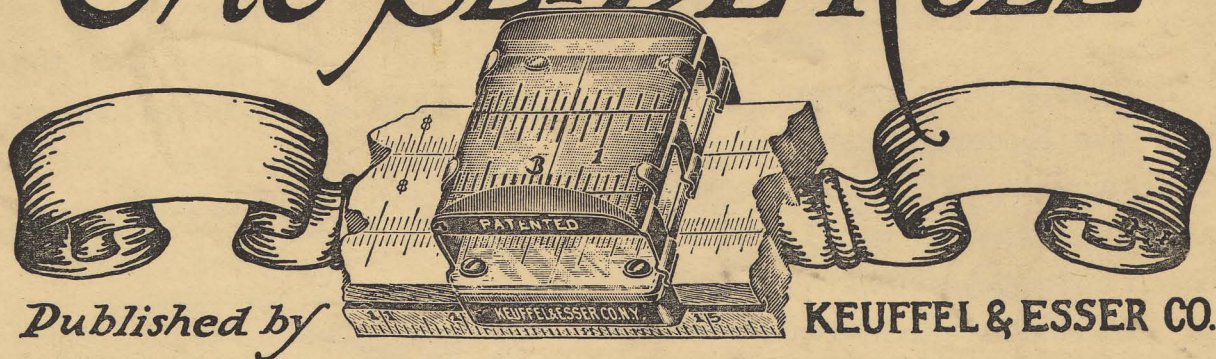


The SLIDE RULE

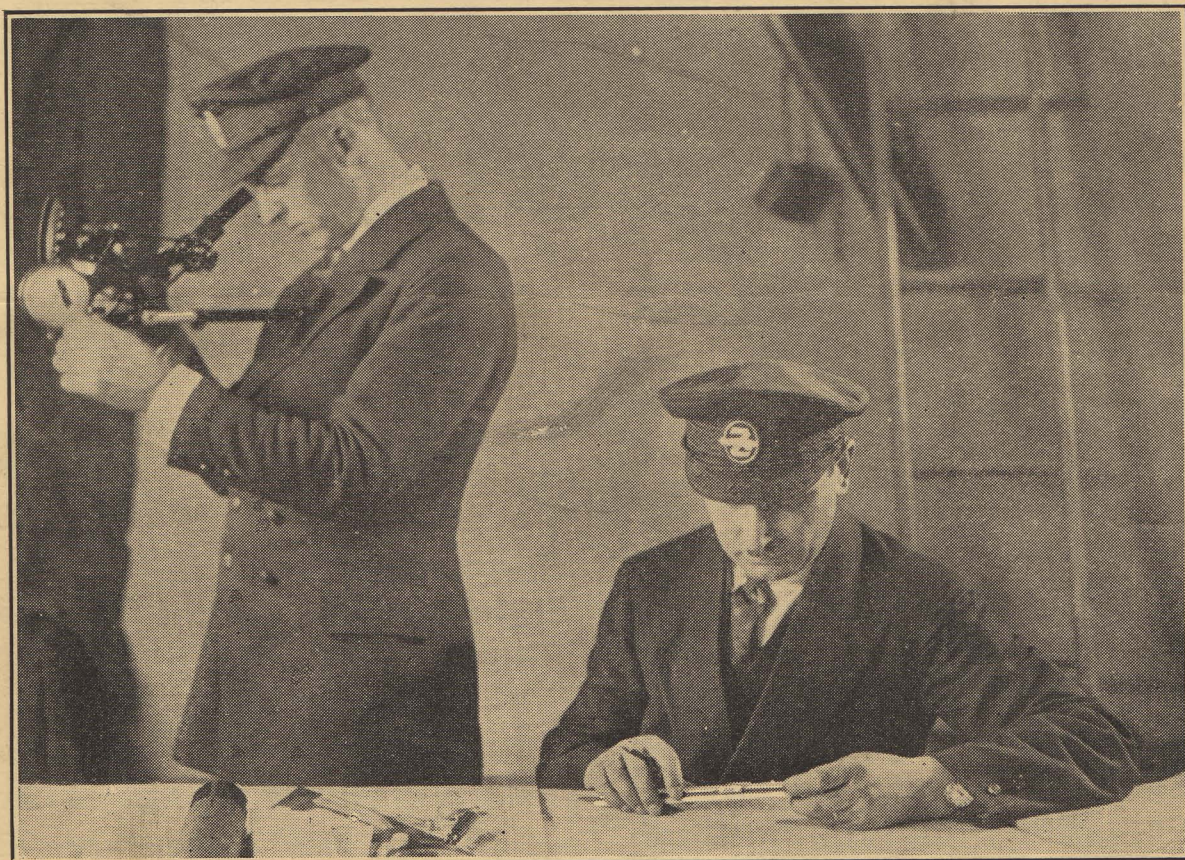


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UP IN THE AIR.



On land and sea the Slide Rule for many years has proved its worth, but it is only recently that this little time saver has invaded the skies above.

The photograph shown is taken in the navigating room of the ZR-3 (now the Los Angeles) during its famous trans-Atlantic trip. The officer on the left is determining his

position in space by "shooting the sun," while the one on the right makes his calculations on the Slide Rule from figures given him by his brother officer.

It is essential that very rapid calculations be made on a ship of this type, as it is traveling at 60 miles an hour and delay in the determination of the position would mean inaccurate results.

THE SLIDE RULE IN CHEMISTRY

In order to show the pupil how to apply the theoretical knowledge he has acquired in Chemistry to practical work, it is the general practise in schools and colleges to have him work out problems in which actual values are substituted in the formulae. These problems give the student good training, but, unfortunately, the routine mathematics involved in them

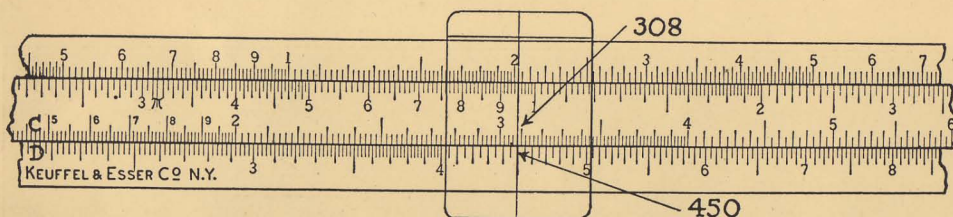
What will its volume be at 90° C. and 630 m. m. pressure?

According to the above laws, the problem would be set down as follows:

$$X = 450 \times \frac{(273 + 90)}{(273 + 35)} \times \frac{790}{630}$$

or $X = 450 \times \frac{363}{308} \times \frac{790}{630}$.

When worked by the old method, this example produces a half page of figures and takes at least *ten minutes* of valuable class time for solution.



take up so much of his time and thought that he often loses sight of the subject he is studying.

To overcome this difficulty and at the same time teach the pupils an efficient way of solving such problems, many schools are requiring the use of the slide rule in their chemistry department. By its use the student can not only cover more ground in the class room under the supervision of his teacher, but he can put his mind on "Chemistry," instead of having to wade through a maze of dull figures.

A very good illustration of the saving in time and work that can be effected by the Slide Rule is seen in a problem making use of the Charles and Boyles Laws.

Assume that the volume of a gas at 35° C. and 790 m. m. pressure is 450 C. C.

On the slide rule we would set 308 on C to 450 on D (To divide 450 by 308).

Then move indicator to 363 on C (multiplication).

Run 630 on slide to indicator (division).

Move indicator to 790 on C (multiplication).

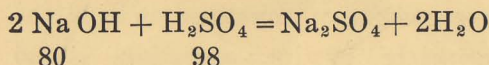
Under indicator line on D will be found answer 665.

Thirty seconds if you are *slow*.

Problems using formulae in which actual weights are substituted for molecular weights are encountered daily in the class room and will have to be solved even more frequently in the commercial laboratory. Solution of these can be made in a few seconds on the Slide Rule.

Assume it is desired to determine how many grams of Sodium Hydroxide are necessary to neutralize 50, 65, or 148 grams of sulphuric acid. The

formula would be written out:



Set 98 on *C* to 80 on *D*.

Under 50 on *C*, find 40.8 on *D*.
(First answer).

Under 65 on *C*, find 53.1 on *D*.
(Second answer).

Under 148 on *C*, find 121 on *D*.
(Third answer).

Analyses in the commercial laboratory must be made rapidly as the results of an analysis will often determine the policy of a business house to whom time means money. Further, the worth of an experimenter depends largely on the amount of work he can accomplish, so it is essential for his own success that he be able to cover as much ground as possible in the least amount of time.

The following is a typical example of the type of work encountered in the laboratory.

It is desired to determine what percentage of aluminum is in a 2.5 gram sample of metallic alloy. The experimenter finds .643 grams of Al_2O_3 .

$$\begin{aligned} \text{Al} &= 27.1, \text{Al}_2 = 54.2, \\ \text{Al}_2\text{O}_3 &= 102.2. \end{aligned}$$

Therefore

$$\% \text{ Al} = \frac{.643 \times 54.2}{102.2} \times \frac{1}{2.5} \times 100$$

Set 102.2 on *C* to .643 on *D*.

Reset index.

Run indicator to 54.2 on *C*.

Set 2.5 on slide to indicator.

Read 13.65% answer, under 1 on *C*.

These are typical examples of the types of problems encountered in Chemistry work. There are many others, but the Slide Rule user, once he becomes familiar with the funda-

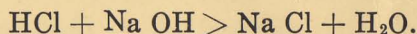
mental operations of the rule, should have no difficulty in applying them to his Slide Rule.

THE CHEMIST'S DUPLEX SLIDE RULE.

For all High School and College problems in Chemistry, the Mannheim Polyphase or Polyphase Duplex Slide Rule will meet every requirement. In the commercial laboratory however, where analyses are performed constantly and frequent reference must be made to the molecular and atomic weight tables, the Chemist's Slide Rule will be found to be particularly useful.

This type of rule has beside the *C*, *D* and *CI* scales, two sets of scales with the symbols of commonly used compounds and elements marked at the points representing their respective molecular or atomic weights. This feature makes unnecessary the use of molecular weight tables.

Assume for example that it is desired to determine the amount of Na OH needed to react with 5 grams of HCl. The formula is written:



Instead of looking up in the molecular weight tables to determine the weights of HCl and Na OH, we have only to set the rule as follows:

SOUGHT	To	HCl.
GIVEN	Set	Na OH
C	Under	5
D	Find	4.56 grams answer.

It can be readily seen that a considerable saving of time would result from the use of this rule if many problems dealing with molecular weights had to be worked out.

Edna - you love this slide rule

THE ORIGIN OF THE SLIDE RULE

It was in 1615 that John Napier, Baron of Marcheston, gave to the world what has been conceded to be one of the most useful of mathematical discoveries—logarithms.

Although “Gunter’s Scale,” as became known, contained no slide, the principle of its operation is so similar to the modern slide rule, that its originator is often referred to as the inventor of the Slide Rule.

William Oughtred, a school teacher in England was the inventor of the



Fig. 1. Gunter's Scale.

From a drawing in Edmund Stone's edition of M. Bion's *Construction and Principal Uses of Mathematical Instruments*, London, 1723. Usually, Gunter's Scale was two feet long and had on it the following logarithmic lines: S. R. (sines of the rhumbs), T. R. (tangents of the rhumbs), Numb. (numbers), Sines, V. Sine (versed sine), Tangents, Merid. (meridian line), E. P. (equal parts).

Edmund Gunter, a Professor of Astronomy in Gresham College, London, was quick to perceive that, although very valuable, the principle disadvantage of the logarithmic table, from a practical point of view, was the necessity of constant reference to it. To overcome this he laid out a scale, with points marked off at distances corresponding to logarithms of the numbers appearing beside them. He demonstrated that, with the aid of a pair of compasses to span these lengths in order to add or subtract them, the product or quotient of numbers could be determined rapidly on such a scale.

It is interesting to note from the illustration that this had beside the ordinary numbers, also scales with the trigonometric functions, which were and still are used to a large extent in navigation problems.

first real sliding rule. In about the year 1632, he added a slide to the Gunter Scale, which made the use of the compasses unnecessary. This permitted more rapid operation than was possible with the Gunter Scale, and his rule was used by a number of Mathematicians of the day. However, because there were no engineers, as we know them to-day, and business calculations were comparatively simple, the slide rule did not come into very wide use.

It was not until 1850 that any real advance was made in the design of Oughtred's style rule. In that year Lieut. Mannheim, a young French Army Officer, constructed a rule with an indicator and a lay-out of scales very similar to those used to-day. This was adopted by the French Artillery and also met with immediate approval throughout the engineering world.