

W&G: An Australian Slide Rule Manufacturer

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Introduction

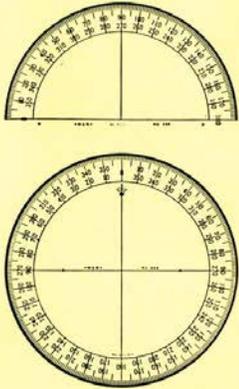
The trade mark >W&G< is well known to Australian collectors of slide rules and scale rules. It appears on an extensive range of high quality products manufactured in Melbourne, Australia, from the 1940s to the 1980s. This article outlines the history of W&G and, in particular, lists their relatively small range of slide rules and describes how they were manufactured.

Most of the historical information was obtained by the author from discussions with Alan Abbott (Export Sales Manager of W&G Precision Instruments in the 1970s), Ron Gillespie (son of W&G founder partner J.D. Gillespie, who has been actively involved in W&G for over fifty years and is now with White & Gillespie (Melbourne) Pty. Ltd.), and John Lawton (Managing Director, W&G Education Pty. Ltd., who followed his father as owner-manager of W&G Precision Instruments in 1984). Some of this information has previously appeared in [1].

ACCURATELY >W & G< ENGRAVED

TRANSPARENT PROTRACTORS

Highest Quality Protractors. Warranted Accurately and Fully Engraved.



<p>BEVELLED, SEMI-CIRCULAR</p> <p>Model 334B — 4" Divided to Degrees ...</p> <p>335B — 5" Divided to Half Degrees</p> <p>336B — 6" Divided to Half Degrees</p> <p>338B — 8" Divided to Half Degrees</p> <p>BEVELLED, CIRCULAR</p> <p>443B — 3" Divided to Degrees ...</p> <p>444B — 4" Divided to Degrees ...</p> <p>445B — 5" Divided to Half Degrees</p> <p>446B — 6" Divided to Half Degrees</p> <p>448B — 8" Divided to Half Degrees</p> <p>449B — 9" Divided to Half Degrees</p> <p>4412B — 12" Divided to Half Degrees</p>	
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ACCURATELY >W & G< ENGRAVED

SET SQUARES

Accurately machined from heavy-duty tinted acrylic, these set squares are .060 thick and will retain their flatness.

All edges are machined with facilities for inking.



MODEL WG 45/6	— 6 in. x 45°
WG 45/8	— 8 in. x 45°
WG 45/12	— 12 in. x 45°
WG 30/60/8	— 8 in. x 60°
WG 30/60/10	— 10 in. x 60°
WG 30/60/12	— 12 in. x 60°

>W & G<

COMPREHENSIVE CIRCULAR SLIDE RULE

(WITH CALCUCHECK SCALES)

Model 707

This COMPREHENSIVE CIRCULAR SLIDE RULE marks a new concept in circular slide rule design and manufacture embodying the following features:—

Scale layout is such that a comprehensive array of scales are all readily related to each other either by direct reading or by means of the cursor line.

The top disc is engraved on the underside thus eliminating parallax between it and the white base disc. It also permits an average scale length of almost twice that found on a twelve inch straight slide rule thus greatly enhancing the accuracy of calculations.

All graduations and figures are uniformly ENGRAVED and filled with special enamels.

Diameter 7"—with Vinyl Case and Instruction Book.

SCALES ON THE RULE A, B, C, D, CI, L, K, LI, & LL2, S, T, & ST, VD, ME, DE and CALCUCHECK

"ADGUAGE"

an invaluable aid for

Layouts and Printing, Composing and Proof Checking, Commercial Art, General Printing, Process Engraving, Commercial Photography, etc.

CROSS SECTION PLOTTER

For plotting sections taken with vertical angles and slope distances for Roads, Railways, Channels, Transmission Lines, etc., in easy or rough country; also for setting out and measuring angles.

PROTRACTOR RECTANGULAR

(6" in mils)

The standard map reading protractors

MARK IV PROTRACTOR

(6" in degrees)

SLIDE RULE MANUAL

by B. A. SIMM

A Text Book for use with standard types of Slide Rules.

SQUARE SQUARE

FOR GRAPHIC ARTS USE

An accurately engraved grid for checking Copy, Printed Sheet, Layouts, etc.

3 sizes, 30" x 20", 15" x 20", 15" x 10"

HOWSE NAVIGATIONAL COMPUTER

Designed by Australian Pilot, Capt. H. Howse, for use by Commercial Airlines. Used by most Flying Schools.

OPTICAL P.D. SCALE

A 5" scale specially designed for use by Opticians and Optical Companies.

DOUGLAS PROTRACTOR 5" and 10"

Combined Protractor and Parallel Rule. The standard navigation aid. (with instructions)

W & G WOOL MEASUREMENT SCALE

A specially developed 6" scale for use by Wool Classers. Invaluable for Teaching. Gives Crimp Quality and Staple Length.

PROPORTION CALCULATOR

The PROPORTION CALCULATOR is a circular instrument constructed in three parts of long-wearing high-quality vinyl. Its function is to give the user accurate proportions in either enlargement or reduction.

FIGURE 1.

Part of a W&G catalogue [2], circa 1970, which lists two circular slide rules, Model 707 and a Proportion Calculator.

An Outline History of W&G

White and Gillespie Pty. Ltd. was established in 1910 by A.E. White and J.D. Gillespie. Both men had been stereotypers with the Signs Publishing Co., Warburton, Victoria, making printing blocks. When linotype machines replaced this process, Signs Publishing offered to support them if they set up their own business to make electrotype plates, used for the longer runs of printing.

The two men established White and Gillespie in Patrick Street, Melbourne. Work for the printing industry built up and the business moved to larger premises on Latrobe Street, then in 1938 to new premises on a Beckett Street. In the same year White and Gillespie began making records because electrotype manufacturing, which involved plating copper and nickel onto vinyl or wax type moulds, used a number of the same processes as record manufacturing. Initially the business made small batches of large sized radio transcription records, used to distribute pre-recorded programs to radio stations. A wholly owned subsidiary, W&G Record Processing Company Pty. Ltd., was established to handle this activity.

When World War 2 began in 1939, the Australian Government set up a register of industrial skills. W&G was one of the firms asked to make some specialist instruments for the armed forces, although printing plate manufacturing remained the core business. The instruments were mainly navigational aids and range finding devices and by the end of the war

W&G had produced about a quarter of a million items. Ron Gillespie remembers that products included a large 24 inch brass slide rule for performing calculations for 25 pound guns (the author knows of no examples), a "sun compass" for use in the Western desert (a form of sun dial, known by an incomplete example¹, probably intended for tank crews, since magnetic compasses were useless in a tank, although it is not clear whether this instrument ever went into service), map measuring scales and protractors, and some special purpose slide rules, described later in this article.

The wartime production of defence material was lucrative for W&G. Because of space restrictions and because some of the company's industrial processes used chemicals and materials deemed potentially hazardous for an inner city location, W&G moved to 17-18 Radford Road, Reservoir in 1945, shortly after the end of the war. The W&G Record Processing Co. continued to make scale rules, slide rules, protractors, and similar items and expanded its range.

After the war, large transcription records were replaced by wire and tape recordings, so W&G Record Processing moved into commercial vinyl records and microgrooves, the first company in Australia to do so. American records were manufactured under licence and local artists were recorded in the company's own studios. This part of the business was sold in 1977 when cassette recorders had seriously affected the demand for vinyl records.

By the 1970s W&G's instrument product range included W&G slide rules (described separately), drafting machine



FIGURE 2.

Two versions of the W&G Proportion Calculator, a very basic slide rule for the printing trade (left: 1938-45, right: probably 1970s).

scales (plastic on a wood core and clear acrylic), hand and pocket scale rules (plastic over wood cores, and solid plastic), protractors (semi-circular and circular from 100 mm to 300 mm diameter), dress-making products (graduated set squares, rules and curves), graphic art products (printers scales, type gauges, hand scales), transparent gridded squares, and circular calculators for reducing and enlarging (Figure 2), reflecting the original business connections with the printing trade. Other products included stainless steel straight edges and rules, squares, adjustable squares, brass rolling parallel rules, drafting and mapping symbol templates, an Optician's Optical P.D. scale, and a few special items such as a protractor for the NSW Lands Dept., and a Mk 4 Rectangular Protractor for the army.

In 1977 the instrument manufacturing section was sold to Peter Lawton, a Melbourne businessman. The new company operated as W&G Precision Instruments Pty. Ltd., and was located at 17 Radford Road, Reservoir, Victoria. Exports were handled by W&G Distributing Co. Pty. Ltd. at the same address. The trade mark continued to be >W&G<. Products were mostly sold in Australia, but were also exported, mainly to America and Canada.

Slide rule manufacture came to an end in the late 1970s when affordable electronic calculators had become readily available in Australia and rapidly replaced slide rules. Drawing instrument manufacture continued but became less profitable because the manufacturing methods employed by W&G could not compete with imports and the increasing use by industry of Computer Aided Drafting (CAD) reduced demand for drafting scales.

In 1984 John Lawton took over management of W&G Precision Instruments from his father. He closed the factory in Reservoir and established a new business, W&G Australia Pty. Ltd., in Berwick, Victoria, with new products, different equipment, and different manufacturing processes. This business continues as W&G Education and in 2007 moved to Springvale. Products include the Mathomat, a clear plastic combination scale, protractor, and template sheet for drawing geometric shapes and mathematical curves, widely used by Australian secondary school mathematics students, measuring items for dressmaking, and navigation scale rules and protractors for the Australian army and the aviation industry. These items are mass produced by hot foil printing and CNC machining, far different from the original W&G hand processes.

The original printing arm of the business still continues as White & Gillespie (Melbourne) Pty. Ltd., and provides pre-press services to the printing trade, including digital graphic reproduction services.

W&G Slide Rules

W&G was by far the largest of the five Australian slide rule manufacturers known to the author, the other four being C. O. Browne, Melbourne (maker of a rare long-scale cylindrical slide rule), Cal Rule Co., Sydney, (maker of several closed-

frame 10 inch linear slide rules), Ernest Mills and Sons, Sydney, (production was halted after 618 rules had been made for the Ministry of Munitions because the glues and celluloid used were considered to be a fire risk to a crowded city area)¹, and the Service Slide Rule Company, Sydney, maker of several closed-frame 10 inch (250 mm linear rules, including an Electronic Engineers Rule designed by J. G. Reed) [3].

Although W&G only made a small range of slide rules, there are problems in establishing a comprehensive list and their dates of manufacture. Some are known to the author by actual examples, photographs or reliable descriptions. But others, named in catalogues and instruction books, are either very rare or may never have gone into production and their details are unknown. For example, Figure 3 shows the back page of an instruction booklet (circa 1945) for a W&G Slide Rule Model 454 which names another five slide rules, of which the details of two, the Graphical Firing Table Slide Rule and the Pilot Balloon Slide Rule, are unknown to the author.

Included among the Precision Instruments now
being manufactured by

> W & G <

are

MODEL 421 SLIDE RULES
" 432 DUALFACE COMPREHENSIVE
SLIDE RULES
" 443 ARTILLERY SLIDE RULES
GRAPHICAL FIRING TABLE SLIDE RULES
PILOT BALLOON SLIDE RULES

A full range of
CIRCULAR AND SEMI-CIRCULAR CELLULOID
PROTRACTORS
DRAFTING MACHINE SCALES
NAVIGATIONAL COMPUTERS
ARTILLERY FIRE CONTROL INSTRUMENTS
MILITARY PROTRACTORS
Douglas, Mark I, Mark III Special, Mark IV,
Fan Protractors, etc.

> W & G <

RECORD PROCESSING CO. PTY. LTD.
Subsidiary of White & Gillespie (Melb.) Pty. " &

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*Obtainable at all Stationers and
Drawing Instrument Suppliers*

Distributing Agents
PONSFORD, NEWMAN & BENSON PTY. LTD.
ALL STATES

•

Where Accuracy is Desired

> W & G <
Instruments are Required

FIGURE 3.
A list of W&G instruments from a slide rule manual,
circa 1945.

Most of W&G's known slide rules are of similar dual-face, open-frame construction, and vary only in their scale layouts. Other known slide rules include one closed-frame model (421) and two circular slide rules, a small and very basic Proportion Calculator for the printing trade (Figure 2) and a 7 inch Model 707 which Ron Gillespie remembers was made in small numbers in the late 1960s.

The Dualface Slide Rule Model 432 was W&G's major selling rule in Australia and is typical of the company's linear range. As shown in Figure 4, the two outer sections of the body are joined by plated metal connectors, the scales are of plastic bonded to wood, and the cursor is of glass in a metal frame. The cursor with a fine-adjustment thumb-wheel shown on the lower rule in Figure 4 was an option for 432 rules and probably for some other models.

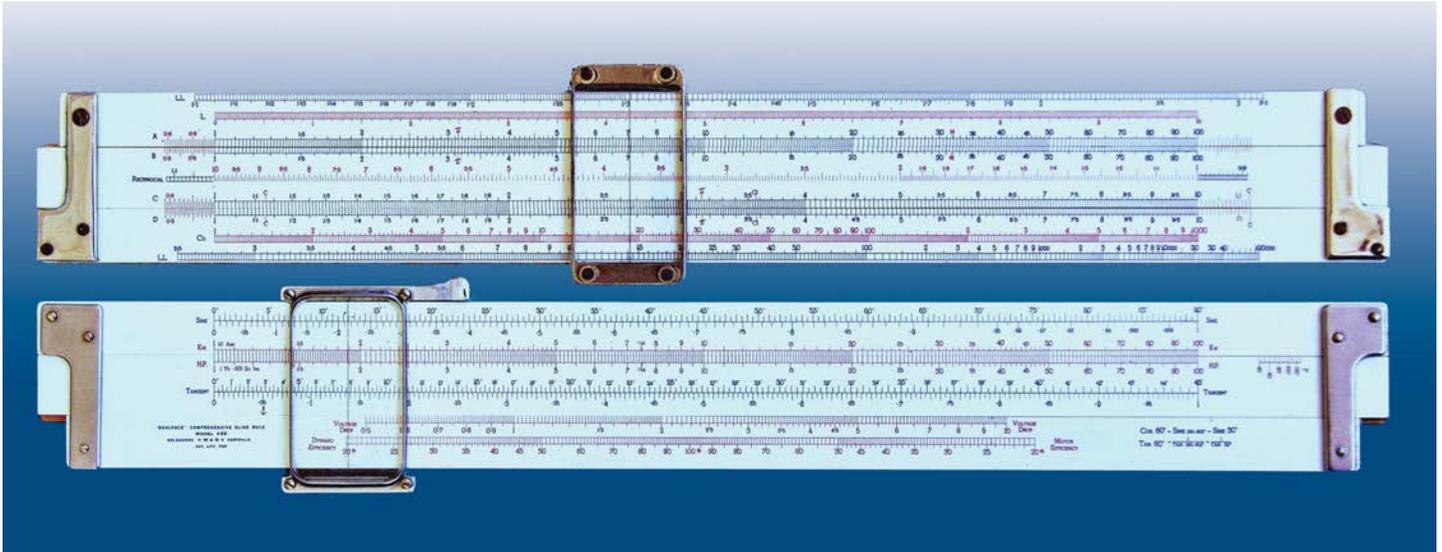


FIGURE 4.
W&G Model 432 Slide Rule, showing plain and thumbwheel cursors.

Dates of manufacture of W&G slide rules are hard to establish. Most seem to have been introduced during or shortly after World War 2. Models 432 and 476, the two most common types found in Australia, were made into the 1970s.

Models 432, 443 and 454, and presumably other models, came with instruction booklets, typically of about twelve pages. These booklets recommend a sixty page *Slide Rule Manual* by B. A. Simm [4] for more comprehensive instructions. Simm's book is undated but contains an advertisement for W&G with an address that predates their 1945 relocation. The contents of the instruction booklets are mostly extracts from Simm's manual, so presumably Simm prepared them for W&G.

A List of W&G Slide Rules

The following are known to the author from examples in Australian collections or photographs on the internet [4]. The scale names are as they appear on the rules:

- Model 421: Closed Frame, 10 inch linear. Scales: L, A [B, Reciprocal, C] D, Cube & Cube Root. Back of slide: [Sin, Sin & Tan, Tan].
- Model 432 Comprehensive: Open frame, 10 inch linear. (See Figure 4)
Side 1: LL, L, A [B, Reciprocal, C] D, Cu, LL
Side 2: Sine, KW [HP, Tangent] Voltage Drop, Dynamo Efficiency- Motor Efficiency.
- Model 443 Artillery: Open frame, 10 inch linear. The scales are the same as for Model 454, except that a pictured example, if correctly identified, is marked on the Upper scale of Face 2: V.F.A. 3400 D↑D Rule, Slide, Artillery Aust. Mk. 1 / >W&G< 1945, so presumably was made for the Australian Army.
Side 1: L, A [B, Reciprocal, C] D, Cu
Side 2: Sine [Angle 2 (Sin), Angle 1 (Sin & Tan)] Range, Tan
- Model 454 Artillery and Survey: Open frame, 10 inch linear
Side 1: l, A [B, Reciprocal, C] D, Cu
Side 2: Sine [Angle 2 (Sin), Angle 1 (Sin & Tan)] Range, Tan
- Model 465 Shipping Freight and General Purpose: Open frame, 10 inch linear.
Side 1: l, A [B, Reciprocal L, C] D, Cu
Side 2: Pounds-Shillings (left) & Shillings-Pence (right), T [R, P, D2, D3] D1, CC

- Model 476 Trigonometrical: Open frame, 10 inch linear.
Side 1: LL, L, A [B, SIN, C] D, Cu, LL
Side 2: V, H-V-H, Exsec-Versine & Arc-Chord, A [B, Reciprocal, C] D, Tan (&Cot) (30'-6° & 5°-45°)
- Proportion Calculator (for resizing areas for the printing trade): 4.3 inch round white plastic. A single 3.4 inch diameter logarithmic scale with two transparent plastic movable cursors marked Width and Depth, which can be rotated individually or together. (see Figure 2)

The following slide rules are named in W&G publications or [6], but are not known to the author by example or photograph:

- Model 707 Comprehensive Circular: 7 inch diameter round circular. Model 707 is described in [2] (see Figure 1) and claimed by Ron Gillespie to have been made in small numbers.
White base disc, transparent top disc engraved on the underside to eliminate parallax, single cursor.
Scales: A, B, C, D, C1, L, K, LL1, LL2, S, T, ST, VD, ME, DE and CalcucHECK.
- Graphical Firing Table Slide rule (listed in instruction booklets for Models 443 and 454).
- Pilot Balloon Slide Rule (listed in instruction booklets for Models 443 and 454).
- Mixing Ration Calculator (listed as a possible in [6]).
- Meteorological Bureau Circular Slide Rule (listed as a possible in [6]).
- Radiosonde Temperature Evaluator Slide Rule (listed as a possible in [6]).

W&G Slide Rule Manufacturing Methods

According to Ron Gillespie and Alan Abbott, slide rule manufacture took the following form. Plastic strips were placed on both faces of rectangular-section wooden strips and the assemblies were put into a heated press that impressed the scales, numbers, etc. and bonded the plastic strips to the wood (some early models also had pins and screws at the ends of the scales to keep the plastic strips in place). The strips were cooled in the press before release. The scale markings were hand-filled with Dulux enamel paint (a former employee said that during the war Kiwi boot polish was also used¹), and the excess paint was removed by wiping. The edges were then machined to be smooth and straight and to form tongues on the slides and grooves on the body pieces. Before final assembly the components were lightly buffed on a cloth wheel charged with a fine abrasive compound.

Initially the plastic strips were celluloid. Mid 1940s instructions, which accompanied Slide Rule Models 432 and 454 refer to the plastic as Xylonite, the product name for cellulose acetate used by the British Xylonite Co, the presumed supplier of W&G's celluloid. After the war W&G realized that putting highly inflammable celluloid into a hot press was very risky, particularly after the bulk celluloid store

caught on fire. Also the celluloid tended to discolour with age. Consequently the plastic strips were changed to extruded polyvinyl chloride and then, circa 1960, to acrylonitrile butadiene styrene, extruded on the Company's own equipment.

The wooden cores were initially Silver Ash or Quondong¹, both Australian hardwoods, then Ramin, a tropical rainforest timber from Southeast Asia.

The dies for the scales were made by a photographic printing process. A wax engraving machine was used to engrave the scale markings on a plastic film negative. A copper plate was treated with resist and brought into contact with the negative, which was then exposed to light that made the resist soluble and able to be acid-etched. After the graduations were etched, the resist was washed off the copper plate. The copper plate was then electroplated with nickel and copper, producing a shell that had raised impressions of all the necessary graduations and figures. The plated shell was removed from the underlying copper plate and mounted on a steel strip to provide mechanical support against the pressures developed in a compression moulding machine.

Footnote

1. Personal communication from Cyril B. J. Catt, Fellow of the Oughtred Society.

References

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5. Mike Konshak, International Slide Rule Museum, (<http://sliderulemuseum.com/Australia>).
6. Hopp, Peter M., *Slide Rules, Their History, Models and Makers*, Astragal Press, New Jersey, 1999.

R. Bruce Sandie, now retired, was Head of Civil Engineering at Swinburne University of Technology, Melbourne, for 24 years. He collects slide rules and drawing instruments and is Chairman of a National Trust of Australia committee assessing Victoria's bridges for heritage significance.