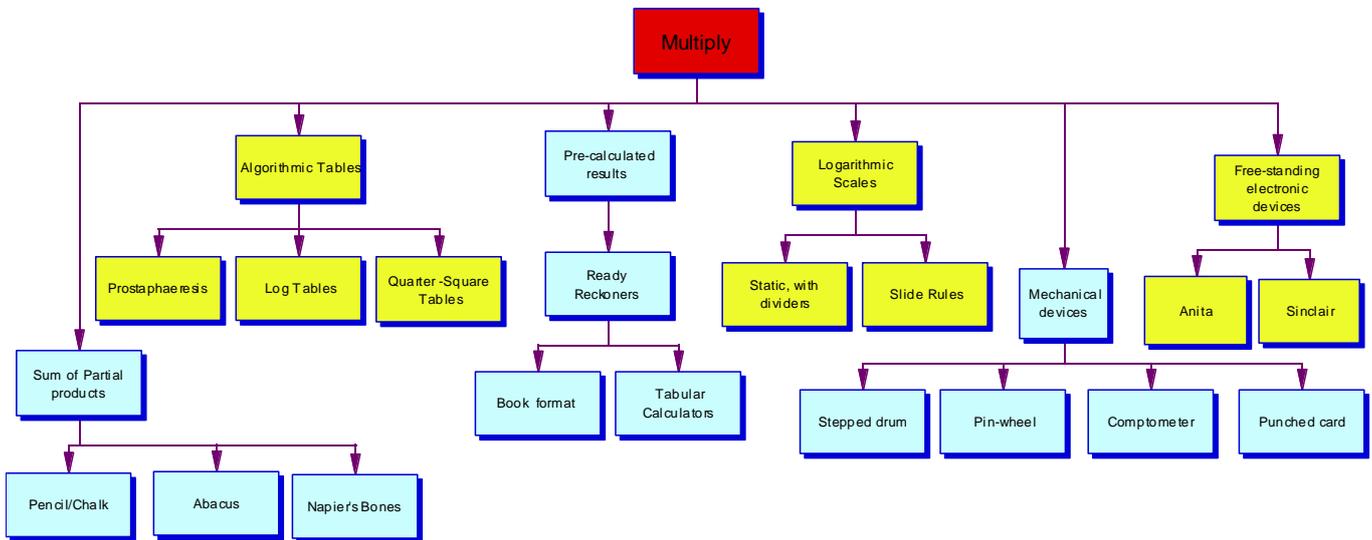


Fig. 19: Bruce Williams’ classification scheme [25]

Tabular Calculators were an attempt to avoid the sometimes “irritating” page-turning aspect of Ready Reckoners by partially mechanising the process. The page-turning problem was most obvious when, for example, having to work through a series of calculations in mixed units of say pounds, quarters, hundredweights and tons. So pages, or parts of tables, were pasted onto discs, cylinders, drums, etc. Then by “dialling” or some kind of mechanical aid, different parts of the old Ready Reckoner tables automatically lined up to give the result.



Fig. 20: Simple 220mm paper on wood „HABS” Multiplication Calculator¹⁶

This simple device has a paper cursor surrounding a finger-thick tube. Juxtaposing any two numbers in red and their product appears in a cursor window. In the example shown, 19×19 (on the right) = 361 (in the left-hand window of the cursor) and 6×9 (on the left) = 54 (in the right-hand window of the cursor). Basically it is a multiplication table for up to 19×20 rolled around a stick. In contrast, the Tariff Calculator provided by Pacific Cable Board, London, SW1 was clearly intended for trade and commerce. It showed the cost of sending a telegram of 1-30 words to various continents and islands around the world.

¹⁶ The instructions are in Dutch but it could be of German origin as the name „HABS” and the D.R.P. suffix (Deutsches Reichspatent) could be derived from the German “*Ich habe es*” or “*I have it*”.

	s.	d.																										
*Australia	2	6	5	0	7	6	10	0	12	6	15	0	17	6	20	0	22	6	25	0	27	6	30	0	32	6	35	0
* " Flinders Island, King Island, and Maria Island	2	7	5	2	7	9	10	4	12	11	15	6	18	1	20	8	23	3	25	10	28	5	31	0	33	7	36	2
*New Zealand and Norfolk Island	2	3	4	6	6	9	9	0	11	3	13	6	15	9	18	0	20	3	22	6	24	9	27	0	29	3	31	6
*Fanning Island	2	3	4	6	6	9	9	0	11	3	13	6	15	9	18	0	20	3	22	6	24	9	27	0	29	3	31	6

NO. OF WORDS	1	2	3	4	5	6	7	8	9	10	11	12	13	14
--------------	---	---	---	---	---	---	---	---	---	----	----	----	----	----

Fig. 21: Early 1900's Pacific Cable Board 355mm wooden Tariff Calculator for calculating the pre-decimal cost of sending a telegram from the UK

But with their cross-over hybrid series, combining a Ready Reckoner with a slide rule, Gall & Inglis took this tabulator concept a step further. They were called: "**Inglis' Flash Reckoners**". Surprisingly the brain behind this innovative hybrid was the apparent "junior partner": H.R.G. Inglis. Apart from being a keen mountaineer (hence the interest in maps and atlases) Harry Inglis appeared uninvolved in the Ready Reckoner side of the business. Indeed when a Ready Reckoner was attributed to a family member, it was to his elder brother, J. Gall Inglis, or later to his nephew: R.M.G. Inglis. None were ever attributed to H.R.G. Inglis. So it is surprising to find his name listed as the inventor on the 1912 patent application. The patent being granted a year and a day later, on 20th January 1913: GB 191201533.

1533. Inglis, H. R. G. Jan. 19.

Slide-rules comprise a base A², two movable slides A, A¹, and an indicator C attached to one slide and extending transversely so as to co-operate with the graduations on the other slide. The usual graduations are in some cases replaced by special marks or signs; these are shown in Fig. 3.

(For Figures see next column.)

3

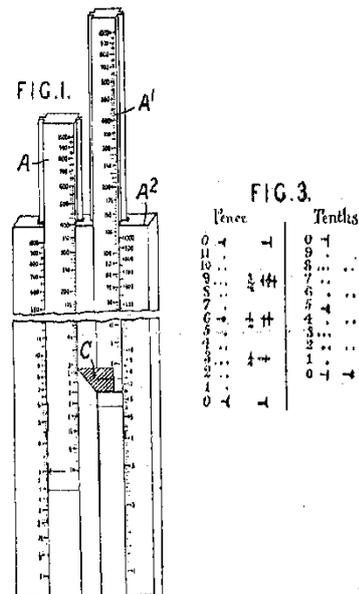


Fig. 22: Original January 19th 1912 patent application for a multi slide rule [25]

But despite being credited as the publishers on all *Flash Reckoners*, intriguingly the Gall & Inglis company name is not mentioned anywhere in the patent application. However, the Edinburgh address always listed for the *Flash Reckoners* is 20, Bernard Terrace. But as Gall & Inglis were only based at this address from 1878-1924 this suggests the Inglis' *Flash Reckoner* had a short print run. The series was most likely first published about 1909 - limiting the production run to a maximum of 15 years. Nevertheless Gall & Inglis still managed to publish a series of 12 radically different *Flash Reckoners* (see the *Appendix*). One of the earliest, for Engineers, innovatively even had scales for fractions as well as decimals.

Clearly these hybrids would have been much trickier and more complicated to print and bind than other Gall & Inglis publications. They would also have been more complicated to use than a conventional printed Ready Reckoner. Moreover, by their nature, the scale ranges had to be compacted and this meant their overall accuracy was far inferior to a normal Ready Reckoner. Indeed on the inside cover "Introduction" speed rather than accuracy was always stressed.

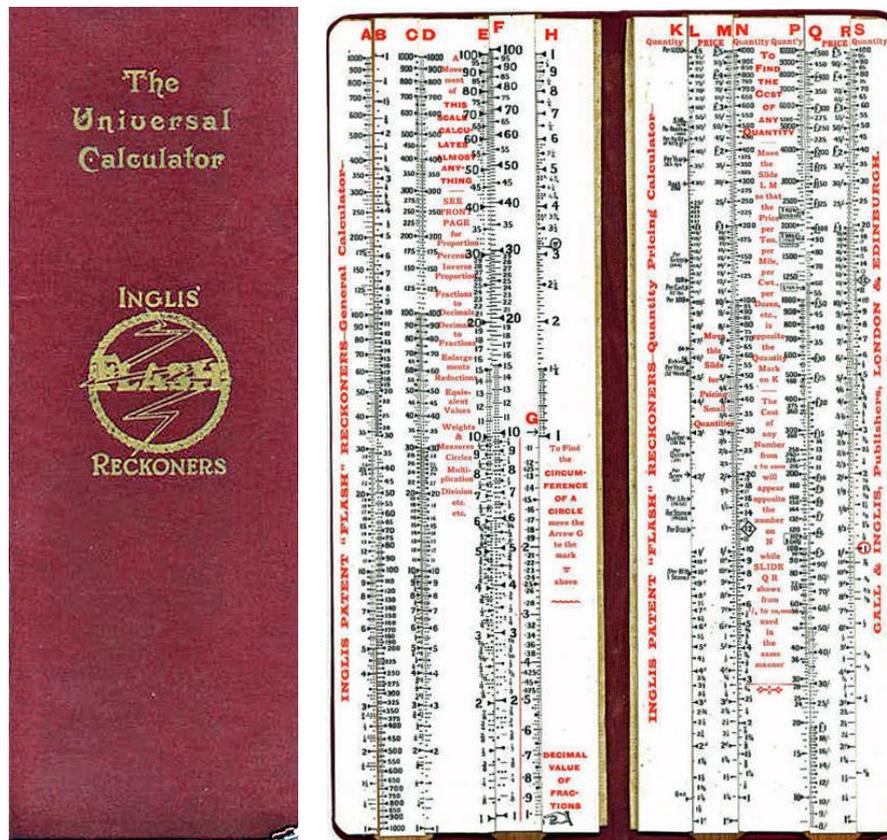


Fig. 25: Inglis' 243x80x6mm *Flash Reckoner* - *Universal Calculator*

So maybe when Gall & Inglis moved their main Edinburgh premises to 12, Newington Road in 1924, the company decided to rationalise their portfolio of titles or their printing and binding equipment? It certainly remains a mystery why such an innovative and patented idea was dropped by Gall & Inglis and no new editions were published after 1924. Perhaps the limited accuracy of the Inglis' *Flash Reckoners* was the ultimate reason for their short production run?

Was "modern technology" a rival?

Despite having its roots in the 18th century, the peak in the sales of Ready Reckoner was from the beginning of the 20th Century through to the late 1950s. Slide rules had an even longer provenance but did not really challenge the popularity of the Ready Reckoner for trade and commerce. But did any of the new early 20th century mechanical calculators pose a threat?

A German company, Addiator GmbH, founded by Carl Kübler started producing Addiator's in 1920's. Kübler's Addiator, often described as a sliding bar adder with an accompanying stylus, is probably the most well known¹⁷. It was one of several companies who started making mechanical calculators around this time. The concept behind the development of the slide rule was the logarithm. Addiator's relied on using a stylus to manually advance each 0-9 column by the number to be added or subtracted and to complete the "ten's carry" or ten's compliment i.e. when the stylus "passed" the 9, complete the carry over from units to 10's, from 10's to 100's, etc (or vice versa). Generically they were all decimal slide adders used for multiplication and division. So, like slide rules, they could not compete on price or with the inherent strength of the Ready Reckoner - i.e. they were not suited to calculations involving:

- fractions
- imperial units
- pre-decimal currencies

However, some 30 years after their introduction, the Addiator's basic 0-9 stepped mechanism was adapted and a limited series of non-decimal slide adders came on to the market [28]. These could work with imperial length measurements (e.g. Yards, Feet and Inches), imperial weight measurements (e.g. Hundredweights, Quarters and Pounds) and pre-decimal currencies (e.g. Pounds, Shillings & Pence).

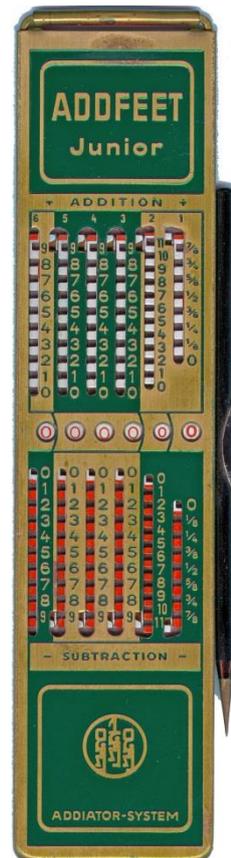


Fig. 26: rare Addiator for Feet and Inches

So you can Reckon on it!

Although some were still being made right up to the 1970's, the sales volume of non-decimal slide adders and specialist slide rules for merchants never made much impression on the millions of Ready Reckoners bought for trade and commerce. To compensate most slide rule manufacturers had, over time, at least added conversion tables and suitable gauge marks to their rules. Consequently slide rule collectors should not, for example, dismiss lightly the significance of a humble paper conversion chart stuck on the back of any slide rule.

For the 19th and most of the 20th century, all over the world, shop assistants, wage clerks, etc relied on their Ready Reckoners. The Scottish publishing dynasty of Gall & Inglis was instrumental in providing millions of the inexpensive pocket-sized printed aids needed for them to perform so many error-free calculations daily. Most modern-day owners of Personal Digital Assistants (PDA's) have probably never heard of a Ready Reckoner. Ironically the reason PDA's are so popular is similar to the reason Ready Reckoners became so popular in their day!

So despite being largely a British trait, the humble but immensely popular Ready Reckoner rightly deserves a place in the "hall of fame" of calculating aids alongside the slide rule. Collectors should look out for the rare hybrids from the Gall & Inglis *Flash Reckoner* series as they would certainly grace any slide rule collection.

¹⁷ Later it became the name synonymous for all such small inexpensive flat metal calculators.

Dedication and Acknowledgements

I dedicate this paper to UKSRC member Bruce Williams. It was Bruce's presentation at the IM2003 [25] that seeded my interest in Ready Reckoners and provided the inspiration to write this paper. Regrettably, following a serious illness, Bruce's previous prodigious output is now somewhat curtailed and he can no longer pursue his many avenues of slide rule related research. I just hope this paper, in some small way, is a fitting tribute to the keen mind of a great collector and researcher.

Naturally many people helped me with my research along the way. Most of you know who you are, but I would particularly like to thank (in alphabetical order):

- **Dr David Gavine** for invaluable work in tracking down the Gall-Inglis family details from Register House, Edinburgh – without this help it would have been impossible to trace and build the "Gall & Inglis family tree",
- **Leo de Haan** for permission to use information and reproduce tables from his article (in Dutch) on English units of measurement – this saved me many, many hours of work,
- **Ray Hems** for information and images,
- **Peter Hopp** for many helpful suggestions and acting as an intermediary to Bruce Williams and his past research,
- **John Hunt Snr** for information and images,
- **David Nichols** for help in tracking down examples of Ready Reckoners,
- **Werner Rudowski** for information and images.

Answers to calculations involving imperial units:

- From the Haberdasher: **9s 4³/₄p or
9 bob and 4 pence 3 farthings**
- From the Ironmonger: **2s 6p or half-a-crown**
- From the Chancery: **£75 0s 0p or 75 quid**

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Appendix – The Ready Reckoners of Gall & Inglis

Starting in the late 1880's, Gall & Inglis in the course of the next 150 years went on to publish more than 140 different (excl. reprints) Reckoners. Most were published as hardbacks although it is known that some paperback versions were published as part of the "Rapid" series.

Apart from a single copy from 1958 held by the National Library of Scotland, no Gall & Inglis catalogues are known still to exist. So this inventory (listed chronologically by approximate date) has been compiled by collating the few snippets of information that were available, entries in the 1958 catalogue and from the author's modest collection of Ready Reckoners (* = denotes part of the author's collection).

Consequently this compilation is almost certainly incomplete and is, at best, just work-in-progress!

SERIES	PUBLISHED BY	VOLUME NUMBERS and/or TITLES of EDITIONS	COMMENTS
"Standard"	J. Gall Inglis	<ul style="list-style-type: none"> - General Ready Reckoners - Combined Reckoners - Discount, Percentage, Profit, Interest, etc - Weight Reckoners 	<i>Selected editions prompted many of the later specialist series' – e.g. the "Express", series.</i>
"Long-Range"	J. Gall Inglis	<ul style="list-style-type: none"> - Ready Reckoner* - Half per Cent Percentage Reckoner* - Wage Reckoners - Interest Tables - Interest Reckoner - Ton Reckoner (Mostley's) - 1/16th's of a Penny Reckoner 	<i>Literally a larger format allowing more and more extensive table entries.</i>
Inglis' "Flash"	Gall & Inglis (H.R.G. Inglis)	<ul style="list-style-type: none"> - Pocket Pricing Calculator - Slide Rule (Improved Form) - Photographic Exposure Calculator - Pocket Engineer's Calculator* - Pocket Calculator (shorter 6 inch model) - Universal Calculator* - Stock Exchange Calculator - Foreign Money Exchange Calculator - Paper Trades Calculator - Box; or Square & Cubic Calculator* 	<p><i>As hybrid Ready Reckoners/Slide Rules, the emphasis (published in the preface) was on speed rather than accuracy.</i></p> <p><i>Only published for a brief period from +/- 1909-1924.</i></p> <p><i>n.b. all "pocket's" have smaller footprint</i></p>

SERIES	PUBLISHED BY	VOLUME NUMBERS and/or TITLES of EDITIONS	COMMENTS
		<ul style="list-style-type: none"> - Bank Interest Calculator* - Health Insurance Calculator 	
“Gem” pocket	J. Gall Inglis	<p>READY RECKONER AND Cyclopedia of Handy Calculations*</p>	<p><i>Waistcoat pocket series (2½ x 3½ x ¼”) first published c1915. Luxury editions leather bound & printed on India paper</i></p>
Inglis “Swift”	J. Gall Inglis	<ul style="list-style-type: none"> - Extended Eighths and Sixteenths Reckoner* - Per Ton Reckoner - 1-140/- per Cwt. Reckoner* - Cubic Reckoner (Rectangular)* - Percentage of Weights - Shaw’s Universal Interest Tables - Machinery and Plant Depreciation Tables - Dollars Exchange \$3.00 to \$5.25 - 48% Interest Tables - 48% Monthly Instalment Tables - 48% Weekly Instalment Tables - Angus’ Surveyors and Famers Reckoner - Donkin’s Reckoner for Auctioneer’s, Live Stock Salesman and Agriculturists - 40 Hours’ Wage Reckoner - 42 Hours’ Wage Reckoner - 45 Hours’ Wage Reckoner - 46 Hours’ Wage Reckoner 	<p><i>Examples with and without volume numbers.</i></p> <p><i>Style suggests the series could have been the pre-runner/inspiration for the later and smaller footprint Express series.</i></p>
Inglis’ “Express”	J. Gall Inglis (some late editions co-accredited with R.M.G. Inglis)	<ol style="list-style-type: none"> 1. General Ready Reckoner* 1a (= 1 but on stronger paper and bound in leather cloth) 2. Percentage and Discount Reckoner * 3. Cwts. & Lbs Reckoner 4. Interest Reckoner (every ½% from 1 to 5%)* 4a. Interest Reckoner 3, 3½, 4, 4½ and 5% * 	<p><i>Series possibly published right up to the late 1930’s.</i></p> <p><i>Later modernised and re-launched a second time by R.M.G. Inglis.</i></p>

SERIES	PUBLISHED BY	VOLUME NUMBERS and/or TITLES of EDITIONS	COMMENTS
		5. Profit on Cost & Percentage on Gross Returns Reckoner* 6. Profit & Pricing Reckoner* 7. British-Foreign Money Reckoner 8. Business Reference Book 9. Per Ton Reckoner 10. Per 100 Reckoner* 11. British into Metric Measure Tables* 12. Metric into British Measure Tables* 13. "On and Off" Percentage Reckoner* 14. Hoppus's Measurer for Timber, Stone, &c* 15. Superficial, Cube and Girthing Reckoner* 16. 46½-47-48 hr. Wage Book 17. Salary, and Pence Per Hour Wage Book 17a Salary & 'Per Hour Wages & Time-Costing Reckoner* 18. 46-47-48-49-50 hr. Wage Book 19. Dollars Exchange Tables 20. Pages Fractional Calculator 21. Per Gross and Per Dozen 22. (23) Stock Exchange* 23. (22) Metric Quotation and Fabric Equivalents 24. Straits' Dollars Exchange 25. Per Yard & Metre Equivalent Prices Reckoner 26-27. <i>unknown</i> 28. Eighths of a Yard Reckoner 29. T.C.Q.(Tons/Cwts/Qrs) Weights Factor 30. European Exchange Tables 31. Cubic Reckoner 32. New Dollars Exchange Rates \$3.00 to \$4.78 33. Decimals of a Penny Reckoner 34. New Francs Exchange Rates @ 84 to 100 to £	<i>Volumes vary in width & vol. 43 (Large-Type) is all round a larger edition.</i> <i>Some of the later volume numbers may have been reused and renamed e.g. volumes 20, 30, 32, 35 and 36.</i>

SERIES	PUBLISHED BY	VOLUME NUMBERS and/or TITLES of EDITIONS	COMMENTS
		35. Marks & Kroner Exchange Rates @ 14 to 22 to £ 36. Florin Exchange Rates at @ 8 to 14 to £ 37. Ostler's Farmers' and Merchants' Reckoner* 38. Dollars Exchange Supplement 39. Stahl's Petrograd Standard Reckoner 40. Timber Tables 41. Smith's Importers Calculator 42. Inglis' 1%, 1½%, 2% and 2½% Tables 43. Large-Type Express Reckoner* 44. Shaw's Decimal Discount and Commission Tables 45. Division (of Money) Reckoner 46. Decimal Tables for Calculating Machines 47. Liquid Contents Reckoner 48. Per Thousand Reckoner 49. Sheep Live Weight Calculator	
"Rapid" Pocket	Gall & Inglis	1. General Ready Reckoner* 2. Discount and Interest Reckoner* 3. Cwts. and Lbs. Reckoner 4. 'Compact' Paper Reckoner* 5. 'Compact' Decimal Reckoner 6. 'Compact' Measuring Reckoner 7. 'Compact' Land and Cattle Reckoner* 8. Pocket Pricer ('On Returns') 9. Pearl Dictionary 10. Per Ton Reckoner, by pennies to 91/- per ton 11. 44-hour Wage Reckoner 12. Eason's Thumb indexed Lighting Calculator 13. Steel, Iron and Metal Reckoner*	<i>True pocket-sized editions - 5½ x 3½ inch but Compact versions are even smaller.</i> <i>Use of volume numbers suggests the series was published pre-1940.</i> <i>Subsequent series' dropped the use of volume numbers.</i>

SERIES	PUBLISHED BY	VOLUME NUMBERS and/or TITLES of EDITIONS	COMMENTS
		14. Total Weight Calculator 15. 45-hour Wage Reckoner 16. 46-hour Wage Reckoner 17. 47-hour Wage Reckoner 18. 48-hour Wage Reckoner 19. 49-hour Wage Reckoner 20. 50-hour Wage Reckoner 21. 51&52-hour Wage Reckoner 22. Harding's Timber Calculator 23. Monthly Wages Reckoner 24. Per Dozen Reckoner* 25-30 <i>unknown</i> 31. 'Compact' Ready Reckoner* 32. Foreign Money Supplement (Rupees Exchange, &c) 33. Cubic Tables 34. <i>unknown</i> 35. Tons, Conversion into Lbs. 36. Record of Investments 37. Every Number Reckoner, 1 to 1000, ½ds to 6d ?? Live Stock Salesmen's Reckoner ?? Income Tax Table 4/6, 4/9, 5/-	
Bankers' Reckoners	Gall & Inglis	<ul style="list-style-type: none"> - Shaw's 100 Day Interest Tables - Shaw's Universal Interest Tables - Shaw's Income Tax Tables - Shaw's Deposit Receipt Decimal Book 	<i>Obscure little known series.</i> <i>Possible inspired by the success of the Express volume 44 of the same name.</i>
"Speedy" Pocket	Gall & Inglis	<ul style="list-style-type: none"> - Ready Reckoner for Office & General Use (i) ¼d to 19/-* (ii) d to £1, 2½d to £1 & 5d to £2* - Per Hour Wages Book 1d to 1/- Per Hour - Workmen's Wages - Discount Book - Atlas of Great Britain - Book of Tables - Spelling Dictionary 	<i>Obscure post 1924 little known soft-back pocket series.</i> <i>Possibly later reissues from the Rapid series</i>

SERIES	PUBLISHED BY	VOLUME NUMBERS and/or TITLES of EDITIONS	COMMENTS
The (new) "Express"	R.M.G. Inglis Gall & Inglis (Reckoners) Ltd.	<ul style="list-style-type: none"> - Universal Decimal Percentage Reckoner* - Universal Decimal Coinage Reckoner - Profit Reckoner For Fixing Selling Prices and Quotations (decimal currency) * - Every 1d to £1 Reckoner - Decimals of a Penny Reckoner - Metric Quotation & Fabric Equivalentents Reckoner - Decimal tables - British to Metric Conversion Tables - Metric to British Conversion Tables - Dollars Exchange Reckoner - Straits' Dollar Exchange Reckoner - Stock Exchange Reckoner - 1% - 2% Interest Tables - Superficial Measurement Reckoner 	<p><i>Issued after the original "Express" series i.e. post 1950.</i></p> <p><i>Compared to the style of the old Express series volume numbers were dropped, modern paper dust-covers were added and a new more modern font used.</i></p>
"Ideal"	R.M.G. Inglis Gall & Inglis (Reckoners) Ltd.	<ul style="list-style-type: none"> - Ready Reckoner - Decimal Coinage Reckoner* - Decimal Percentage Reckoner - Office Reckoner* - 1-200 Percent and Per 100 Reckoner - Foreign Exchange Reckoner ? unknown 	<p><i>Early editions published by J. Gall Inglis and R.M.G. Inglis.</i></p> <p><i>Owned examples not printed by Gall & Inglis.</i></p>
Foreign (published abroad)	R.M.G. Inglis Gall & Inglis (Reckoners) Ltd. and Rigby Ltd. Adelaide	<ul style="list-style-type: none"> - Australian Dollar Ready Reckoner and Percentage Reckoner* 	<p><i>Printed in Australia by The Griffin Press, Adelaide in 1964.</i></p>

The author invites anyone spotting an error or an omission to e-mail him at david.rance@xs4all.nl so that this compilation can, over time, become a more comprehensive inventory.