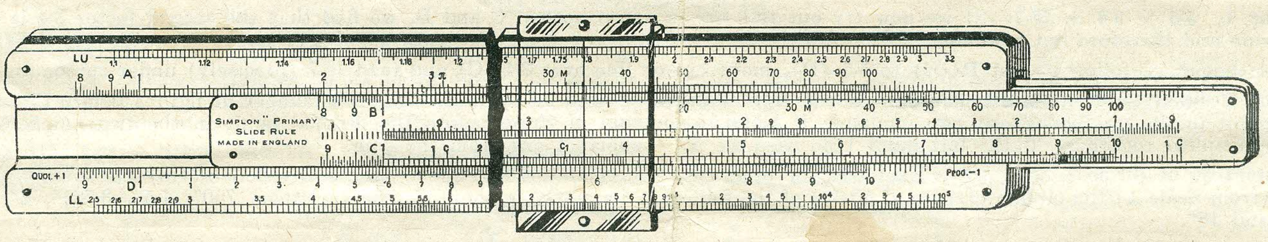
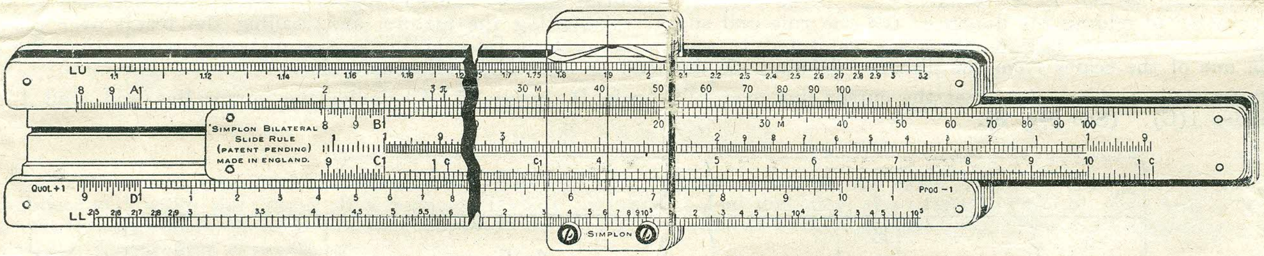
# "SIMPLON" SLIDE RULES (BRITISH MAKE).

**"Primary," "Bilateral," "Major," "Reitz," "Electro," "XL-10,"**

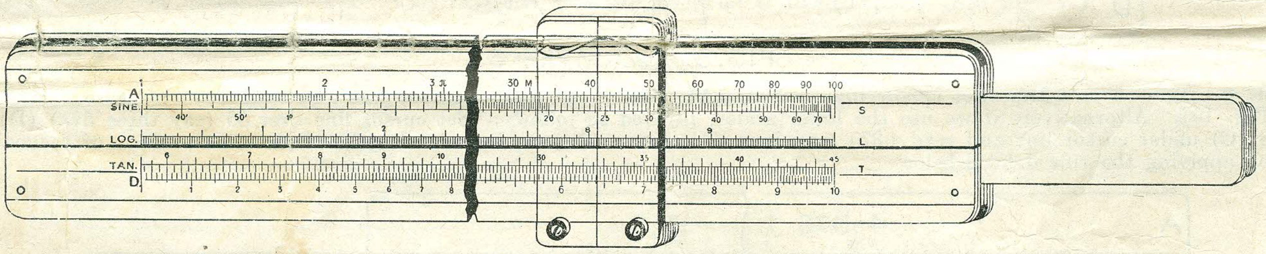
AND OTHER SIMILAR PATTERN RULES.




PRIMARY.




BILATERAL—FACE.



BILATERAL—BACK.

The Slide rule is a calculating instrument for rapidly solving arithmetical problems by mechanical means.

## INSTRUCTIONS FOR USE.

**Introduction.** The processes of multiplication and division are so quickly performed by its aid that the slide rule has now become an instrument of universal use all over the civilised world. The degree of accuracy obtainable is sufficient for most practical purposes, and the speed of operation naturally increases with its use.

These brief instructions are intended for beginners only, but the more advanced student, desirous of attaining a better knowledge of the slide rule such as will enable him to use it for higher mathematical operations, is recommended to purchase a copy of "*Slide rules and how to use them*" which may be had for 1/9 from the suppliers of this "Simplon" slide rule, or direct from the makers, Dargue Brothers Ltd., Halifax, England.

**First Principles.**

The calculating part of the rule comprises the 4 scales—A, B, C, D. These scales are logarithmic in principle and are simply tables of logarithms graphically represented (plotted out to scale). Note that scales A and B are alike and are numbered 1, 2, 3, 4, etc., up to 100 and that these scales, which are decimally divided, repeat themselves from 1 to 10 and from 10 to 100. The ciphers are sometimes omitted to lessen appearance of overcrowding.

The three several parts of the instrument will be referred to in the following instructions as:—

**The Rule** which is the main member.

**The Slide** which is the movable part sliding along the channel or groove.

**The Cursor** which is the movable portion with hair line across it.

The scales A and B are called the upper scales, and the scales C and D the lower scales, but for convenience and brevity the left hand index number 1 on each of the four scales will be described simply as 1(A), 1(B), 1(C), 1(D) respectively. In cases where the **right hand** index 1 is intended, the references will be R1(A), R1(B), R1(C) and R1(D).

Multiplication and division may be carried out on either the upper or lower scales, and though greater accuracy in results apply more to the lower scales, the upper scales should be used where great precision is not required.

## MULTIPLICATION.

Two numbers are multiplied together by adding the distances corresponding to the numbers on the rule and slide.

**Example 1 2·5 × 3 = 7·5.**—Set 1(B) under 2·5 (A), move cursor line over 3(B) and read 7·5 under cursor line on A (See Fig. 1 over page).

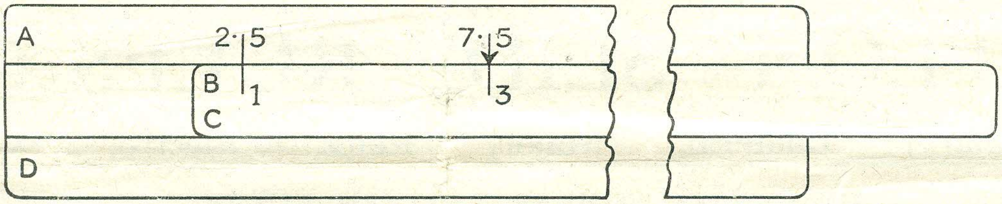



FIG. I. EXAMPLE I.

**Example 2. 5·5 × 3·4 = 18·7.**—If we now try out this on the lower scales, C and D, we find that the second factor 3·4 is off the rule and therefore not available.

Proceed though as follows:—Set R1(C) to 5·5 (D), move cursor line over 3·4 (C) and read 18·7 (precisely) under cursor line on D.

**Rule for Decimal Point in Multiplication.**—If the **right hand** 1 be used as an index line, the number of figures **before** the decimal point in the product of any two numbers is **equal** to the sum of those before the decimal point in the two numbers being multiplied together; if the **left hand** 1 be used we must subtract one from the sum.

**Circumference of Circle = $\pi$ × D.**—Exercises for practice.—Set 1(B) under $\pi$ (see special division 3·1416) on A and read off (from Scale A) the circumferences of circles of the following diameters without further settings. 750″, 1·5″, 3·785″, 4″, 12·5″, and 18″.

## DIVISION.

It will have been noticed by the Student that in the process of multiplying two numbers together, the result is obtained by a simple operation of adding the distances (on the rule and slide) representing the factors, and reading the result over the second factor, conversely, two numbers are subjected to a dividing process by subtracting the distance representing the divisor on one of the scales from the distance defining the dividend on the other adjacent scale.

**Example 6. 7·65 ÷ 4·5 = 1·7.**—Set the cursor line over 7·65, scale D, bring 4·5 (C) under the cursor line and read 1·7 on D under 1(C). **(See Fig. 8).**

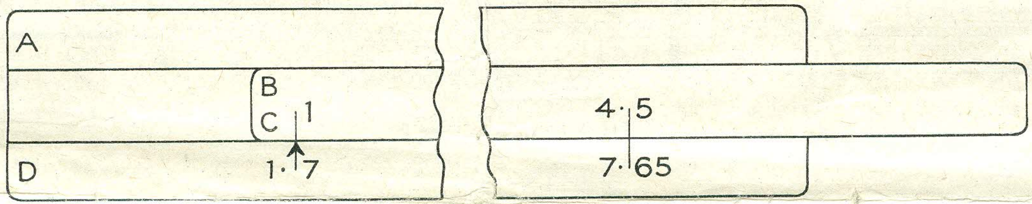



FIG. 8. EXAMPLE 6.

**Example 8. 35 ÷ 8 = 4·375.**—Set cursor line over 35 (A), slide 8 (B) under cursor line and read 4·375 on A, over 1(B) (See Fig. 10). Alternatively if we use the lower scales, proceed as follows:—Set cursor line over 35 (say three five) (D), slide 8 (C) under cursor line and read 4·375 (say four three seven five) on D under R1(C). Determine position of decimal point by applying the rule defined below.

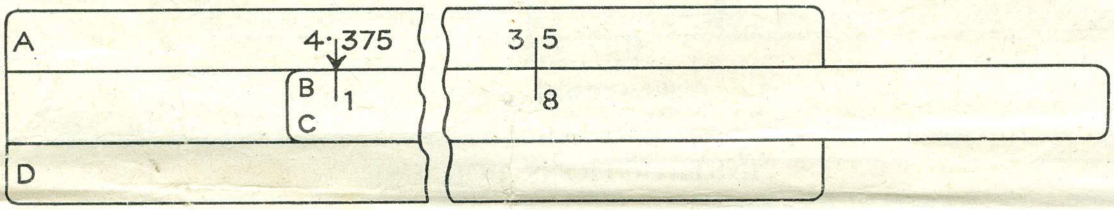



FIG. 10. EXAMPLE 8.

**Rule for position of decimal point in Division.**—If the result is read at **right hand** end of **slide,** the number of figures **before** the decimal point in the quotient is equal to the **difference** of those before the decimal point in the dividend **and** divisor; when the result is read at the **left hand** we must add **one** to the difference.

Greater accuracy will always result when C and D scales are used in multiplication and division.

## SQUARES AND SQUARE ROOTS.

If the student now takes up the rule again he will notice on further examination that the readings on Scale "A" are the squares of exactly opposite readings on Scale "D." Thus, if he slides the cursor line precisely over 9 (A) he will find that the cursor line also registers over 3 (D), the square root of 9. Further, if he again slides the cursor line over 5 (D) the line will be seen to be locating the square of 5 = 25 on A. This arises by reason of the graduations on the upper scale 1 to 10 being equal to 10 to 100, and the whole of the upper scale, 1 to 100 being equal to 1 to 10 on the lower scale. It is evident from this arrangement that twice the logarithm of any number equals the logarithm of the square of that number.

**Example 11. $4^2$ = 16.**—Place the cursor line over 4 (D) and read 16 under the cursor line Scale A. (See Fig. 14).

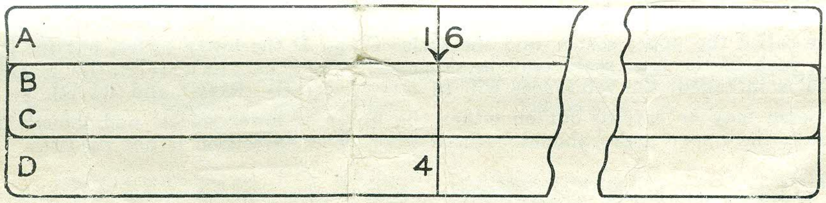



FIG. 14. EXAMPLE II.

**Example 12.** $\sqrt{64} = 8$.—Set the cursor line over 64 (A) and under the line read 8 on Scale D. (See Fig. 15).

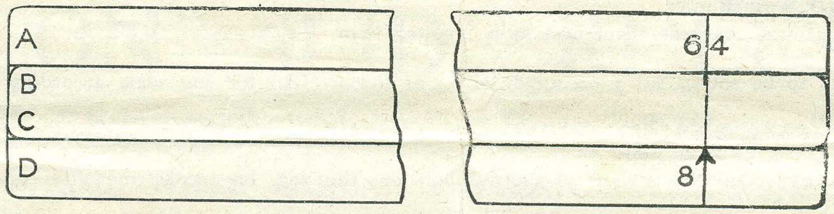



FIG. 15. EXAMPLE 12.

## CUBES AND CUBE ROOTS.

The operation of raising a number to its third power, on a slide rule not having a special direct reading cube scale is easily performed by continued multiplication, thus to raise 2 to the power of 3 ($2^3$) proceed as follows:—Set 1(C) to 2 (D), slide cursor line over 2 (B) and read 8, the cube of 2, under the line on A.

**Example 13.** $1{\cdot}5^3 = 3{\cdot}375$.—Set 1(C) to 1·5 (D), move cursor line over 1·5 (B) and read 3·375 under line on A.
Explanation.—1·5 on D is opposite or in line with its square (2·25) on A, and $2{\cdot}25 \times 1{\cdot}5 = 3{\cdot}375$ as shown on A. (See Fig. 16).

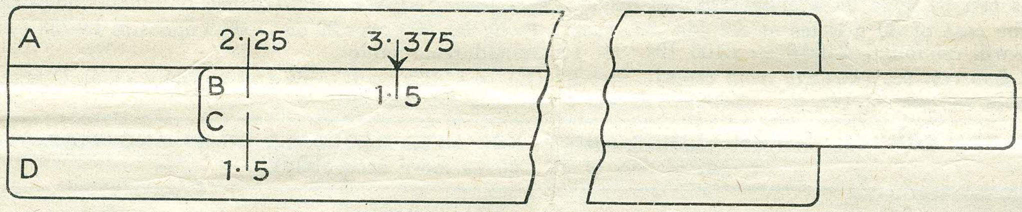



FIG. 16. EXAMPLE 13.

**Note.**—We have observed that the finding of the square root of a number presents no more difficulty than the squaring of a number, and while the cubing of a number likewise presents no real difficulty, the extracting of the cube root is not quite so easily performed. A little practice, however, will enable the student to find the cube roots of numbers with only a fraction of the difficulty first experienced.

**Example 14.** $\sqrt[3]{27} = 3$.—Move cursor line over 27 (A), draw out slide (to the right in this case) until the same number (3) comes under the cursor line on B which registers simultaneously on D under 1(C). (See Fig. 17).

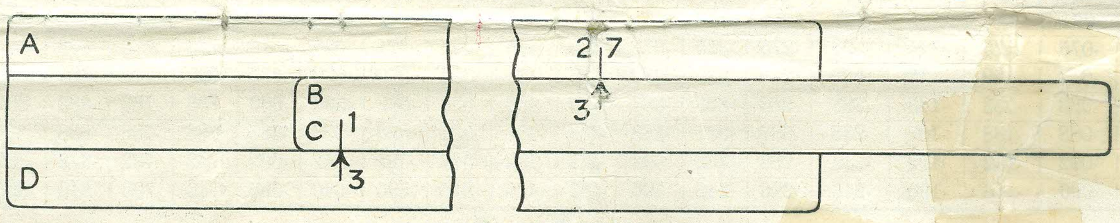



FIG. 17. EXAMPLE 14.

**Example 15.** $\sqrt[3]{4{\cdot}1} = 1{\cdot}6$.—Set cursor line over 4·1 (A), draw out slide (to right) until the position is reached where the same number which comes under the cursor line on B also comes under index 1(C) on D. This answer, 1·6, though not absolute, is very near. (See Fig. 18).

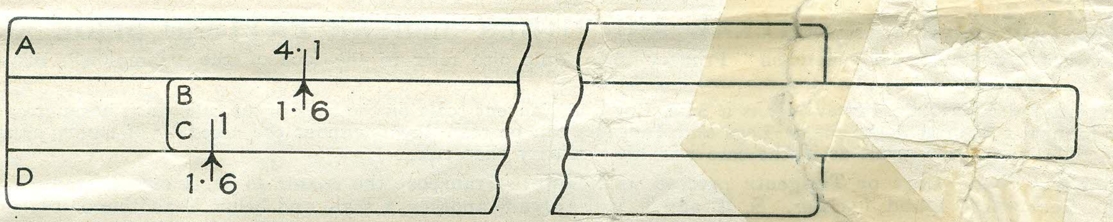



FIG. 18. EXAMPLE 15.

## THE LOG LOG SCALES.

These scales begin at the top left hand of rule (LU) with 1·1 and extend to 3·2 and are then continued on the bottom left hand of rule (LL) from 2·5 to $10^5$ (100,000). The two portions are arranged in relation to one another so that the bottom scale (LL) is the tenth power of the top scale (LU), and the cursor line is used for setting.

**Example.** $1{\cdot}15^{10} = 4{\cdot}045$. $2{\cdot}286^{10} = 3899$. $1{\cdot}162^{10} = 4{\cdot}498$. $1{\cdot}697^{10} = 198$.

Conversely over every number on the lower scale (LL) is to be found on scale LU the 10th root of the number.

**Example.** $\sqrt[10]{3{\cdot}5} = 1{\cdot}133$ $\sqrt[10]{15} = 1{\cdot}311$ $\sqrt[10]{1000} = 1{\cdot}995$

Under every number (n) on scale D will be found $e^n$ on the lower scale (LL). If $e^{-n}$ has to be worked out, read off first $e^n$ and then take the reciprocal value. (Reciprocal scale is on centre of Slide).

**Example.** $e^3 = 20{\cdot}1$ $e^5 = 148$

Over every number (n) on the D scale is to be found $e^{\frac{n}{10}}$ on the upper scale (LU). e = ... 33.

**Example.** $e^{0{\cdot}25} = 1{\cdot}284$.

... on the r...

... under cursor lin...

## THE LOG LOG SCALES—*continued.*

If roots of "**e**" have to be found, express them first as a "power" of "**e**," e.g., $\sqrt[4]{e} = e^{\frac{1}{4}} = e^{\cdot 25}$ and proceed as previous paragraph.

If the equation $e^x = y$ has to be solved set y on upper (LU) or lower (LL) log log scale according to its size and read x on the D scale.

**Example.** $e^x = 10$ $\quad x = 2{\cdot}303$
$e^x = 2{\cdot}7$ $\quad x = {\cdot}993$

As the values on D are the hyperbolic logarithms of the numbers on the log log scale the rule gives a table of hyperbolic logarithms.

**Example.** $\text{Log}_e\ 25 = 3{\cdot}22.$ $\quad \text{Log}_e\ 1{\cdot}95 = 0{\cdot}668.$

**Solve** $1{\cdot}124^{\,2\cdot 22} = 1{\cdot}296$ $\quad 1{\cdot}2^{\,2\cdot 5} = 1{\cdot}578$

**TANGENTS, SINES AND LOGS.** Scales for **direct reading** of Sines and Tangents are on the back of the slide of the "Simplon" Major rule and the log scale is on the back of the rule.

The scales for **direct reading** of Sines, Logs and Tans are on the back of the Bilateral rules and are read with the transposable cursor.

## MONEY VALUES.

Money calculations can be done on a slide rule and a conversion table is given below to use in connection with this.

**Example:**—Find the cost of 39 articles at £2 14s. 8d. each. Bring R1 (C) over 39 on D then opposite £2·733 (£2 14s. 8d. = £2·733 from table) will be found £106·6 = £106 12s. 0d. (extracted from table).

**Example. $7\frac{1}{4}$% of £54 12s. 6d. (£54·625 from table).**—Set R1 (C) to 54·625 on D scale and opposite $7\frac{1}{4}$ on C read on D 3·96 = £3·96 and from table we get £3 19s. 2d. (3·958). Actual amount is £3 19s. $2\frac{1}{4}$d.

### TABLE FOR CONVERTING SHILLINGS AND PENCE INTO DECIMALS OF £1 AND VICE VERSA.

**$\frac{1}{2}$d. = ·002 of £1 (·00208 more accurately).**

| | SHILLINGS. | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pence | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 0 | | ·050 | ·100 | ·150 | ·200 | ·250 | ·300 | ·350 | ·400 | ·450 | ·500 | ·550 | ·600 | ·650 | ·700 | ·750 | ·800 | ·850 | ·900 | ·950 |
| 1 | ·004 | ·054 | ·104 | ·154 | ·204 | ·254 | ·304 | ·354 | ·404 | ·454 | ·504 | ·554 | ·604 | ·654 | ·704 | ·754 | ·804 | ·854 | ·904 | ·954 |
| 2 | ·008 | ·058 | ·108 | ·158 | ·208 | ·258 | ·308 | ·358 | ·408 | ·458 | ·508 | ·558 | ·608 | ·658 | ·708 | ·758 | ·808 | ·858 | ·908 | ·958 |
| 3 | ·012 | ·062 | ·112 | ·162 | ·212 | ·262 | ·312 | ·362 | ·412 | ·462 | ·512 | ·562 | ·612 | ·662 | ·712 | ·762 | ·812 | ·862 | ·912 | ·962 |
| 4 | ·017 | ·067 | ·117 | ·167 | ·217 | ·267 | ·317 | ·367 | ·417 | ·467 | ·517 | ·567 | ·617 | ·667 | ·717 | ·767 | ·817 | ·867 | ·917 | ·967 |
| 5 | ·021 | ·071 | ·121 | ·171 | ·221 | ·271 | ·321 | ·371 | ·421 | ·471 | ·521 | ·571 | ·621 | ·671 | ·721 | ·771 | ·821 | ·871 | ·921 | ·971 |
| 6 | ·025 | ·075 | ·125 | ·175 | ·225 | ·275 | ·325 | ·375 | ·425 | ·475 | ·525 | ·575 | ·625 | ·675 | ·725 | ·775 | ·825 | ·875 | ·925 | ·975 |
| 7 | ·029 | ·079 | ·129 | ·179 | ·229 | ·279 | ·329 | ·379 | ·429 | ·479 | ·529 | ·579 | ·629 | ·679 | ·729 | ·779 | ·829 | ·879 | ·929 | ·979 |
| 8 | ·033 | ·083 | ·133 | ·183 | ·233 | ·283 | ·333 | ·383 | ·433 | ·483 | ·533 | ·583 | ·633 | ·683 | ·733 | ·783 | ·833 | ·883 | ·933 | ·983 |
| 9 | ·038 | ·088 | ·138 | ·188 | ·238 | ·288 | ·338 | ·388 | ·438 | ·488 | ·538 | ·588 | ·638 | ·688 | ·738 | ·788 | ·838 | ·888 | ·938 | ·988 |
| 10 | ·042 | ·092 | ·142 | ·192 | ·242 | ·292 | ·342 | ·392 | ·442 | ·492 | ·542 | ·592 | ·642 | ·692 | ·742 | ·792 | ·842 | ·892 | ·942 | ·992 |
| 11 | ·046 | ·096 | ·146 | ·196 | ·246 | ·296 | ·346 | ·396 | ·446 | ·496 | ·546 | ·596 | ·646 | ·696 | ·746 | ·796 | ·846 | ·896 | ·946 | ·996 |

### DECIMAL EQUIVALENTS OF 1/-.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $\frac{1}{2}$d. is ·0417 | 2d. is ·1670 | $3\frac{1}{2}$d. is ·2920 | 5d. is ·4170 | $6\frac{1}{2}$d. is ·5420 | 8d. is ·6666 | $9\frac{1}{2}$d. is ·791 | 11d. is ·916 |
| 1d. is ·0834 | $2\frac{1}{2}$d. is ·2083 | 4d. is ·3333 | $5\frac{1}{2}$d. is ·4580 | 7d. is ·5835 | $8\frac{1}{2}$d. is ·7080 | 10d. is ·833 | $11\frac{1}{2}$d. is ·958 |
| $1\frac{1}{2}$d. is ·1250 | 3d. is ·2500 | $4\frac{1}{2}$d. is ·3750 | 6d. is ·5000 | $7\frac{1}{2}$d. is ·6250 | 9d. is ·7500 | $10\frac{1}{2}$d. is ·875 | |

## THE "SIMPLON" BILATERAL AND OTHER SIMILAR PATTERN SLIDE RULES.

The foregoing instructions for the "Simplon" Primary Slide Rule also refer to the face of the "Simplon" Bilateral and other Rules.

The Simplon Bilateral Slide Rule, however, has a Sine, Log and Tangent scale on the back of the rule which has a great advantage over the commoner form of rule in that the Sines, Logs and Tangents can be read direct without the necessity of having either to reverse the rule or slide in order to get the result as is the case with the ordinary slide rule.

To find either Sines, Logs or Tangents proceed as follows:—Transpose the cursor so as to obtain readings on the back of the slide rule. Here will be found 5 scales. S. L. and T. and above S another A scale and below T another D scale.

### SINES

are found by putting the cursor line over angle on scale S and reading on scale above (A) the answer. The sine scale starts at an angle of about 35 minutes.

**Examples. Sine 30° = ·5. Sine 2°35′ = ·0451. Sine 6°52′30″ = ·1198. Sine 5°25′ = ·0945.**

### LOGS

are found by reading on the log (L) scale the logarithm of the number under the cursor line on scale D under T scale.

**Examples. Log 2 = ·3010. Log 7·5 = ·875. Log 3 = ·4771. Log 1·2 = ·079.**

### TANGENTS

are found by reading direct from T scale on to bottom scale (D). The Tangent scale starts about 5° 45′.

**Examples. Tangent 45° = 1. Tangent 6° 45′ = ·1184. Tangent 19° = ·344. Tangent 31° 55′ = ·6228.**

**DARGUE BROTHERS, LTD.,** SIMPLON WORKS, - SOUTH STREET, **HALIFAX, Eng.**

**Telephone 2477** **Telegraphic Address: "Simplon, Halifax."**