How To Choose a Slide Rule

by don herold

I WISH I had married a good slide rule when I was young.

(After all, choosing a slide rule is a lot like getting married, because you're going to have it for a long, long time.)

I put off getting my slide rule until I was pretty far along in college, and it wasn't long until I was asking "Where have you been all my life?" And about the time I got to be a shark with it, it was time to graduate.

My advice to all beginners in school is: Size up the slide rule market and take unto yourself the finest one you can swing, and do it early, even if you have to beg, borrow or carry a laundry route to underwrite it.

I mean, my point is, get a swell slide rule while you're young and grow up with it. Buy it before you buy a pennant, a mailing bag or a Tux.

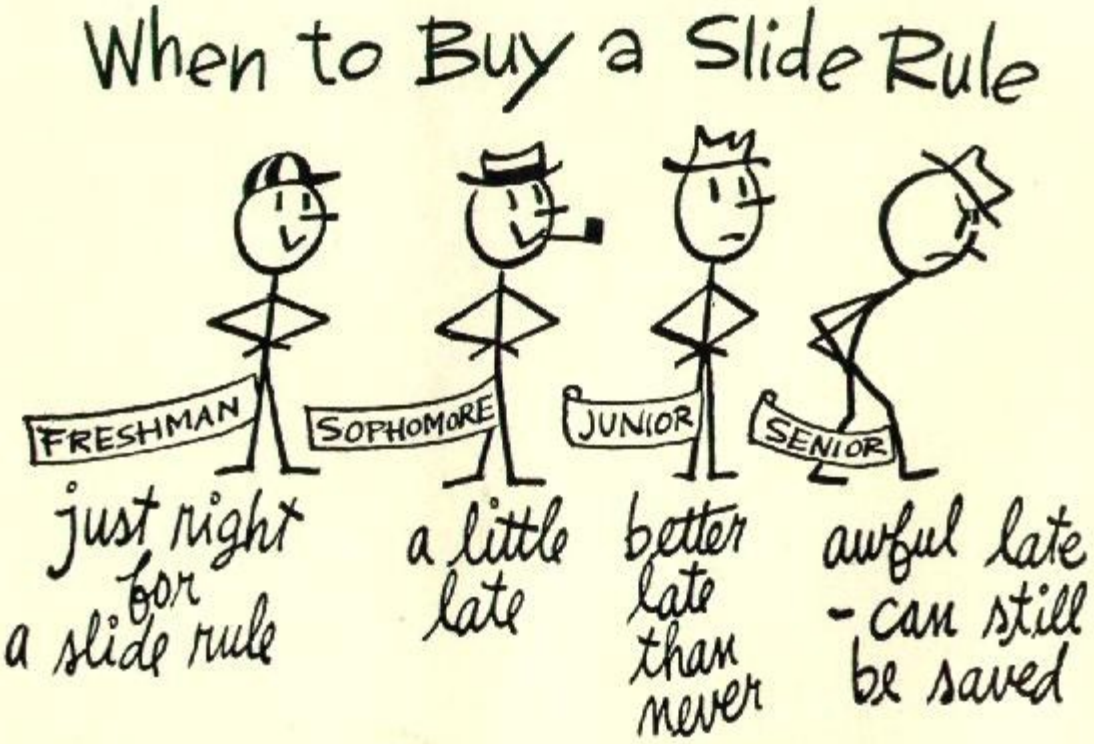
You'll soon find that you can do everything with it except get money from home.

And by the time you're ready for major engagements with Old Man Math, you'll be able to play sweet or hot on your rule without hitch, hesitancy, hem or haw.

Just think . . . forty years ago it was possible to graduate even from an engineering college without ever learning to use a slide rule!

Engineering was softer then. Thermodynamics had just been invented. There was none of this talk about Mechanical, Civil, Electrical or Chemical Engineering—you either were an engineer or you weren't, and that was that.

In those days the fellows who did have slide rules stood out from the crowd like a well thumb on a hand with four sore fingers. Legends grew up about them. It was rumored that they could tell you anything from the volume of Saturn to the k^{th} power of PV in two slips of the stick. Professors were afraid to cross



them up, and they were almost never called upon to recite. Football captains treated them with respect. Girls made a fuss over them. A glimpse at the slide rule itself made freshmen tremble with awe.

That was forty years ago.

Today Engineering is a pretty complicated business. Everything is speeded up. You have to step if you're going to inhale all that comes your way in a four year course. Today every engineering student worth his salt owns some kind of slide rule. Today more than half the accredited engineering schools have slide rule courses. Today it would be hard to find an engineering professor who could not box the compass with the most complicated slide rule you could hand him.

In short, if you want to be an engineer in this day and age, you've just got to have a slide rule. And I say the sooner you get yours, the easier it will be to knock off good grades for the next four years.

There's a whale of a lot of difference in slide rules, and it's pretty important that you get exactly the baby that's going to help you most. That's what this book is for—to help you choose the right rule for your needs and to help you get the most slide rule for your money.

I hope it will help you the way I hope it will.

NOTHING UP THE SLEEVE

The first time I saw a slide rule I ran like a scared cat and climbed a tree.

A slide rule looks like something a magician might use to take rabbits out of a hat.

But actually, it's a very simple bit of machinery. It's nothing more or less than two logarithmic scales sliding against each other, and who's afraid of two logarithmic scales sliding against each other?

Logarithms are as old as logs. They were discovered by a smart fellow named John Napier in 1614, and haven't changed much since. A logarithm is a sort of distillation of a number with which you can cut some pretty nifty capers. For instance, if you *add* the logarithms of two numbers, it's practically the same as *multiplying* the numbers themselves.

The slide rule gives you a simple way of adding and subtracting logarithms.

A slide rule is not to make work. It is to *save* work. This explains my morbid interest in the things.

Slide rules have of course grown up during the past fifty years. Some of them now almost have brains—will almost play themselves. There are now many kinds of scales in many different combinations—making the modern rule more complicated, but faster, simpler, easier to use, and more helpful in every way to its owner-operator.

Just to make this clear, let's talk about clarinets for a minute. There are two kinds of clarinets in the world—the Albert system and the Boehm system. The Albert system is the oldest; it has only 22 rings and keys. The Boehm system has over 168 rings and keys. It is ever so much more complicated than the Albert.

And yet the Boehm system clarinet is three times as fast and twice as easy to play as the Albert! Cuts out forked fingering, simplifies arpeggios and makes possible the high speed, modern clarinet music played by Artie Shaw, Peewee Johnson and Benny Goodman.

That's how it is with slide rules, too. The modern ones cut out forked fingering and simplify arpeggios so that you can bat out a heap of answers without working up a sweat.

I hate sweat!

THE MANNHEIM RULE

When Napoleon set out to conquer the world in 1804, his artillery officers were using a simple form of slide rule to solve ballistics and gunnery problems. Their aim was excellent.

But the British, Austrian, Belgian, German and Swiss artillery was pretty good too. They also used slide rules.

Except for that, Napoleon might have had a brilliant future.

In 1859 a dapper young lieutenant in the French artillery named Amedée Mannheim fell to tinkering with logarithms, and invented the slide rule that still bears his name. It made quite a stir in military circles. Everyone spoke well of Lieutenant Mannheim and his promotions came rapidly.

Now young Mannheim invented better than he knew. The Mannheim rule is the grandpappy of all modern slide rules. Over eighty years have passed and hundreds of thousands of engineers all over the world are still using this rule, just as he invented it.

And no wonder.

In spite of the dozens of improvements that the years have brought, the original Mannheim rule is still pretty good. Its simplicity is admirable —yet, if you are a good mathematician, you can do almost anything with it.

We will do well to look it over in detail before proceeding further.

Turn quickly, please, to the Mannheim slide rule on the next page.

It has four scales, marked A and B, C and D, because those are their names.

C and D are simple logarithmic scales, 25 cm long, both exactly alike. These are the scales we will use the most. With them we will multiply, divide, do percentage, ratio and proportion, and solve equations. Some fun!

(A and B are each composed of two 12.5 cm logarithmic scales, repeating, one after the other. These will come in might-ee handy, as you shall see later.)

Now suppose we want to multiply 2 x 2 in a hurry to get somewhere else. We slide the slide until number 1 on scale C is over number 2 on scale D. *Every number on scale C is now multiplied by two!*

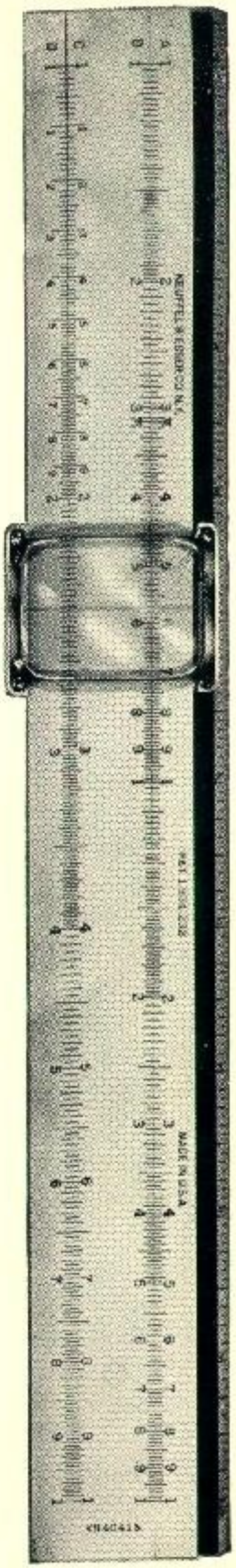
You don't think so? Slide the glass indicator along the rule until the hairline is directly over 2 on scale C. Now read the number that the hairline intersects on scale D. Sure enough, it's 4. Two times two is four, and the answer is correct.

Try the hairline on 3 on scale C. Look where the hairline crosses scale D. It's 6. Two times three is six, and again the answer is correct.

Of course you can do that in your head—but can you multiply 2.14 by 3.2? It's easy on the slide rule! Just as easy as 2 times 2, when you know how. And now you know!

Now let's get back to the A and B scales. These give us instantaneous squares and square roots —when we crave 'em.

Suppose we want to know the square of 2. Set the indicator at 2 on the D scale and read where

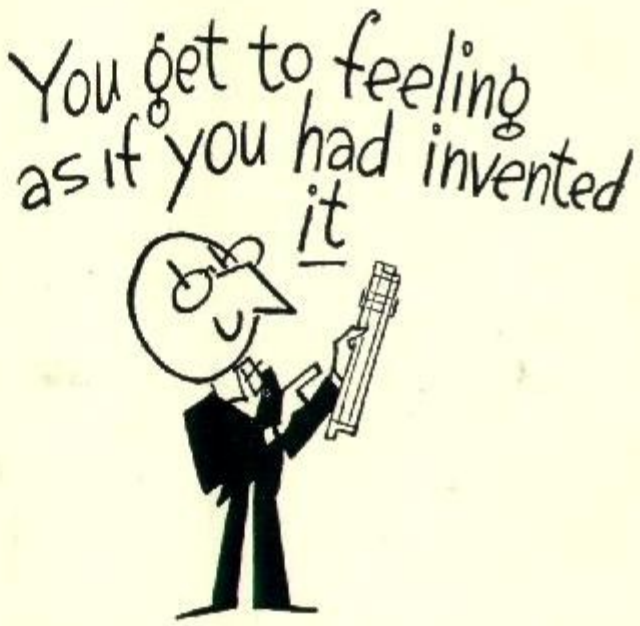


the hairline crosses scale A. What is it but 4. 4 is the square of 2.

Suppose you want to find the *square root* of 9. Set the indicator at 9 on the *A* scale and read where the hairline intersects scale D. And it's 3. 3 is the square root of 9. Notice that this is the same as finding the square, only backwards.

Easy enough, you say. And it's just as easy if you want the square of 1.73 or the square root of 7.61, which do not come out even at all!

By this time we are practically slide rule experts. (I'm beginning to feel as if *I* had invented the slide rule; you get *that* way.) If we can multiply 2 x 2 we can learn to do practically anything else in a very few minutes.



Let's look at the back of the slide, for instance. Here are three scales, S, T and L. The L scale gives you logarithms—set the number on scale D, read its logarithm on scale L. What could be simpler?

S and T are trig scales. S refers to AB and gives you sines and cosines, T refers to CD and gives you tangents and cotangents with a minimum of struggle. Sometimes you have to reverse the slide to use these scales, but more of that later. Don't worry about it now.

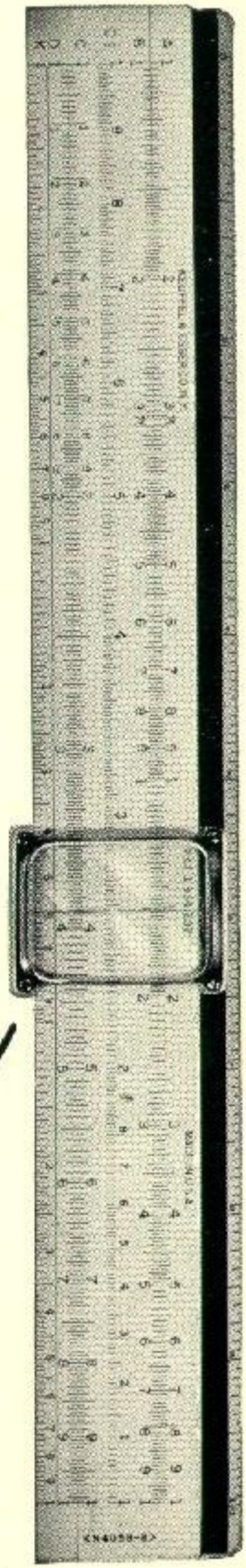
Except for tricks and short cuts, that's all there is to the Mannheim slide rule. You can't help but admire its simplicity, and the wisdom of the young French lieutenant who invented it over eighty years ago. (Mannheim later became a colonel and taught math at L'École Militaire for years. Perhaps we'd better think of him as "Colonel.")

But before we decide to buy a Mannheim rule, let's have a look at some of the others. As a matter of fact, we're due for a strange surprise at this point:

As a general rule, the more complicated a slide rule becomes, the easier it is to operate!

Quit looking skeptical. Uncle Don wouldn't fool you. Just wait and see . . .

THE POLYPHASE SLIDE RULE



Gentlemen, meet the Polyphase Slide Rule. Sounds pretty technical, doesn't it?

Tsck . . . tsck!

A Polyphase is just a Mannheim with a few new tricks. It isn't even named after anybody—there never was a Colonel Polyphase. *The only difference between the Polyphase and the Mannheim rule is that the Polyphase has a CI and a K scale!*

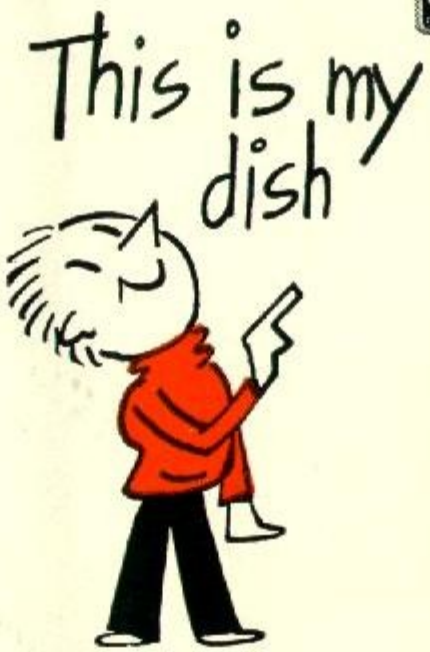
CI stands for "C inverted"—it's just a C scale printed backward. But what a whale of a difference this new scale makes! It lets us do multiplication and division at the same time, and in one operation. You'll find it invaluable for solving complex equations with long sequences of multiplication and division.

Now bring on that K scale . . .

This one is a cinch. It gives us direct reading cubes and cube roots instantaneously! Set the number on scale D, read the cube on K. Set the number on scale K, read the *cube root* on D.

Pretty solid sending, hey?

If you were thinking of getting a Mannheim rule, you may as well go one step further and get a Polyphase. There is very little difference in the price — and the two additional scales will save you a lot of fuss and bother. As a matter of fact, most of the people who swear by the Mannheim rule, really own Polyphases. They're hard to tell apart.



But don't rush out and buy a Polyphase until you hear about the Polyphase Duplex Trig. *That* has some new wrinkles on its dashboard that you're going to like . . .

THE POLYPHASE DUPLEX TRIG RULE

A well known professor of mathematics once said, "Anyone who would give a slide rule a name as long as that would steal sheep!"

Sorry, it couldn't be helped.

This slide rule is called "Polyphase" because it has all the scales of the Polyphase rule.

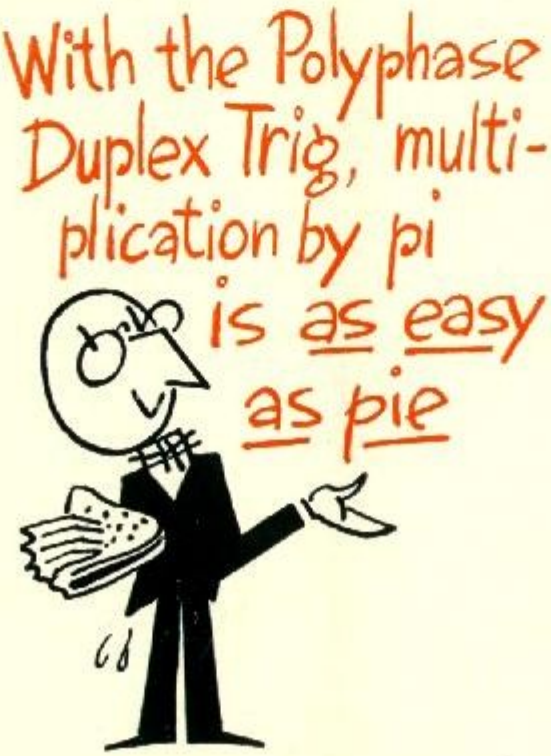
It's called "Duplex" because that's a name Keuffel & Esser thought up to suggest the double barreled wallop this rule packs.

It's called "Trig" because it's a honey at mowing down trig problems.

Put these all together and you have "Polyphase Duplex Trig," a name that describes this kind of a slide rule pretty well. It wouldn't be the same rule if we named it "Freddie."

Here's why . . .

Polyphase Duplex Trig has three more scales than the Polyphase, and three of the old ones have been revamped. It also has two D scales, but we'll go into that later. Let's look at the new scales first.



The new scales are called CF, DF, and CIF. These initials stand for "C folded," "D folded," and "C inverted and folded." All three are used with the basic scales C and D, directly below. Here I am —come on!

Notice CF and DF are the same as C and D except that they are "folded" to begin and end with π, or 3.1416. *This means that every number on D is automatically multipled by π on scale DF!* By the same token, every number on scale C is automatically multiplied by π on scale CF. By working backwards, you can also divide by π with the greatest of ease, without the aid of mirrors.

There's more than meets the eyeball here. In engineering calculations, π keeps bobbing up all the time. You'll be surprised to find how convenient it is to have multiplication and division by π reduced to such child's play.

Right here, that CIF scale becomes invaluable. Like the CI scale, it performs multiplication, division, *or both multiplication and division at one setting of the slide!* Once you have used π as a factor, you are still at liberty to multiply and divide by any factor you like, *without resetting the slide.* A great scale, this CIF.

Isn't that something, though?

The trig scales too have been beautifully streamlined. On the Polyphase and the Mannheim rules, the S scale refers to scale A, and the T scale refers to scale D. Usually we have to take the slide out and reverse it if we want to do trig. Moreover, once we find our trig function, we have to find its numerical value before we can use it in an equation—and we have to set it up on the CD scales before we can get going again.

But on the Polyphase Duplex Trig Slide rule both of the new trig scales refer directly to the CD scales. Catch on?

Now we can use the trig functions in any equation without bothering to determine its numerical value—and without resetting this value on another scale!

Boy, if you've got trig to do, this is wonderful! Once you've tried it, you'd hate to go back to the old horse and buggy way.

A while ago, we mentioned that this new slide rule has two D scales, one on each side. They run in tandem, so that both scales always give the same reading on both sides of the rule.

One refers to scale C to form a CD combination for multiplication, proportion, and division.

The other refers to the trig scales to form a fast trig combination. Since both D's give the same reading, you don't have to reset every time you turn your rule over.

Isn't that a nice thing to have in the house?

The Polyphase Duplex Trig Rule is made in another model called the Polyphase Duplex Decitrig. The only difference is that the trig scales on the Decitrig rule are graduated in degrees and decimals of a degree instead of in degrees and minutes.

These decimals of degrees greatly simplify the handling of trig functions in equations and they have come into wide use in many engineering colleges. Electrical Engineers have found them so convenient that a recent Don Herold poll shows that practically all EE's prefer this type of graduation. Before you decide whether you want your slide rule with trig or decitrig graduations, you had better talk it over with your math professor or faculty advisor. Regardless of the merits of the two kinds of graduations, you will find it a good idea to use the same kind of a rule that the rest of your class is using.

Polyphase Duplex Trig and its companion rule, Polyphase Duplex Decitrig, are excellent medium priced rules for all around use. They offer you every possible convenience for general calculations, and more time-saving "short cuts" than can be described here. You will do well to consider this type carefully before you make a decision.

Of course, if you're *really* going in for engineering in a big way you'll have to mess around with *logarithms* of *logarithms* quite a bit.

Digging these out of a book is a nuisance—perhaps you'd like a slide rule that puts them at your finger tips . . .

Step to the next platform, please . . .

THE LOG LOG DUPLEX TRIG

Don't let the double logs frighten you.

This Log Log Duplex Trig Rule is our old friend the Polyphase Duplex Trig Rule *with a complete set* of Log Log scales.

"Log Log" is short for "logarithms of logarithms" which begins to sound a little inbred. But don't sneer —these scales may save your life some day. They're sweethearts for solving the powers of numbers.

Every now and then engineering students have to find the n^{th} power of a number—x^n, as engineers write it. (This is one of the reasons why so many engineering students transfer to the school of music.) Let us say that the number is 5 and the power is 4.5 or $5^{4.5}$.

This just couldn't be done "by hand." If we did it with a four place log table, we would have to find the log of 5, multiply it by 4.5, then chase it back through the book to find the answer. While you're getting the book out, we have the thing all done on the slide rule. Here's how:

All the Log Log scales—LL00, LL0, LL1, LL2 and LL3—are really divisions of one long Log Log scale, cut up in easy bites to refer to conveniently.

Set the index of scale C over 5 on scale LL3. Move the indicator to 4.5 on scale C and read where the hairline intersects scale LL3. It's 1400!

How's that for getting out of a bad hole in a hurry! Think how it might have been if the number were 3.25 and the power 6.13. Impossible by hand or head, not too easy with a log table—but a pushover on the Log Log Duplex Slide Rule!

Sounds simple, doesn't it? It really is when you get to know them better. *And*

yet these LL scales are among the most important, most convenient, handiest scales you could own.

They will save you hours and hours of grinding work. They will make difficult engineering problems relatively simple for you. They will pay for themselves over and over the first year that you use them.

By this time you have guessed it—I think that the ideal slide rule for all around engineering use is the Log Log Duplex Trig or Decitrig. It has every scale you need for riding through a tough engineering course with a minimum of headaches. It will serve you well throughout the years to come when you graduate and take your place in the profession. For real knock-down-and-drag-out, math-eating, fire-breathing engineering there isn't another slide rule in the world that can touch it.

The Log Log Duplex Trig has a companion rule called the Log Log Duplex Decitrig. The only difference between these rules is that the trigonometrical scales on the Decitrig are graduated in degrees and decimals of a degree instead of degrees and minutes. As a general rule the Decitrig graduations are easier to handle. Be sure that you get the same kind of trig graduations that the rest of your class is using so that your answers will be in the same language as theirs. Your engineering professor can set you right on this point.

HERE'S HOW YOU CHOOSE . . .

Now that we have some idea what the various types of rules are all about, the time has come to get down to the serious business of making a choice. Naturally, the kind of slide rule you will need will depend entirely on what kind of math and how much you are going to be called upon to do, not only in college but throughout the years to come. While this is difficult to determine in advance, there are a few general rules that may help you to get in the groove.

If your math is bounded on the left by quadratic equations and on the right by plane geometry you can probably get by with a Mannheim rule. If a Mannheim is good enough, however, you may as well have the Polyphase slide rule with the CI and K scales added. The Polyphase rule costs little more than the Mannheim and the two extra scales will come in mighty handy.

If you expect a lot of mathematics to come trotting your way, you will at least need a Polyphase Duplex Trig, or Decitrig. The CF, DF and CIF scales will shave a lot of corners for you and the improved arrangement of the trig scales will make the handling of trig functions a joy. Polyphase Duplex Trig might be called a "minimum" rule for serious engineering students.

If you are going in for engineering in a great big way you really should have a Log Log Duplex Trig or Decitrig slide rule. The addition of the Log Log scales gives you a rule that will cut down midnight oil and save you countless hours of tedious calculation in an engineering course. As a matter of fact, the Log Log Duplex Trig or Decitrig slide rule is earnestly recommended for all future engineers. It will do everything that the Mannheim, Polyphase, and Polyphase Duplex Trig rules will do, and it will lend strength to your good right arm in the most complicated calculations you might meet. It is the meanest, fightingest, most all-around useful slide rule that has ever been invented. If you can possibly afford it, there is no better investment you can make.

The difference between the Trig and the Decitrig graduations on the trigonometrical scales gives you something else to think about. The Trig scales are divided conventionally in degrees and minutes. The Decitrig scales are divided in degrees and decimals of a degree. Since most engineering calculations are in decimals, the new Decitrig graduations are quite naturally much easier to use as factors. The only thing that would stop you from choosing this type is that it would be embarrassing to be the only Decitrig in a class full of Trigs, or vice versa.

Simple isn't it!

We almost forgot the LOG LOG DUPLEX VECTOR!

No booklet on this fascinating subject would be complete without some mention of the Log Log Duplex Vector slide rule.

This rule is more than its name implies. Ordinary vectors can be chopped into stove lengths with your Log Log Duplex Trig or Decitrig rule while you are looking up the next assignment. *This* new killer-diller can also solve vectors involving *hyperbolic* functions! Doesn't that set your teeth on edge?

Hyperbolic vectors are an old horror for Electrical Engineers who work for Public Utilities. They occur over and over again in transmission line problems and in some other special cases. When you need them, you need them bad. Most people live all their lives without ever meeting one. If you're going off the deep end over Electrical Engineering *you'd* better keep them in mind.

Now the Log Log Duplex Vector rule is exactly the same as the Log Log Duplex Decitrig *except* that it has two hyperbolic scales, and the DI and K scales have been omitted to make room for these new friends.

The new scales are called Th, Sh1 and Sh2. Th is a scale of hyperbolic tangents. Sh1 and Sh2 are a continuous scale of hyperbolic sines, in two parts. All of them refer to scale "D."

They tell me you can slay hyperbolic vector problems with the Log Log Duplex Vector . . . but you'll have to figure it out for yourself whether you need this type or not.

Me, I'd run a mile from hyperbolic functions!

And Now for the "COMMERCIAL"

Every time a manufacturer gets out a booklet, some chapter is usually reserved for a fight talk on what a good manufacturer he is and why his products are better than others. You've got to expect it. After all, who pays the printer? And who pays me?

In this case I can make it brief. Why? Because, if you buy a really professional slide rule, *the chances are ten to one that it will be made by Keuffel & Esser Co.!* That's the way the cards fall. That's the way things are.

There must be a good reason for this—and there certainly is. A slide rule is a precision instrument. A good one will last a long time, in fact, for a lifetime unless you abuse it. You've got to look ahead for 10, 20, 30 or even 40 years if you want to be sure you are getting your money's worth.

You want to be sure that the scales, and the arrangement of the scales have been designed and developed by experts and that they have been used in the field by enough practicing Engineers to get the "bugs" out of them.

You want to be sure that the mahogany and the white facings have been bonded and seasoned properly to maintain a close partnership throughout the years to come. You even want to be sure that you're getting mahogany, when it comes to that.

You want to be sure that the graduations are accurately spaced, deeply and cleanly cut and properly filled for permanent contrast. Ragged or shallow graduations wear off after a while.

You want to be sure that the end plates and indicator frame are properly designed and built to hold perfect alignment and not rattle in any kind of weather. This is particularly important on two faced rules, where reference must be made from one side to the other.

You want to be sure that the case is well sewn and made of fine selected leather. It should be not only good looking, but designed to protect the rule against breakage and to stand up under hard service.

How can you be sure of so many things? You can't—unless you have

plenty of time and all the testing equipment of the Bureau of Standards. You can't always tell a whole lot by looking at rules, no matter how carefully you try to make a comparison. You've got to have faith in the manufacturer.

You've got to choose a manufacturer you can have faith in . . .

So now for the commercial . . .

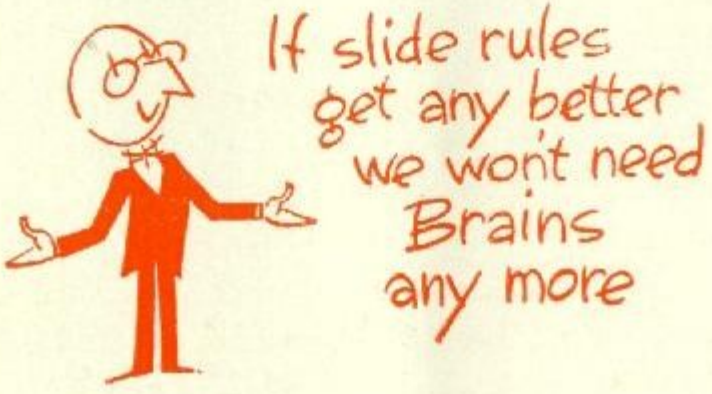
Keuffel & Esser Company has been in the precision instrument business at Hoboken, N. J. since 1867. It is the oldest and largest manufacturer of drawing instruments and materials, surveying instruments and equipment, slide rules and calculating instruments in the United States—if not in the entire world. Without the formality of a written guarantee, K&E stands four square behind every product it sells. That's why the K&E trademark has become an engineering tradition all over the civilized world.

You'll love your K&E slide rule like a Stradivarius, once you have bought one.

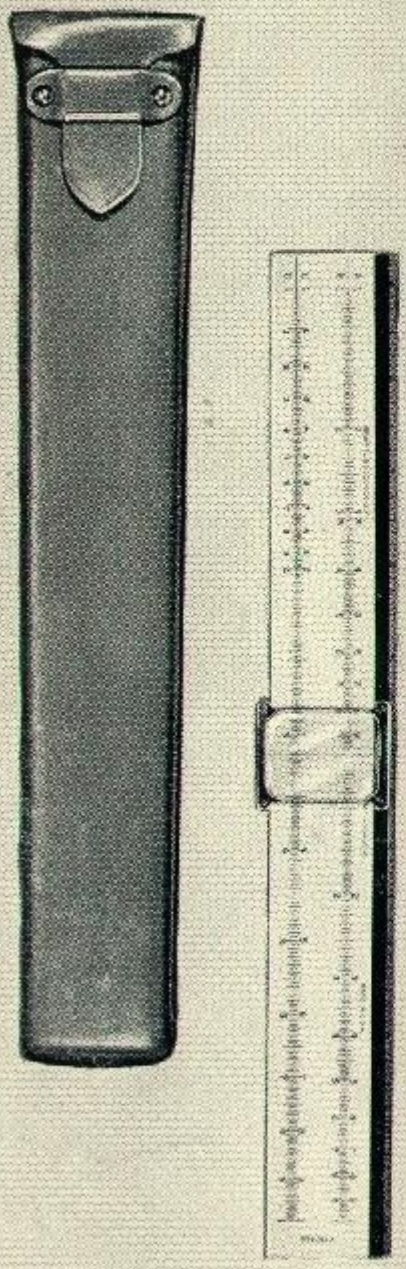
And that's all there is to it, except for this: don't buy *any* slide rule that doesn't conform to the recommendations of your faculty advisor, your math professor or your engineering department. They may have "ground rules" that are pretty important.

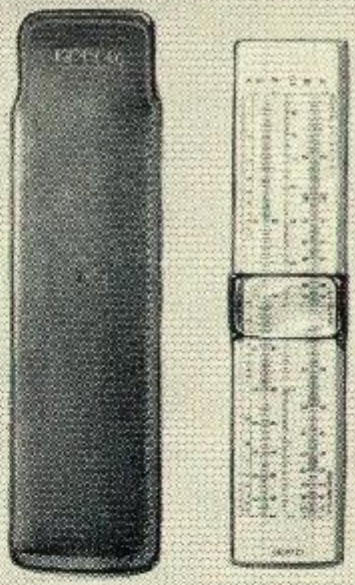
Good luck to you in your chosen profession . . .

don herold

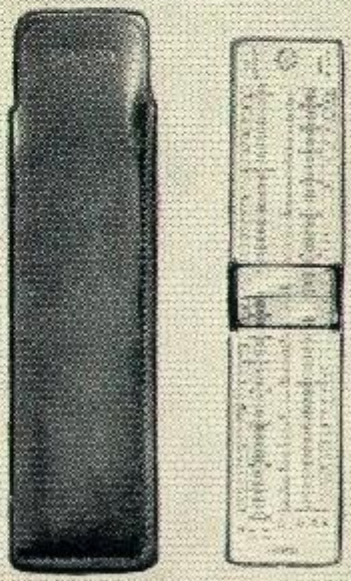


N 404T S—K&E ADJUSTABLE (MANNHEIM) Slide Rule 10 in., engine divided graduations on permanent white facings. Improved glass indicator, with stainless steel rim. Case of selected leather. Complete with instruction book . . $7.00

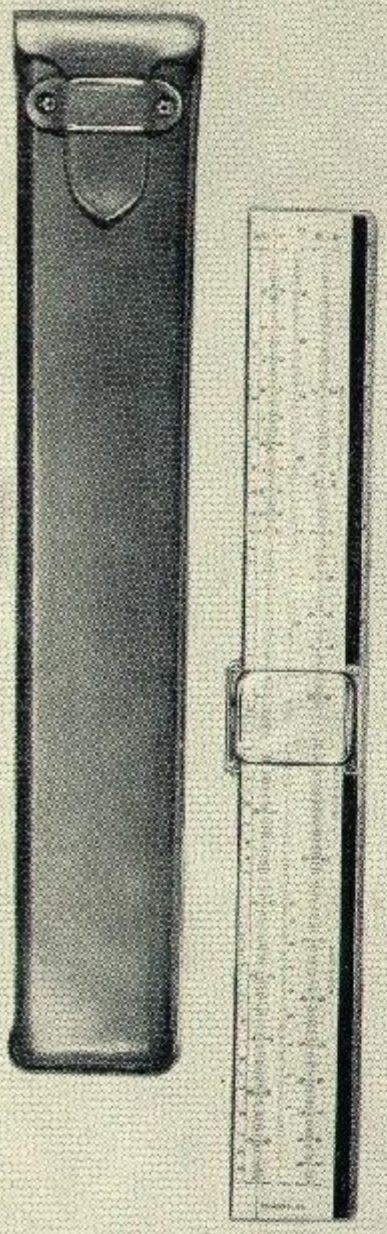




4097 C—EVER-THERE Slide Rule, 5 in., white Xylonite, engine divided, improved glass indicator, with logarithmic and trigonometrical scales; in high-grade leather sheath. Complete with instruction book . . $3.75

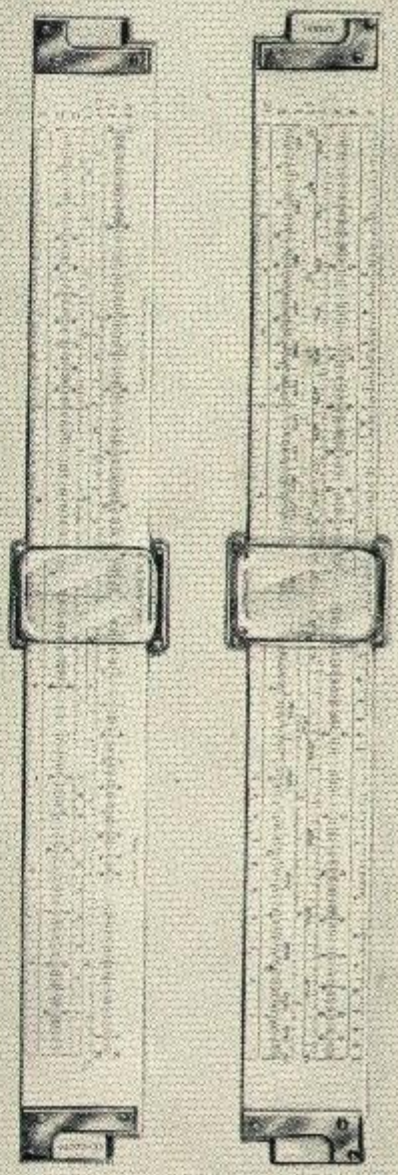


4097 D—EVER-THERE Slide Rule, 5 in., white Xylonite, engine divided, improved glass indicator; with logarithmic, trigonometrical and folded scales, in high-grade leather sheath. Complete with instruction book $4.25



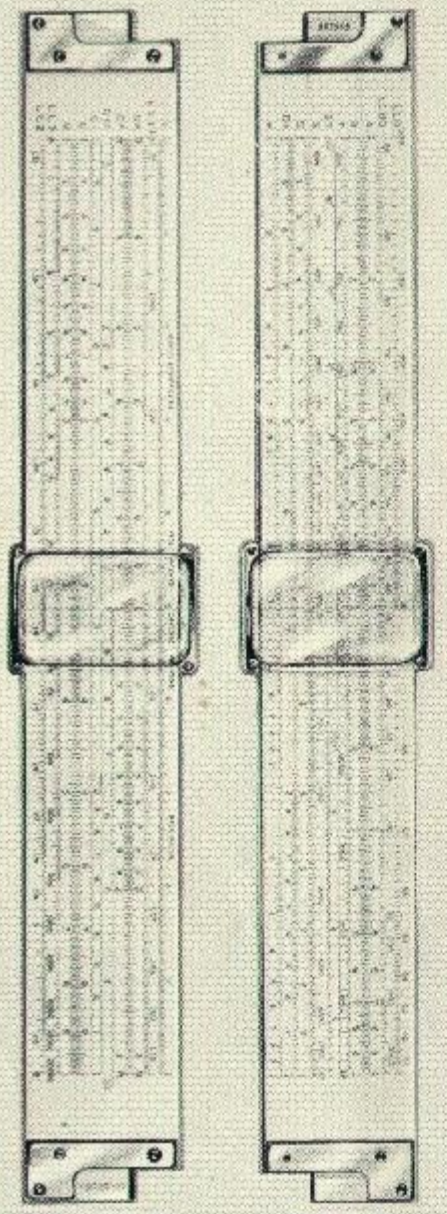
4070-3S—**POLYPHASE DUPLEX TRIG** Slide Rule, **K&E ADJUSTABLE** 10 in., engine divided graduations on permanent white facings. Improved glass indicator, with stainless steel rim. Trigonometrical scales divided in degrees and minutes, Case of selected leather. Complete with instruction book $11.25

4071-3S—**POLYPHASE DUPLEX DECITRIG** Slide Rule. Like #4070-3S but with Trig scales divided in degrees and decimals of a degree, $11.25



FRONT REAR

N 4053-3S—**POLYPHASE** (Mannheim) Slide Rule, **K&E ADJUSTABLE** 10 in. engine divided graduations on permanent white facings. Improved glass indicator, with stainless steel rim. Case of selected leather. Complete with instruction book..$7.80

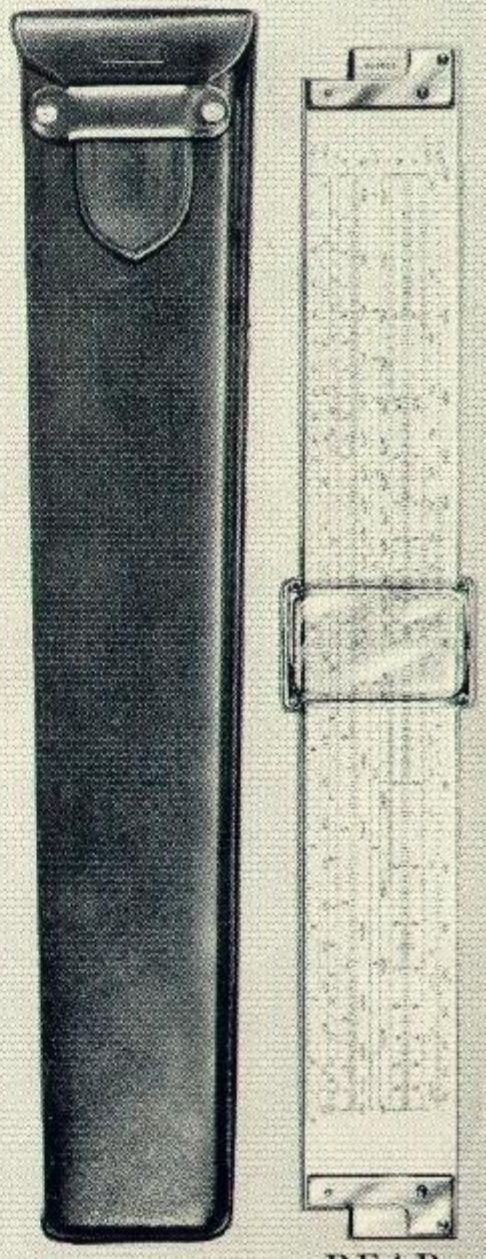


FRONT REAR

4080-3S—LOG LOG DUPLEX TRIG Slide Rule, K&E ADJUSTABLE 10 in., engine divided graduations on permanent white facings. Improved glass indicator, with stainless steel rim. Trigonometrical scales divided in degrees and minutes. Case of selected leather. Complete with instruction book $12.75

4081-3S—LOG LOG DUPLEX DECITRIG Slide Rule. Like 4080-3S but with Trig scales divided in degrees and decimals of a degree $12.75

4083-3S—LOG LOG DUPLEX VECTOR Slide Rule. (front face same as 4080-3) K&E ADJUSTABLE 10 in., engine divided graduations on permanent white facings. Improved glass indicator, with stainless steel rim. Case of selected leather. Complete with instruction book $14.00



REAR

IF YOUR SLIDE RULE IS IDENTIFIED BY ONE OF THESE **K&E** TRADE MARKS:

K&E
POLYPHASE
POLYPHASE DUPLEX TRIG
POLYPHASE DUPLEX DECITRIG
LOG LOG DUPLEX TRIG
LOG LOG DUPLEX DECITRIG
LOG LOG DUPLEX VECTOR
EVER-THERE

YOU CAN BE SURE THAT IT WAS MADE BY

KEUFFEL & ESSER CO.

(All K&E slide rules are, of course, made in U.S.A.)

printed in U.S.A.
by
COLLINS-DOAN CO.
JERSEY CITY, N. J.