Blundell – Blundell Harling – W.H. Harling Slide Rules
A Brief History of Blundell Harling Limited

Peter Soole

Blundell Brothers Limited originated as a family firm in 1852 as drapers and furnishers[1] in Luton, England. After 1922, or thereabouts, its activities included felt hood manufacture for the hat industry, and a dyeworks. During the 1939–1945 War, these activities had to be restricted, but a machine shop was opened to supply machined components for the then Ministry of Supply.

In 1945, it was imperative to develop other types of manufacturing if the machine shop operations were not to close down, so Blundell Brothers began to experiment with the manufacture of slide rules. Slide rules were chosen because, not only was the machinery suitable for such diversification, but also nearly all slide rules previously available had been manufactured in Germany, and a shortage of slide rules was experienced in England after the war.

By 1948, sufficient progress had been made in slide rule manufacturing to form a separate company, Blundell Rules Limited, although production continued in the same premises owned by the parent company, just outside Luton. Progress was very slow and difficult in those first years, because of a lack of technical know-how. By 1955, the Company had developed fully its own manufacturing techniques, and was beginning to satisfy a limited market. It was also beginning to make specialist instruments for Government departments.

This was just in time, because the parent Company was taken over in 1955 and Blundell Rules Limited was served with notice to vacate its premises. Rather than close down, the Company decided to move away from Luton and the Midlands, where large industries had first call on skilled and semi-skilled labor.

Weymouth, on the South Coast of England, was selected because the Weymouth Corporation offered a site on their small industrial estate. A factory was built and the Company moved into it in January 1956. At first, about twelve employees from Luton agreed to come, and about thirty from Weymouth were trained. From then on the Company developed stage by stage, until by 1963 it had secured a place as a manufacturer of quality slide rules, scales, and associated specialist instruments – many for government and technical colleges.

In January 1964 the company purchased the assets of W.H. Harling Limited of Clapton, London (established 1848), makers of high-quality brass drawing instruments, mahogany T-squares, etc. The growing range of drawing office and specialist products ushered in a period of considerable growth for the company, necessitating the employment and training of many more local people.

The 1970s saw the decline of the slide rule – replaced by the electronic calculator – and the Company focused on other product development. Metrication aids in many forms brought great activity for several years from 1971; and a range of lightweight drawing stands, parallel motion units and boards were developed and became a major feature. Another fast growing area was that of navigation instruments for offshore sailing, and the Company developed – and continues to manufacture – a full range of plotters and instruments for this purpose.

Still another product range for Blundell Harling is Dalton type aeronautical navigation plotters for general aviation.

In 1989 a new range of office and computer furniture was introduced and is now sold under the Magpie trademark.

Today, Blundell Harling makes a wide range of standard equipment and accessories for drawing office and graphics artists. Many special products (including calculators), are supplied on contract or to industrial customers, and a range of plotters and other specialist items is made for the Armed Forces. A significant proportion of the Company's production is in the advertising/business gift market; also, small batches of Humidity slide rules, using the Super Duplex construction, are still being made as the year 2000 approaches.

Manufacturing Processes Over the Years

Bakelite Slide Rules

Manufacturing processes can be summarised in the following way:

- Bakelite was ground to specified thickness
- Sprayed with Sterns white enamel
- Baked at low temperature, repeated twice
- Wet and dry sanded to remove high spots
- Blind blocked with heated dies
- Wet and dry sanded again to remove displaced enamel set up by blocking
- Hand filled, using paint supplied by Croda of Dunstable

[1] i.e., purveyors of cloth, clothing, etc.

- Machining operations undertaken on a high-speed routing machine running at 24000 rpm
- Further light buffing and polishing; slide tension created by a center cut to weaken back

A spring tension device to adjust friction on the slide was designed and patented

Cursor Construction

The frame, made from plated brass, was subcontracted out with a glass cursor ground to size. The glass was coated with acid resisting paint and two lines scribed on the paint using a scribing block and acid etched. The paint was then removed and the lines filled with paste.

The rules were then inspected and boxed. During inspection, 40% of the completed slide rules were rejected, mostly due to inaccuracy.

First Series PVC Slide Rules

Due to the high wastage in bakelite slide rule production, an alternative material was sought. The wastage was due mainly to uneven stability of body and slide, caused by their different thickness.

White Poly Vinyl Chloride (PVC) was chosen as a replacement for bakelite. The first PVC used, called GEON, was obtained in the USA. Many manufacturing steps were eliminated. Because the PVC was softer than bakelite, less heat was required in the embossing die. The dies were deep-etched brass or copper plate.

The bodies were machined from solid PVC to an oversize form. After blocking and filling further machining completed the slide rule profile.

Geon was expensive, so Astralon from Germany was substituted, although it did not machine as well as Geon.

A slotted head was added to the spring.

For a short period, white perspex (acrylic) was used for 611 rules in addition to Astralon.

Astralon slide rules brought the introduction of a new cursor. A perspex plate was riveted to two metal runners. Lines were scribed on the perspex and filled, then frames were brought in.

In 1956, the Company moved from Luton to Weymouth on the South Coast of England.

Experiments in pressure moulding were tried. Engravings would be flush with material surface without raised edges. Astralon did not pressure mould well, and since Astralon was becoming difficult to obtain in sufficient quantity, Cobex PVC made by BX Plastics in England was tried. Cobex was more suitable and was adopted for the new process.

The Omega Range

The slide rule range was redesigned for the new process and called the Omega range. Traditional solid back construction was retained.

The upper part was moulded separately from the base in sheet form, and the sheets were filled and polished.

The moulded slide rule strips were guillotined into threes. Adjacent bodies and slides were kept together right through to assembly. Location holes were punched, tongues and grooves machined and taped together. The base was roughed out, the center relieved and a glue retaining cut included. A center cut was made for the tension adjuster.

The upper parts were cemented to the base using location pins for alignment. Further machining trimmed the outside and formed a bevel. A pressure moulded bevel strip was cemented on together with an insert in the well.

The slide rule thumb cut and trig windows were included. The spring holes were drilled and springs inserted.

A cursor slot was cut and bevel trimmed.

A new injection moulded cursor was designed using acrylic material. This was flat with the lines scribed on and hand filled.

Later, a magnifying cursor was introduced.

Janus Dual-Faced Slide Rules

By 1958, imported slide rules included dual-faced types. To compete with these trials were undertaken with a dual-faced rule.

Early production rules were made from solid Astralon material, pressure moulded down to stops to achieve a constant thickness.

After moulding, the blanks were hand filled, sawn to singles, and machine fitted.

The sheet material varied in thickness, thus high pressure was needed to prevent thickness tapering from one end of the rule to the other. The slide had an outward facing tongue. Unfortunately, despite the high pressure used the process frequently failed to eliminate the natural thickness taper in the material, resulting in high wastage.

Due to the waste of this process, it was changed to a three-part laminated construction in Cobex. The faces, in pairs, were pressure moulded, filled and polished. Kept together, the faces were machine-trimmed oversize.

The core, from thicker material, was machine flattened to a precise thickness.

The three pieces of material, after coating with cement, were placed into a vacuum jig and the cement allowed to set.

The engraving included a small dot at one end and parallel lines at the other end to enable exactly-positioned holes to be drilled.

The rule was sawn into three components, and placed on a machining jig using a location hole.

Tongues and grooves were cut with the tongue reversed out of the body.

The three components were precisely positioned to each other and taped together. The assembly was placed into a jig for the end piece drilling. The top hole was left larger to enable adjustment.

The slide rule was assembled using four chrome-plated end plates. Stability was maintained by the tightness of the screws. Chrome-plated brass cursor rails

were supplied by a local company, Patrick Engineering. The rails were assembled onto injection-moulded acrylic plates. The lines were scribed on and hand filled. The plate holes were oval to allow for adjustment. A spring screw was attached.

A hinged, lidded box was supplied with a wood frame. It was covered with black paper and fastened with brass clips.

A lightweight version was also produced without the core (T51).

The Academy 300 Series

By 1958 students were using slide rules and lightweight, low-cost models were being introduced into the market by Continental manufacturers. The Academy slide rules were introduced to compete in this market.

The 300 range was process-engraved (pressure moulded) using Darvic PVC sheet. Three separate strips were engraved and filled, using filling paste supplied by Croda of Luton. The strips were punched to provide locating holes and machined on a vertical mill. The three strips were kept together at all times.

After lining up, the components were taped together, and end pieces cemented on the reverse side. Finally, the ends were parted off by a milling cutter, then cleaned and polished.

Early end pieces were prefabricated from sheet material, but later were injection mouldings. The cursors were Diakon material of flat section with a scribed line.

Packaging initially was a paper-covered, slide-lidded box with red printing. Later this was changed to a PVC case.

The Academy 800 Series

This was an improved version of the 300 series. The changes were the introduction of new end pieces with extensions keeping the cursor captive. A moulded, slide-lidded box was introduced and a magnifying cursor. The material remained Darvic.

To economise in the production process, the rules were engraved in sheet form, six up. They were filled all black only.

After filling and cleaning, the sheets were cut into strips and kept in sets of three. Locating holes were punched and then the strips were machined. The strips were lined up, taped, and captive end pieces were cemented on.

The rules were then parted off and polished. A convex cursor was then fitted.

After a period of time, a more mechanised new production process was evolved. The slide rules would be foil-blocked and two-color printing reintroduced. The material would be ABS.

New machines were built. These were specially designed foil-blocking presses, and a guillotining and punching machine to produce the strips. Two special-purpose automatic slide rule machines were built to machine the tongues and grooves (called SPASMS). A twin-bladed saw parted off the ends.

One SPASM made the tongued slide and the other the two body parts.

The three strips were taped together and end pieces glued on. The holes were used for blocking location. The slide was removed and side pieces and slide blocked together using one or two colors. When two colors were required, two blocking presses were used simultaneously. The slide was replaced and both ends parted off simultaneously. A foil-blocked cursor was fitted.

The 900 Series Duplex

The 900 slide rules were foil-blocked and manufactured on the SPASM system. Being double sided, they were passed four times through the foil blocking system.

The manufacturing process was similar to the 800 series. The printing jigs were adjusted in position to ensure the lining-up of back to front.

The packaging was a blow-moulded box or PVC case.

The cursor was made from two single cursors, interlocked back to back.

The 500 Series Duplex

The 500 series Duplex slide rules were made from Darvic PVC sheet. The sheets were process-engraved two up (i.e., four faces). The markings were hand-filled black, red, and green as required. The sheets were buffed and polished.

The slide rules were cut into pairs of front and reverse, and machine-flattened to make a uniform thickness. Two opposites were trimmed and one end trimmed. The slides were separated and locating holes punched. The opposite sides were cemented together in a vacuum jig. After separating by saw, the tongues and grooves were machined on a router. The components were lined up with tape and injection-moulded end pieces cemented on. The slide rules were given a final buffing and polishing.

End holes were drilled and rubber feet inserted. An injection-moulded adjustable cursor was fitted. The reading lines were put on by a special cursor press, and hand filled. Transparent yellow bands were sprayed on over the principal scales.

Packaging was a soft-lined, welded PVC case in one piece. It was fastened with press buttons. A green-printed cardboard outer box was provided.

The 500 Series Super Duplex

These slide rules were made from white acrylic in a solid component.

The acrylic sheet was sawn to one-up blanks, oversize.

Both sides were process-engraved at the same time. The rule was hand-filled black.

Locating holes were drilled, and components sawn to singles. Tongues and grooves were machined on a router. The individual components were lined up with tape. Darvic PVC strip bridges were cemented on and riveted.

The slide rules were buffed and polished and refilled as necessary. Red reciprocal figures were then blocked on,

using drilled holes for alignment. The slide rules were parted off. Rubber feet were assembled into end caps, opposite sides put together and cemented to the slide rule over the Darvic bridges. The cursor was injection-moulded in four components, two side pieces and two plates.

The side piece, opposite the spring, was glued to one plate and placed onto the rule and lined up. After setting, the second plate was cemented on and lined up. Then, the top piece was cemented into position. Finally, the spring was slid into place.

Packaging was a welded, soft-lined PVC case with press button lid. Included in the presentation box was the Blundell Harling publication "The Slide Rule in Everyday Use".

W.H. Harling Slide Rules

The Company was founded in 1848. W.H. Harling was an instrument maker, apprenticed to W. F. Stanley, who decided to manufacture drawing instruments independently. Harling instruments soon built up a reputation for high quality, and today are much valued by collectors.

Harling instruments were exhibited in 1851 at the Great Exhibition, an exhibition intended to be a celebration of British Engineering achievement.

Like most manufacturers of the period, total self-sufficiency was normal, and so a wood department was created to make instrument cases. The Company even made its own sandpaper.

The wood department was soon making other products, including scale rule blanks, and later, complete slide rules.

Only the finest quality wood was used, including mahogany for tee squares and slide rules, and boxwood for scale rules and parallel rules. Walnut was used for the instrument cases.

Wood was purchased in log form and kept for a minimum of two years, after splitting, before being used in manufacturing.

W.H. Harling frequently made their products for other companies, such as Stanley and Halden, and also trained apprentices.

Once such apprentice was A.G. Thornton, who later began making his own slide rules. An interesting note in the journal of the time concerns Thornton's arrival back in the factory, one Saturday after lunch, showing signs of having consumed too much beer. He was fined 6d ($0.12 US) and sent home.

It has not been possible to date the exact start of slide rule production, but it was in the 19th century, as there are 20" slides in existence bearing the 47 Finsbury Pavement address, which was vacated in 1899.

Slide rule production ceased in about 1938, but resumed intermittently during the war period. The last slide rule was made in 1947.

Manufacturing Process of W.H. Harling Slide Rules

Mahogany wood for the body was cut and stacked with separating strips to stand for two years to dry and stabilise.

The wood body was made in three parts. The base and one side were solid. The slide and second side were machined separately all on a spindle moulder.

The second side of the body was held down, on 20" slide rules, by brass screws which engaged into a threaded insert.

One end of the body, the second side and slide were stamped with the same number to ensure they remained together.

White cellulose acetate strips were cemented on using a fish glue, and dried out under pressure applied with a stone weight.

When drying was complete the slide rule was machine-trimmed.

Dividing and figuring were all applied by hand using an inscribed brass master.

The blank rule was clamped to the master and a special set-square used to transfer the logarithmic scales. The set-square had a tooth that engaged into each incision on the master, progressively. Lines on the slide rule were scribed by hand using a scribing knife against the set-square edge.

Figuring and lettering were applied by hand using cold punches. The craftsmen worked with great speed.

Gauge lines were scribed using a marking gauge.

Filling paste was a mixture of charcoal powder and step white powder mixed with linseed oil. This mixture was applied with a fabric pad. After drying for half an hour the surplus was wiped off with sawdust.

Finally, the surface was completed by hand polishing using white shellac. The slide tongues were coated with French polish to give good movement.

Cursors were built up from cellulose acetate, and a reading line was scribed on.

The 20" slide rules were housed in a wood box made by W.H. Harling.

The standard slide rule was 20" but 10" rules were also made to special order.

Special Design Slide Rules Slide Charts & Disk Calculators

The presentation of a gift as an incentive to buy has been an activity of manufacturing and service companies since the nineteenth century. The potential of Blundell Slide Rules was quickly seen and they were being purchased for this purpose from the earliest days. Even the first

pocket slide rule, the P8, was sold with a client name printed on the reverse.

Soon the standard constructions and manufacturing process were being adapted to make special designs to order. An early user of the developing techniques was the Ministry of Defence who designed graphical plotters for Gunnery, Naval, and Air Navigation use. In the 1960s and 1970s manufacture of military designs was an important activity.

In the 1980s increasing use of electronics brought about the decline of this market, but industrial and commercial users have commissioned Blundell Rules and Blundell Harling to design and make specials, and they continue to do so.

Many specials were designed to fit the standard constructions and can be found in all types.

A need for a simpler and less expensive construction resulted in development of the Plastograph. This was made from pressure-moulded Cobex and Darvic sheet, and built up by laminating the sheets using adhesives. The edges were machine-finished.

In 1960, screen printing was introduced as an alternative and cheaper printing process when engraving was too expensive. Gradually, screen printing took over, and by 1990 it was the predominant process.

The Plastograph gave way to the Foldograph, whereby the outer envelope is heat-folded from a one-piece transparent PVC sheet. The slide remains the same, although now all screen printed.

The screen printing process is now so precise that accurate circular slide rules and scale rules can be made to international standards. An international award was given to the company by the European Federation of Screen Printing Associations (FESPA).

Many circular specials have also been made.

When Blundell Rules moved to Weymouth in 1956, a numbering system was adopted starting with P1000 and numerically progressing. P6000 was passed in 1997, and it is intended this system will continue indefinitely.

As the year 2000 approaches, special slide charts and disc calculators continue to be designed and made, but now drawn on CAD systems. Most are data presenters, but logarithmic types are also made.

A record of all types is kept by Blundell Harling, but is not published, as some of the material is confidential to companies who commissioned the designs.

Standard designs have always been produced with well known brand names. Slide rules were made in large quantities for the retail company W.H. Smith in England, among others.

Acknowledgements

Blundell Harling was founded by Alison Blundell (1896-1990). He was a Director of Blundell Bros of Luton and began experiments in slide rule manufacture using the facilities already there. He was assisted by Fritz Hamelberger who had left Germany in the 1930s. Fritz Hamelberger had worked with a German slide rule manufacturer.

Alison Blundell was Managing Director from 1948 to 1951, and Chairman from 1951 to 1973. His son Terence Blundell joined Blundell Harling in 1965, after training as an accountant. Terence Blundell was Joint Managing Director with John Young from 1973 to 1991. He is now the Chairman of the company.

Peter Stevens was originally a Director of W.H. Harling. He was a Director of Blundell Harling from 1964 until he retired in 1989.

Vic Best joined as a trainee at Blundell Bros in 1938. After war service in flying boats he rejoined Blundell Bros in 1946. He retired as Works Manager in 1988. During his tenure he was involved in the manufacture of all slide rule types.

David Rawlings joined Blundell Rules in 1955 as a trainee. He retired as Production Director in 1996. Modernisation of the manufacturing processes was carried out by him.

Barry Camp came as a trainee in 1957. He has been working on all slide rule production since then, and today is Manager of plastic component production.

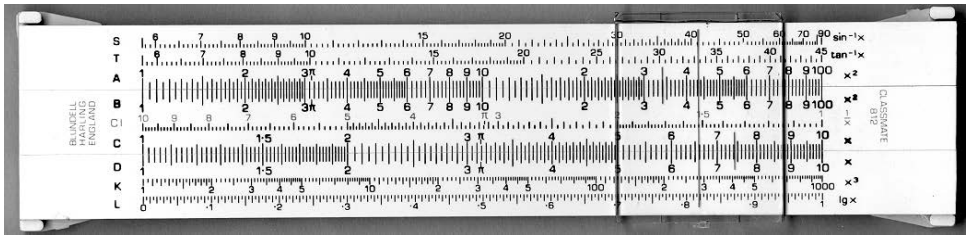
John Denman joined W.H. Harling as a trainee in 1947 and retired in 1997. He saw the last Harling slide rule made in 1947.

Peter Soole was an engineering apprentice at the De Havilland Aircraft Company during 1955-1960. He joined Blundell Rules in 1960 and has designed many of the special-purpose slide rules made by the company. He was encouraged to write this article by Ijzebrand Schuitema, who is the European representative of the Oughtred Society.

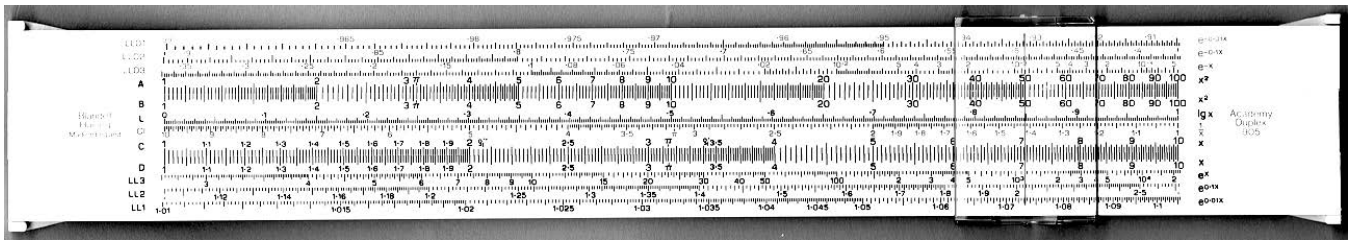
The text was typed by Lindsey Hubbard at Blundell Harling Limited.

Thanks to them all for their time, so freely given.

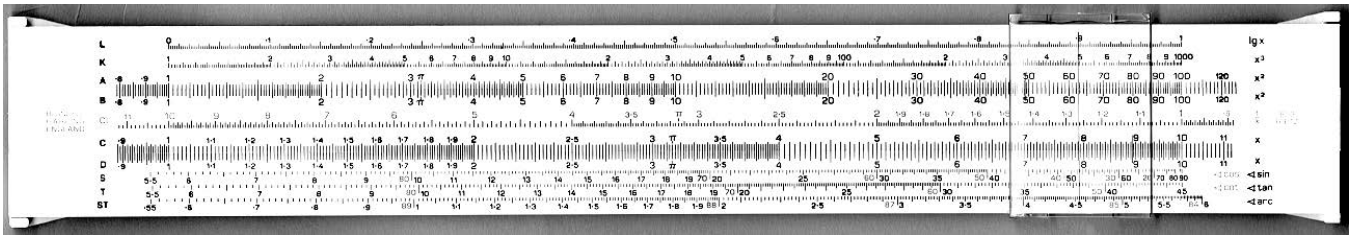
Some Examples of Blundell–Harling Rules



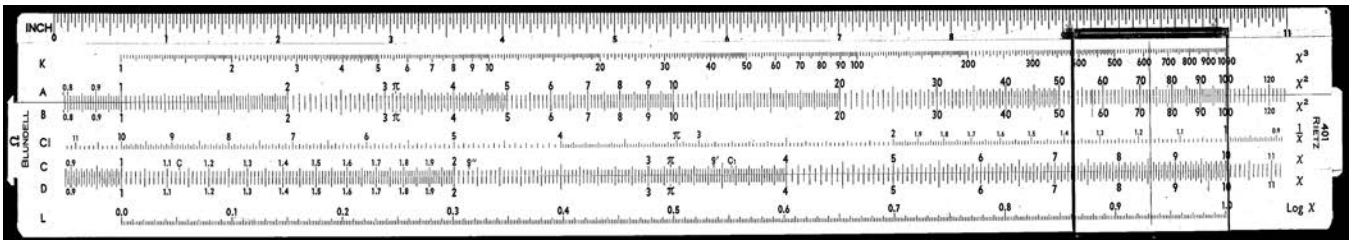
The Classmate 812



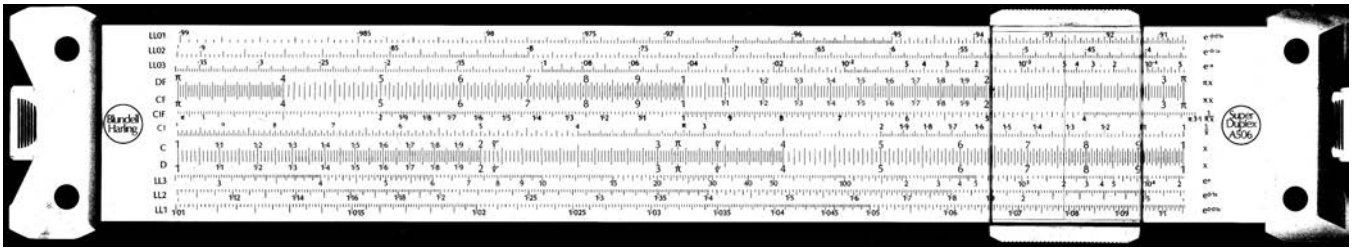
The Academy Duplex 905



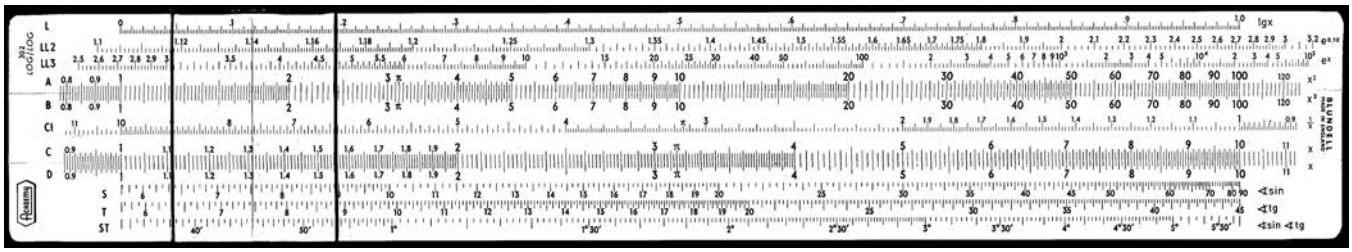
The Reitz



The Ω Reitz



The Super Duplex 809



The Academy 302 LOG/LOG