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Instructions

for the use of

The

A.W. FABER "BUSINESS"

Pocket Slide Rule

A.W. FABER CASTELL

Founded 1761

STEIN near Nuremberg

Factory

specialising in Slide Rules and Drawing Instruments

GEROLDSGRUN

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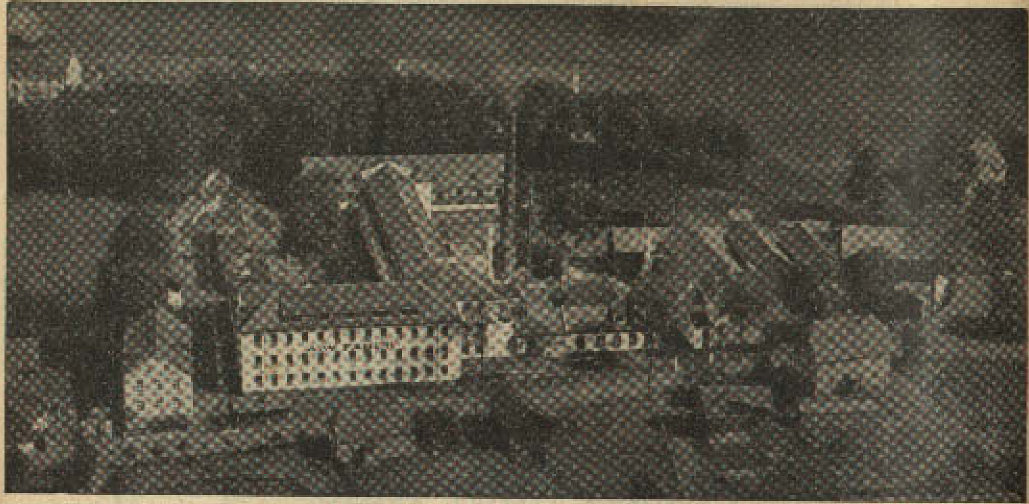

Factory for Precision Slide Rules and Drawing Instruments
GEROLDSGRUN

A.W. FABER CASTELL - PENCIL-WORKS

STEIN near Nuremberg

Description of the "Business" Pocket Slide Rule.

Before we pass on to a general explanation of slide rule methods, we shall give a thorough explanation of the "Business" slide rule.

This rule, Fig. 1, consists of three parts: —

1. The stock, or body, of the rule is the rectangular external portion.

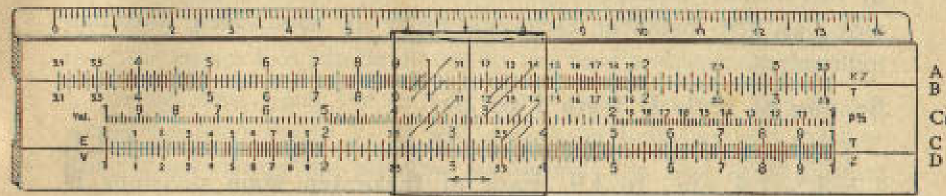

Fig. 1

2. A narrow strip the length of the body, which fits into the channel and is free to move lengthways in the grooves. This is called the slide.
3. The cursor of celluloid which can slide over the full length of the rule face.

The face of the rule body and slide are provided with five sets of graduations, called the scales: —

1. A scale with graduations along the lower face of the rule body. It commences on the left with a graduation marked 1, and continues with the numbers 2, 3, 4, etc. to 10 though this 10 on the extreme right, is again marked 1. This set of graduations is called the lower rule scale, or scale D.
2. A scale along the lower face of the slide adjacent to scale D. This is known as the lower slide scale C.
3. A scale along the middle of the slide. This is exactly the same as scales C and D, only graduated from right to left. It is called Cr.
4. A scale along the upper edge of the slide face, "the upper slide scale" B starting on the left with the graduation 3.1, reaching 10 at the middle of the scale, and continuing beyond 35 (marked 3.5) at the right-hand end.

5. A scale on the upper part of the rule body, the "upper rule scale" A which is identical with B.

Reading and setting of numbers on the scales.

It will be seen that the space gradually decreases between graduations of the slide rule scales as the numbers increase. Because of this variation all parts of the scale cannot be equally subdivided as, for instance, each centimetre is subdivided into den millimetres.

Section of scale D from 1 to 2.

This part of the scale is divided into ten parts, marked 1.1, 1.2, 1.3, 1.4, etc., to 1.9. Each of these ten main divisions is again subdivided into five parts, but these are not marked with figures, owing to lack of space.

It is necessary to form the habit of reading all numbers from the slide rule scale without considering the position of the decimal point. Instead of 1.1, read 11, not calling it "eleven" but "one-one". Call 13.4 (and 1.34) "one-three-four". Call 108 "one-nought-eight".

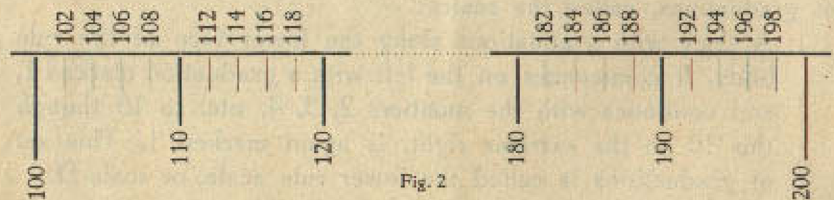

Fig. 2

The beginning and the end of the portion of scale D from 1 to 2 are shown in fig. 2. From this it is possible to see the values of the intermediate, unnumbered, graduations.

When the figure in the number is odd, it is necessary to set in the space between graduations on this portion of the scale. This is not difficult, since each odd number, 1, 3, 5, etc., in the third place must come exactly in the middle of the space between graduations. This will be clear from the next exercise: —

117 153 109 167 191 197 101 105 199 193.

In this section operation with four figures is still possible, but requires some exercise in estimating the values between two graduation marks.

The spacing of the graduations at the left-hand end of the scale is a little more than one millimetre, while at the right-hand end it is about half a millimetre. In so short a space one can easily estimate the value by eye. After using the cursor line to set to the main graduation, the tenth parts can be found by inspection, then the cursor line can be moved to the final and correct position.

For practice, push the cursor along until the line lies somewhere between 1 and 2. It will always lie between two graduations. Now define the position absolutely; the first three figures are given unmistakably by the nearest graduation on the left, and the fourth figure is found by estimating (how far the cursor line is beyond this last graduation).

The very useful exercise described in the last paragraph should be repeated at least thirty times, after which the reader will have no trouble in setting numbers of even four figures.

Section of Scale D from 2 to 5.

Here the main divisions are again tenths, but they are not all numbered. Figures are only found at 2, 2.5, 3, 3.5, 4 and 5. The remaining tenths are easiliy found by counting the graduations from the numbers. Thus we find 2.1, 2.2, 2.3, . . . 4.7, 4.8, 4.9.

Only the halves are shown between the tenth graduations, as will be seen from Fig. 3, which represents the beginning and end of this scale section.

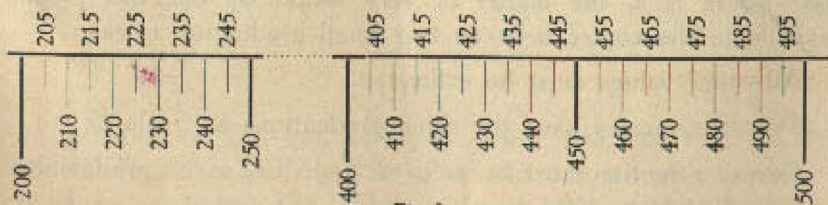

Fig. 3

In this section the settings are the simplest.

If the third number is neither 5 nor 0, the position must be found by estimating the distance in the space between graduations.

As another exercise, place the cursor line or, alternatively, 1 on Scale C, anywhere between 2 and 4. If it does not happen to come exactly on a graduation, nor in the exact middle between two graduations, read the value of the graduation or middle of space between graduations, whichever is closest to the line set.

In this section it suffices to read the first three figures.

Section of Scale D from 5 to 10.

In this last section the settings are the simplest. Only the halves are shown between the tenth graduations, as will be seen from Fig. 4, which represents the beginning and end of this scale section.

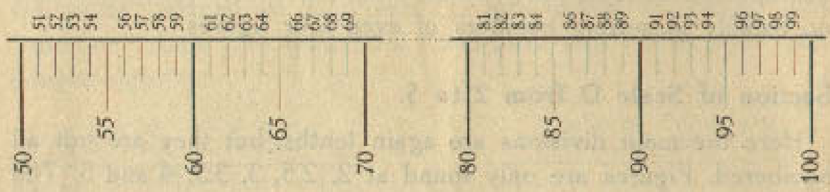

Fig. 4

As shown, small graduation marks are put only against the values 5-1, 5-2, 5-3, . . . 9-6, 9-7, 9-8.

In this section therefore one operates with three figures. If the last figure is 5, the matter is very simple as one has to set exactly in the centre between two small graduation marks.

All other values must be estimated.

The other scales have the same graduations as Scale D.

Special attention must be paid to Scale Cr, as its graduations run from right to left.

Proportion.

We shall begin with a simple example in unitary method.

If we know that 65 grammes of a certain drug cost \$ 2.59, we may determine the cost of any quantity by bringing these two values together on adjacent scales. We may, for instance, take the weight in grammes on Scale D, and the price in dollars on Scale C. Setting the cursor line over 65 on D and moving the slide until 259 on C is under it, fig. 5, we read that 70 gm. cost \$ 2.79, 350 gm. cost \$ 13.95. Reading may also be done in the reverse order: we may find the weight that can be purchased for a given sum of money by placing the cursor over the money on C and reading the weight on D: for \$ 20.00 we can obtain 502 gm., for \$ 1.50 we get 37.6 gm.

From this example, we see that with only one setting, the complete answer is found. With this one setting a table has been formed.

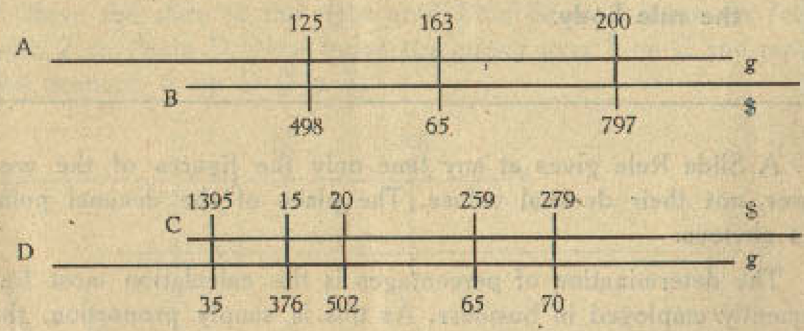

Fig. 5

The price of 125 gm. seems to elude us, however, for the slide projects so far from the rule body that scale C is not near D at the graduation 125. When the lower scales on the "Business" slide rule fail in this way, the answer can be found on the upper scales. Scale A also gives weight in grammes, and B the corresponding prices. Under 125 gm. on A read $ 4.98 on B. The cost of 200 gm. is $ 7.97, and for $ 6.50 we obtain 163 gm.

The upper and lower scales comprise an inseparable whole; as soon as — either above or below — the initial setting for a Rule-of-Three problem has been made, answers to all questions can be read off. In order to obtain the widest possible scale range, care should be taken to see that more than half the slide does not project beyond the rule body. The figure 1 at the middle of Scale B should remain inside the body. The foregoing may be summarised in the following rule: —

In proportion, the ratio is set between the slide scales and the rule scales. Then all corresponding values will coincide on adjacent scales. More than half the length of the slide should remain inside the rule body.

A Slide Rule gives at any time only the figures of the answer, not their decimal values. The place of the decimal point is obvious.

The determination of percentages is the calculation most frequently employed in business. As this is simply proportion, the answers are found by setting up a ratio between scales. We shall begin with a simple example.

Find 68% of £ 735.

The ratio is found by taking £ 735 as 100%. Therefore, set 100% (the right-hand graduation 1) on Scale C to 735 on D (Fig. 6). Then the rates per cent. are on the C scale, and the corresponding sums of money are on D. Under 68% on C read £ 500.

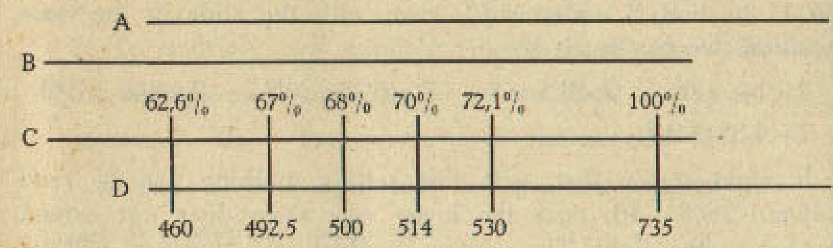

Fig. 6

Other percentages of £ 735 may be read from the rule as it is now set. For instance, 70% is £ 514, 67% is £ 492.5 (£ 492. 10 s. 0 d.). Also, reading in the reverse order, £ 460 is 62.6%, and £ 530 is 72.1%.

Multiplication.

We shall begin with a simple multiplication, 2×3.

Move the slide to the right until 1 on Scale C comes in line with 2 on Scale D. Now move the cursor over 3 on C and read the product, 6, on D (Fig. 7).

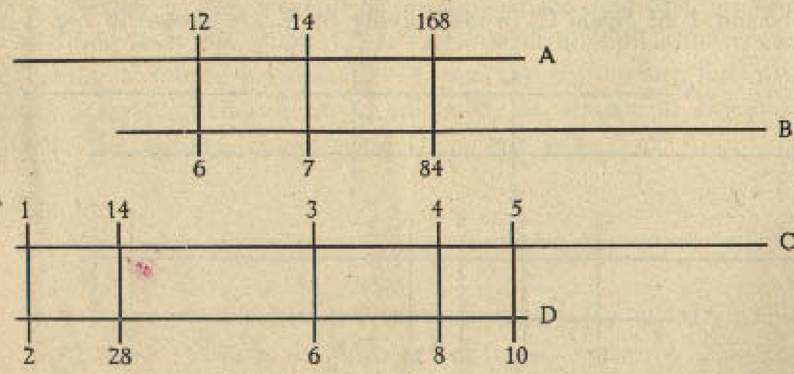

Fig. 7

Here a valuable characteristic of the slide rule becomes apparent; without moving the slide, we may find the product of $2 \times 4 = 8$ (it is only necessary to move the cursor line over 4 on C to find 8 underneath), also, with the slide in the same position, we can read: —

$2 \times 14 = 28$ $2 \times 2.5 = 5$ $2 \times 0.35 = 0.7$ $2 \times 440 = 880$
$2 \times 4.85 = 9.7$.

It might appear that, with this setting, nothing can be read beyond $2 \times 5 = 10$, since the lower rule scale does not extend further to the right. The missing graduations, however, will be found on the upper scales — above 6 on Scale B, for instance, read 12 on Scale A. The second factor of the multiplication is on the slide scale, B or C, while the product is on the rule scale, A or D. Thus the following may be found: —

$2 \times 70 = 140$ $2 \times 0.84 = 1.68$
$2 \times 9.35 = 18.7$ $2 \times 525 = 1050$.

In some cases, however, this setting causes the slide to project too far to the right for the answer to be read. When this happens the right-hand 1 of Scale C should be used. For instance, in multiplying 6 by 7, we find that 7 on Scale C is beyond the end of the rule body. We, therefore, bring the right-hand 1 of Scale C to 6 on D, move the cursor over 7 on C and read 42, the required answer, on D. Further examples of the use of the right-hand 1 of Scale C, in multiplying by 4, are shown in Fig. 8.

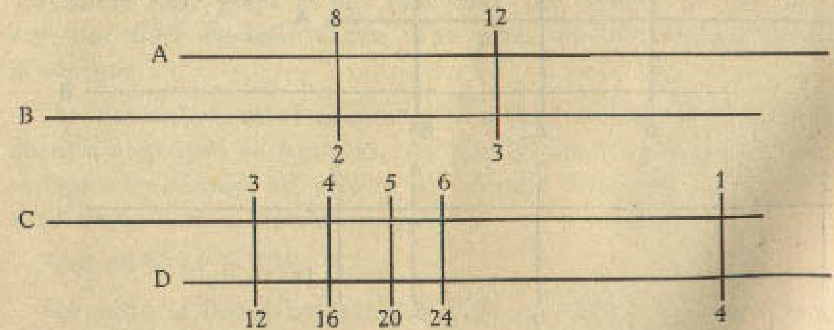

Fig. 8

A general rule for multiplication is as follows: —

To multiply two numbers together, set the left- or right-hand 1 of Scale C to the first factor on Scale D. Move the cursor over the second factor on Scale C or B, and read the product on Scale D or A under the cursor line.

Whether the left- or right-hand 1 of Scale C is used in multiplication will depend on the size of the factors. The slide should be set so that more than half its length remains inside the rule body. Thus the right-hand 1 should not go to the left of the mark ←—|—→ on the lower scale, and the left-hand 1 should not be moved to the right of it.

Division.

Division is the reverse of multiplication, and the method of dividing with the slide rule is just that of multiplication reversed. Taking a simple example, $8 \div 4$, we set the cursor line over 8 on Scale D, bring 4 on C under it, as shown in Fig. 9, and read the answer, 2, on Scale D, in line with 1 on C.

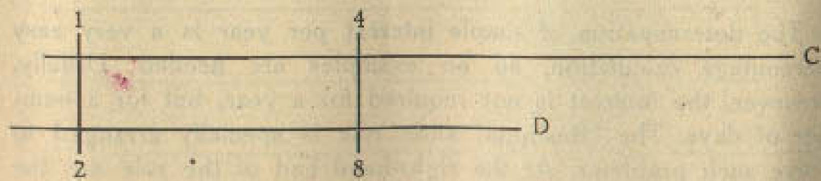

Fig. 9

However, this rule does not apply in all cases, as will be shown by the following example: Divide 180 by 30; set 30 on Scale C to 180 on Scale D, and read the answer, 6, on D, in line with the right-hand 1 of C (Fig. 10).

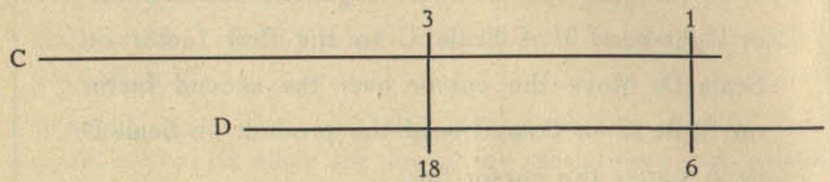

Fig. 10

The quotient is read on Scale D against the right- or left-hand 1 of C, whichever is within the rule body (it can also be found on Scale A against 1 on B).

Rule for division: —

> **Set the divisor on C (or B) to the dividend on D (or A) and read the quotient on D (or A) in line with the right-hand or left-hand 1 of C (or the centre 1 of B).**

Simple Interest.

The determination of simple interest per year is a very easy percentage calculation, so no examples are needed. Usually, however, the interest is not required for a year, but for a number of days. The "Business" slide rule is specially arranged to solve such problems. At the right-hand end of the rule are the letters P, I, D, and r%. They mean that the corresponding scales

represent principal (P), interest (I), number of days (D), and rate per cent. (r%). The method of working is explained in the following rule: —

> **Move the main cursor line over the principal on Scale A — the principal must be taken only on Scale A — set the rate per cent. on Scale, Cr, under the short cursor line, and read the interest on Scale A or D in line with the number of days on Scale B or C.**

Set the main cursor line over 115 on A (Fig. 11), bring 3 on Cr under the short cursor line, and read 435 on A over 46 days on B, or, alternatively, on D under 46 days on C. An approximate answer can be simply found; since the interest on this principal for 365 days is about £ 3, the interest for 46 days can be taken as one-tenth. Therefore, the approximate interest may be taken as £ 0.3, which fixes the answer at £ 0.435.

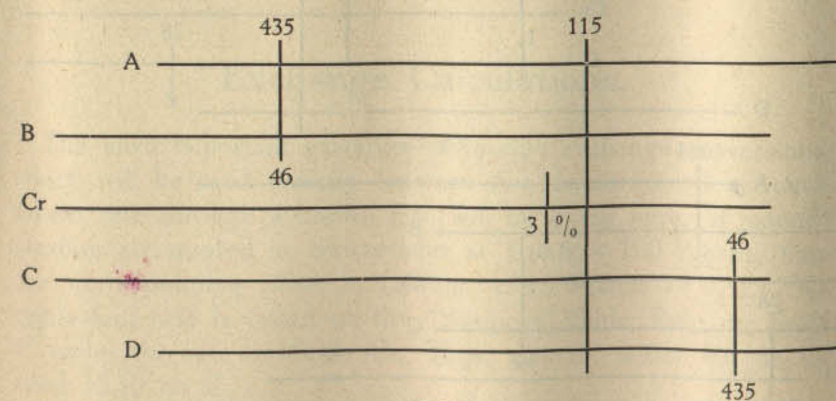

Fig. 11

Find the interest on £ 115 for 35 days at 3% per year of 365 days.

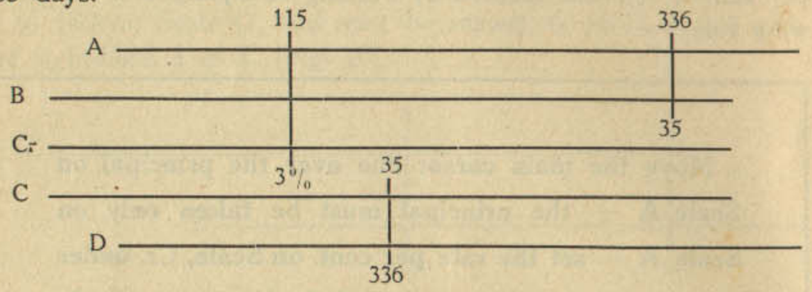

Fig. 12

Set the main cursor line over 115 on A (Fig. 12), bring 3% on Cr under it, and, in line with 35 on the scales B or C, read 336 on A or D. This is \$ 0.336, or 34 cents.

Usually the interest can be found with only one setting of the slide, but sometimes it becomes necessary to **re-set** the slide, as in the following example.

Find the simple interest on £ 308 for 28 days at $4\frac{1}{2}\%$ per annum.

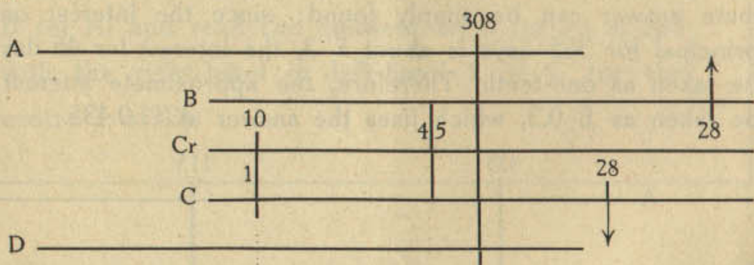

Fig. 12a

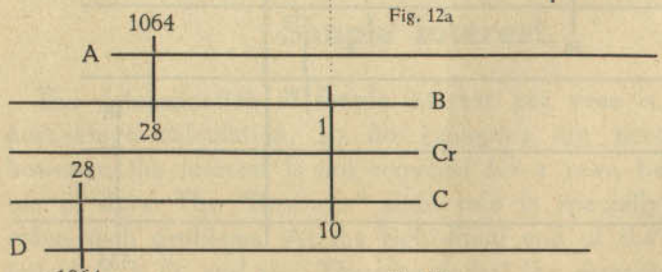

Fig. 12b

The graduation 308 is close to the right-hand end of Scale A. Set the main cursor line to it (Fig. 12a), and bring 4.5 on Cr under the short cursor line. Now the graduation for 28 days, on the C scale, projects beyond the rule body, and so cannot be read. The slide must now be **re-set**, to bring 28 within the rule body.

This is done by setting the opposite end of the slide under the cursor line; in other words: if with the left end of the slide the result cannot be read, draw the slide so far to the left that its right end comes under the cursor line and vice versa (Fig. 12b). Now the result can be read off both over B 28 and under C 28; one reads the figures 1-0-6-4. The interest is thus £ 1.064, or £ 1.1.3.

Rule: —

> **To reset the slide, place the cursor over 1 on Scale C and move the slide through until 1 at the other end of C comes under the cursor line.**

Exchange Calculations.

The most important examples of foreign exchange conversions, which will be used directly between two countries, of an equivalent rate through a known rate will be given here. If pounds sterling are quoted in Switzerland at £ 6.6 = 100 Francs, then the corresponding price in London 15.15 Francs = £ 1. This equivalent rate is found on the "Business" Slide Rule on Scale C under the rate on Scale Cr. Thus, directly under 6.6 on Cr read 15.10 on C.

Examples: Dollars are quoted in London at 4.97; at this rate $ 10 = £ 2.012 (£ 2-0-3).

Norwegian kronor are quoted in London at 19.90. The corresponding rate gives £ 5.025 = 100 kronor.

It is good practice to find the corresponding values of all the rates of exchange for a few days.

The foregoing brief introduction gives only a few of the more important slide rule uses. Much more explanation and numerous examples in all branches of business mathematics will be found in the full instructions to the "Business" Slide Rule.

For the desk

the "Business" Slide Rule No. 1/22/322

is recommended,

for students

the Student's Business Slide Rules

No. 51/22

No. 52/22