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SLIPSTICK---

By Gordon Inskeep

YOU may call it a "guessing rod", a "slip stick", or some other such name, but think how valuable that slide rule of yours really is, especially to you sophomores pseudo-physicists; the slide rule is "God's gift to the engineer". Think how much enjoyment you would get from working a problem containing Π , and a number of radicals, multiplied my several four-place figures. You may enjoy it, but you surely will not claim to have time to run through very many of such calculations. Using a slide rule, the answer could be written down in at least one-fourth of the time required to calculate it arithmetically. It must be admitted, however, that the answer of the slide rule would be only approximately correct—correct to not more than four integers; that is where the name "guessing rod" originated.

The slide rule has made it reasonable for the physics, and other engineering departments, to assign a great many more problems than would be possible, were they to be worked out arithmetically!

Historically, the slide rule is not an old instrument, although one of the first rules was made by William Oughtred as far back as 1630. Since the slide rule is based on logarithms, there could have been no such instrument before the time of John Napier (1614), the inventor of the first logarithmic tables. About the middle of the nineteenth century, an ingenuous officer of the French army, Mannheim, devised the slide rule which bears his name; the Mannheim rule was the fore-runner of all our modern rules.

At present, there are many different types of slide rules on the market: the Mannheim, Duplex, circular, cylindrical, and others are made by various companies both in America and Europe. The Duplex is a newer type than the Mannheim and differs in that the sliding scale does not need to be removed and turned over to use such scales as trig and log; in other words, the Duplex has scales on both sides of the rule while the Mannheim has scales on only one side.

Many of the formulas used in engineering practice are exponential functions, and frequently involve the use of decimal exponents. An example of this is the formula which shows the relationship between volume and pressure of air when it expands without gain or loss of heat (adiabatic expansion). This

formula, $PV^{1.41}=k$, is rather difficult to handle with an ordinary slide rule, and for problems such as this a new scale was devised called the log-log scale. Log-log scale is based on hyperbolic logarithms and makes computations of exponential functions as simple as multiplication on an ordinary rule. The log-log scale is seldom found on the lower priced rules. It is used for the most part in more advanced or specialized work.

Straight slide rules are made in sizes from five inches up; the longer ones are called desk models and rest on stands. Demonstration rules have been made in sizes up to six feet in length. Theoretically, the accuracy of the slide rule is directly proportional to the length; the ten inch size should be accurate to one part in one thousand, this being about the maximum. The magnifier on some of the smaller rules increases their accuracy, of course. In no case, however, should an attempt be made to read more than four figures on a ten inch rule; the ten inch rule is the one more commonly used.

The trigonometric scales may be divided into degrees and minutes, or into degrees and tenths of a degree; the latter has been called the "deci-trig" rule. The slide rule is not recommended as a means of solving triangles, but it can be used as a check.

The circular and cylindrical rules are merely other adaptations of the logarithmic principles. There is one circular type which may be of interest, however, the Boucher type. The Boucher is about the size of an ordinary pocket watch but not quite as thick; in fact, it is often carried in the pocket at the end of a chain in the same manner as a watch. It is constructed entirely of metal, but has two glass faces—front and back. Scales printed on the front face are arranged on four circles and may be revolved by turning the stem; as simple as winding your watch. Computation by this circular rule is somewhat more difficult to get accustomed to than by the straight rule, but many engineers prefer this type because it is more convenient to carry around.

In practice, since its accuracy is quite limited, the slide rule is used only for approximate solutions or as a means of checking problems which have been worked out using arithmetical processes. Obviously, the slide rule is valuable to the engineer because of the speed which involved computations can be approximated.