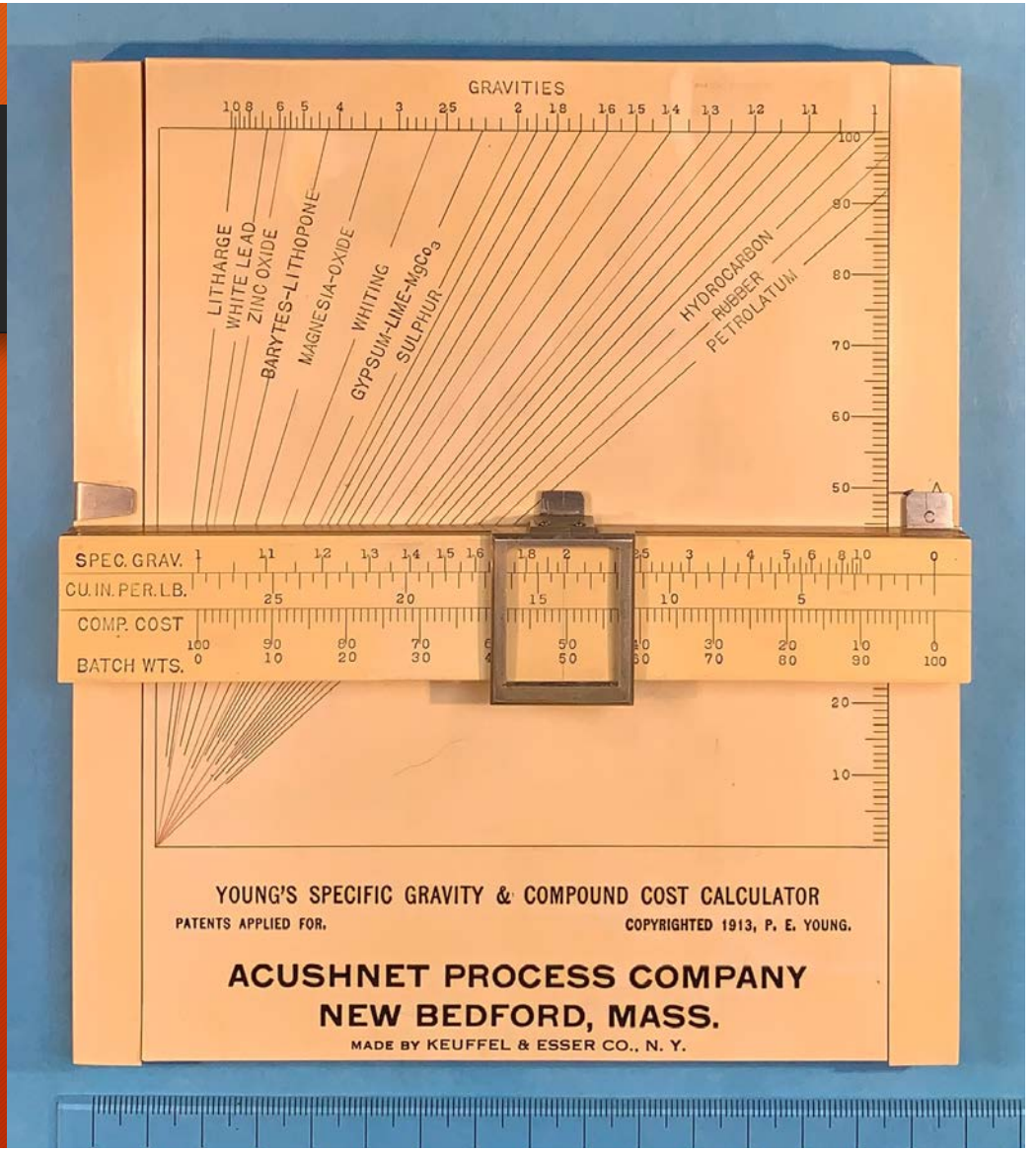
Keuffel & Esser Young's Specific Gravity & Compound Cost Calculator

M. H. Frey

IM2024

Young's Specific Gravity & Compound Cost Calculator



P. E. Young & Acushnet Process Company

Philip Endicott “Skipper” Young

- Born December 1, 1885, Dorchester, Massachusetts
- Attended public school in Dedham, Massachusetts
- Married his childhood sweetheart Edith Bulkley Ames, 1910, 2 children: Edith Endicott (1912) & Richard B. (1916)
- Graduated from the Massachusetts Institute of Technology with a degree in Mechanical Engineering
- First job with Goodyear Tire & Rubber Company in Akron, Ohio
- Formed a partnership, Peabody, Young, and Weeks on March 10,1910 that became the Acushnet Process Company
- Died June 17, 1955, New Bedford, Massachusetts

Ref: 1 & 2

Acushnet Process Company

- Founded 1910 in Acushnet, Massachusetts
- Initial business: Deresinating Mexican Guayule as a substitute for natural rubber from the Amazon valley in Brazil.
- Follow on Businesses:
  - ~1915 Reclaimed uncured friction rubber
  - 1922 Rubber toys: turtles, dolls, toy boats, teddy bears, etc.
  - 1924 Rubber sundries: hot water bottles, enema bags, bulbs for atomizers, ear syringes, etc.
  - 1930-1932 Golf balls with improved center of gravity
  - 1937 Gas masks for U.S. Army
  - Early 1940's, World War II, A-10 oxygen mask and goggles for Air Force
  - Post World War II, Golf balls and expansion into other golf items.

Ref: 1

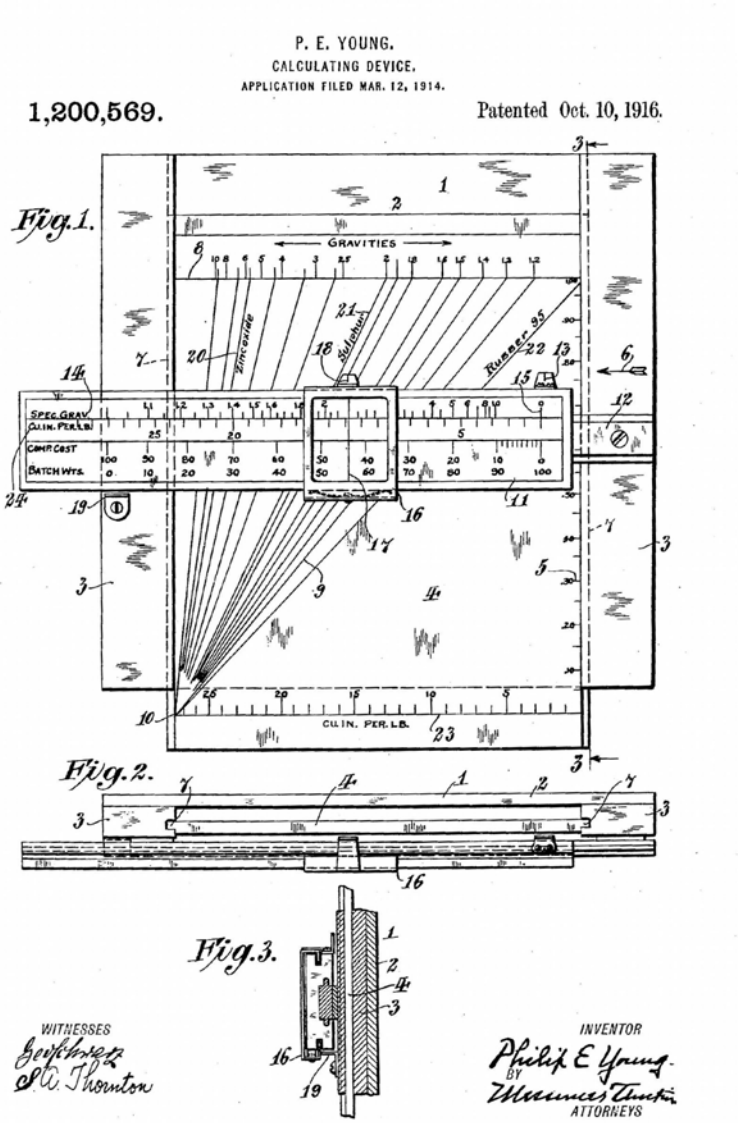
Acushnet Process Company

- Went fully public in 1966 as Acushnet Company
- Acushnet Company purchased by American Brands (Fortune Brands) in 1976
- Rubber compounding business spun off as Precix in 1995.
- Purchased by Fila Korea, Ltd. and Mirae Asset Private Equity June 29, 2011, as Acushnet
- Listed on the New York Stock Exchange as Acushnet Holdings Corporation, October 28, 2016

Ref: 1, 3

Young's Specific Gravity & Compound Cost Calculator

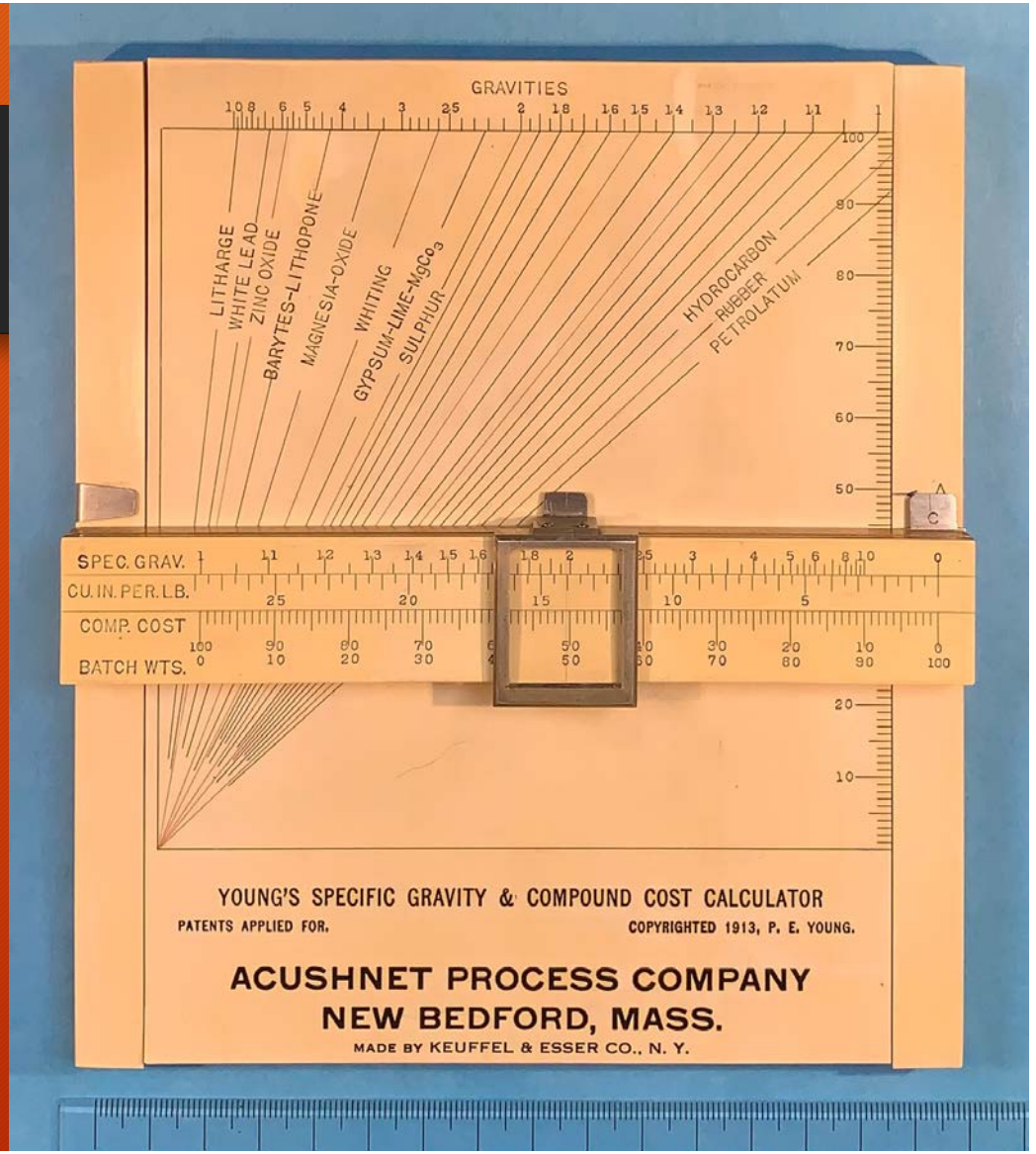
- Copyright 1913 P. E. Young
- Patent Applied for March 12, 1914
- Patented October 10, 1916,
- US Patent 1,200,569
- Manufactured by Keuffel & Esser Co.



Ref: 4

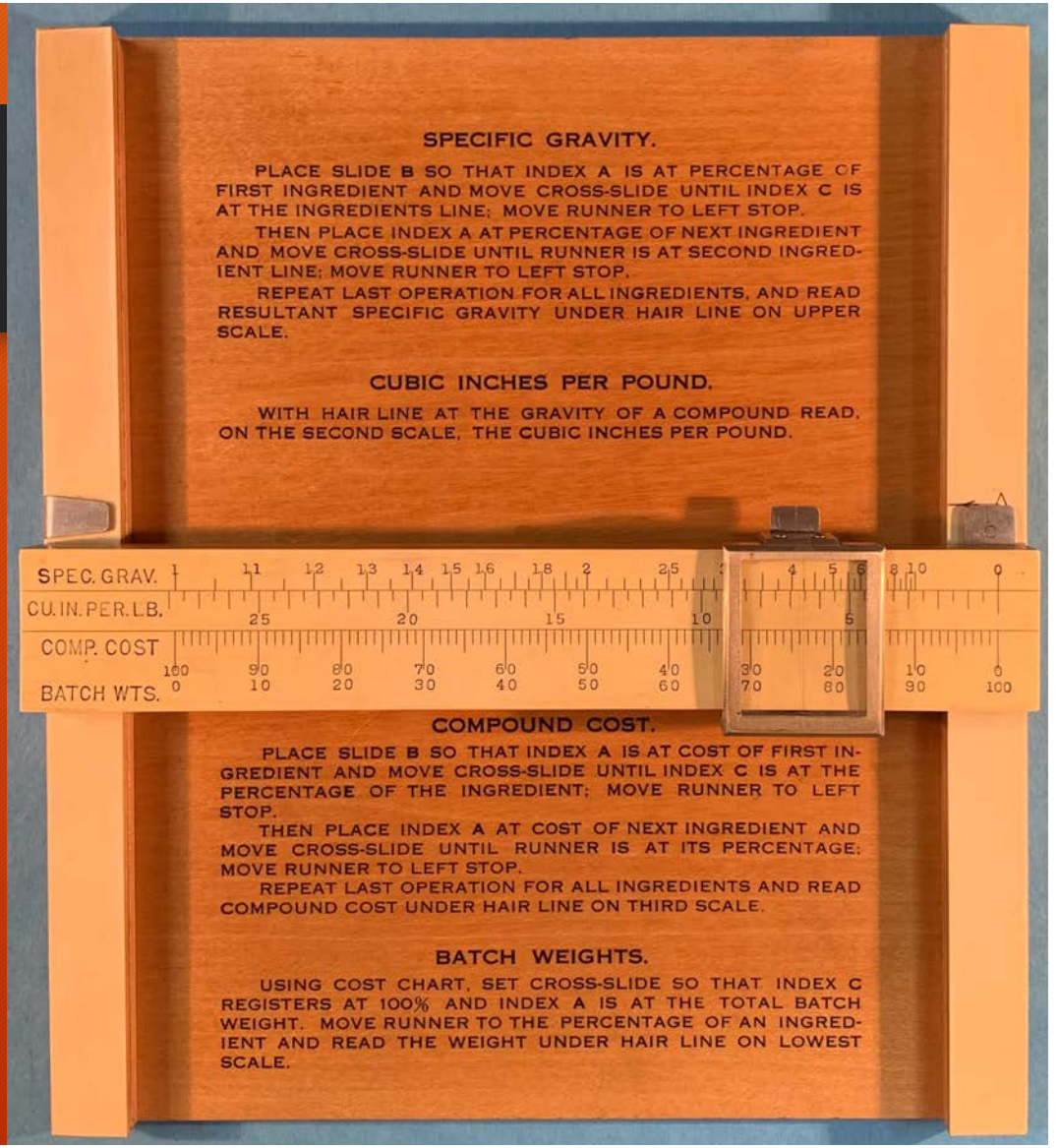
Young's Specific Gravity & Compound Cost Calculator

- Produced by Keuffel & Esser
  - Does not appear in any catalog
- Reference Points:
  - A: Select percentage of a component
  - B: List of Components
  - C: Pointer on Cross-Slide for selecting a component
    - End Stamp 50 on Cross-Slide & Body Rail
  - Runner (Cursor) for memory
- Front Scales on Cross-Slide:
  - SPEC. GRAV.
  - CU. IN. PER LB.
  - COMP. COST
  - BATCH WTS.
- Materials
  - Appears to be Boxwood
  - Scales appear to be laminate Nitro Cellulose
  - The Beveled Metal Frame Runner (Cursor) is consistent with K&E cursors of the period.
- Dimensions
  - 15.7 cm X 17.7 cm x 2.3 cm (6 3/16” x 7” x 15/16”)



Calculations

- Specific Gravity
- Cubic Inches per Pound
- Compound Cost
- Batch Weights



Specific Gravity

- Definition from Wikipedia: “Specific Gravity, is a dimensionless quantity defined as the ratio of the density (mass of a unit volume) of a substance to the density of a given reference material.”
- The modern term is Relative Density
- The standard reference material for liquids and solids
  - Water at 4°C

Ref: 5

Compounds Covered

Material	Formula	Calculator SP Gr	cu in /lb
Litharge, yellow lead oxide	PbO	9.50	2.9
White Lead	$2PbCO_3 \cdot Pb(OH)_2$	6.60	4.2
Zinc Oxide	ZnO	5.75	4.8
Barytes Lithopone	$BaSO_4$*ZnS	4.26	6.5
Magnesia Oxide	MgO	3.28	8.4
Whiting	$CaCO_3$	2.60	10.6
Gypsum Lime MgCO3	$CaSO_4 \cdot 2H_2O$ * CaO *$MgCo_3$	2.22	12.5
Sulphur	S	2.00	13.8
Hydrocarbon	C_nH_{2n+2}	1.00	27.7
Rubber	Latex Rubber	0.94	29.4
Petrolatum	Petroleum jelly	0.90	30.9

Ref: 6

Compounding Specific Gravity Calculation Example

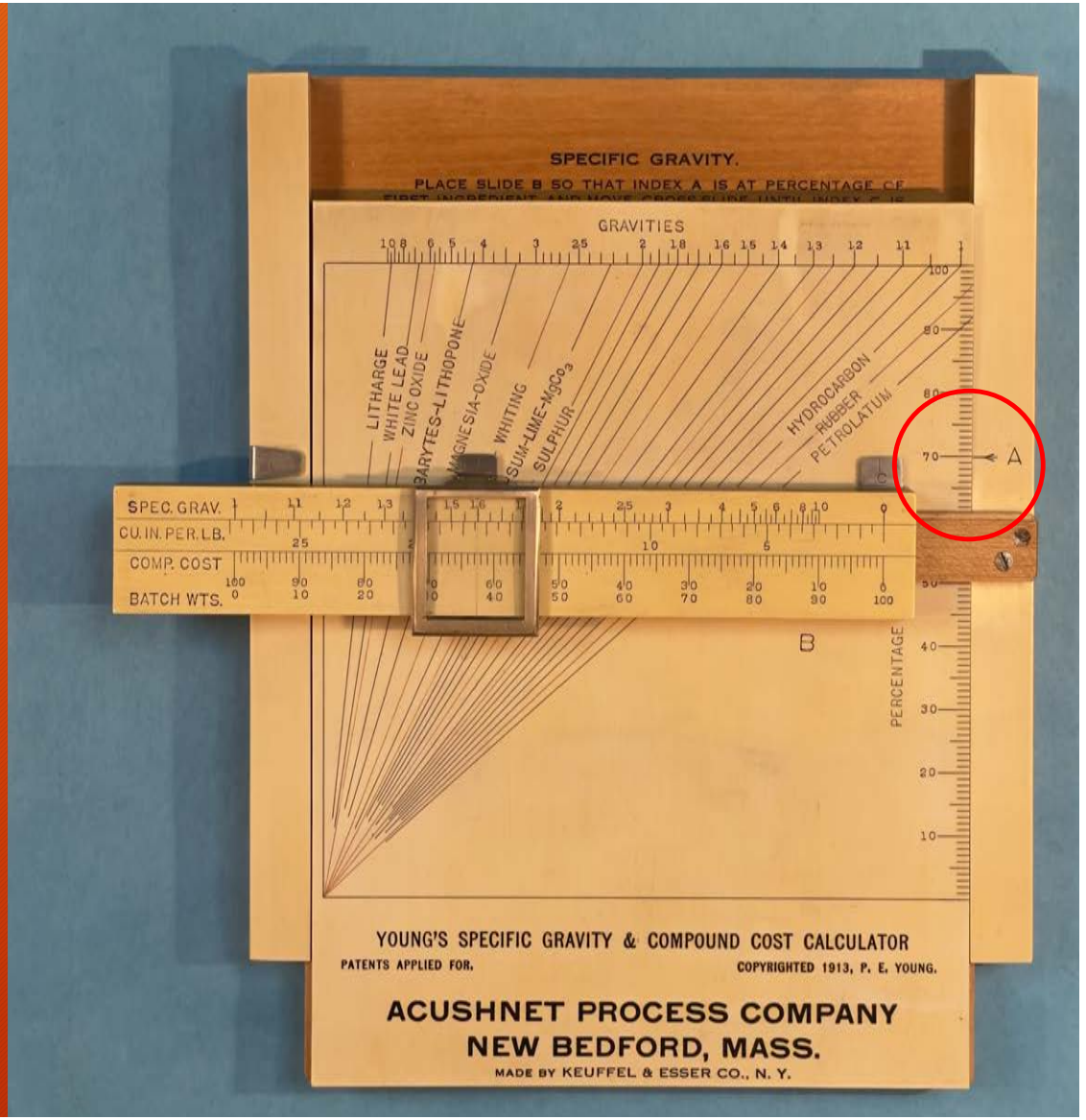
$$\text{Sp. Gr.}_c = \frac{1}{\sum_1^n \frac{M_n / M_t}{Sp.Gr._n}}$$

- Desired compounded rubber:
- 125 Lbs.
- 70% Rubber
- 30% Whiting

Material	Formula	Calculator SP Gr	cu in /lb	Mass /lb	Percent Mass	Volume Cu in
Whiting	$CaCO_3$	2.60	10.6	37.5	**30**	14.42
Rubber	Latex Rubber	0.94	29.4	87.5	**70**	93.09
Total				125	**100**	107.51
					Sp. Gr.	**1.163**
					cu In / lb	**23.8**

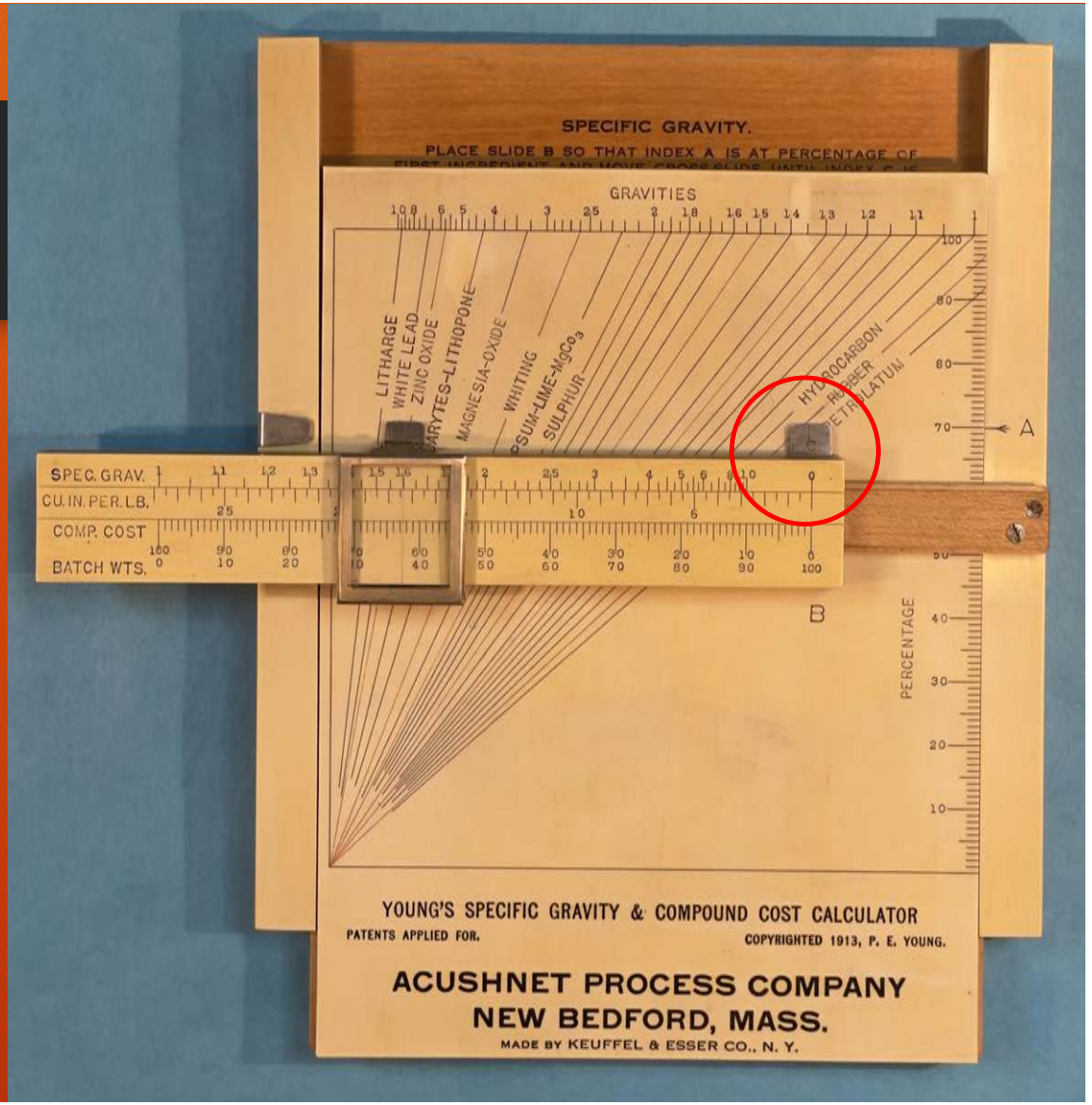
Step 1

- Place slide B so that index A is at the percentage of the first ingredient.
- 70%



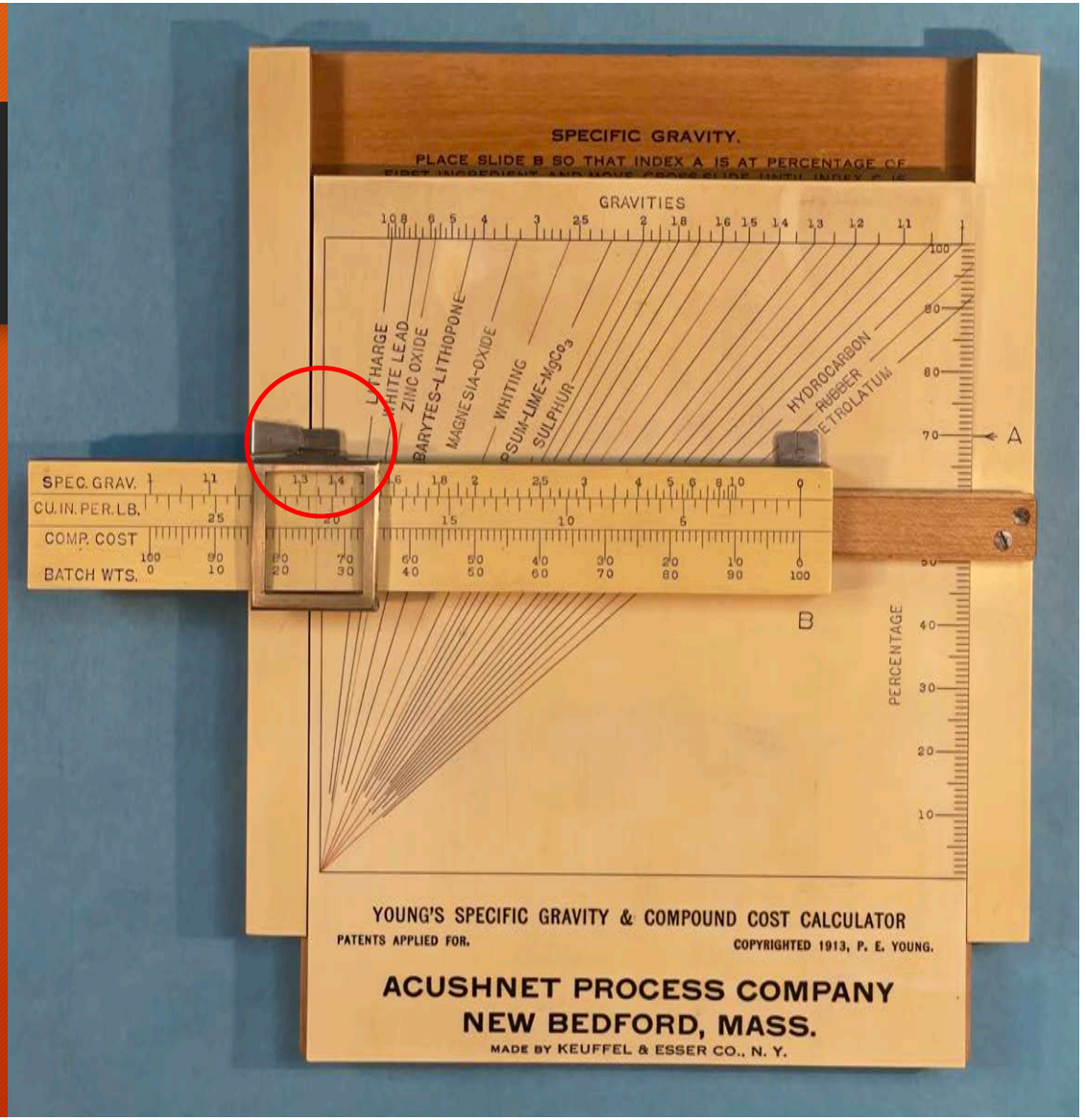
Step 2

- Move the Cross-Slide until the index C is at the ingredient's line
- Rubber



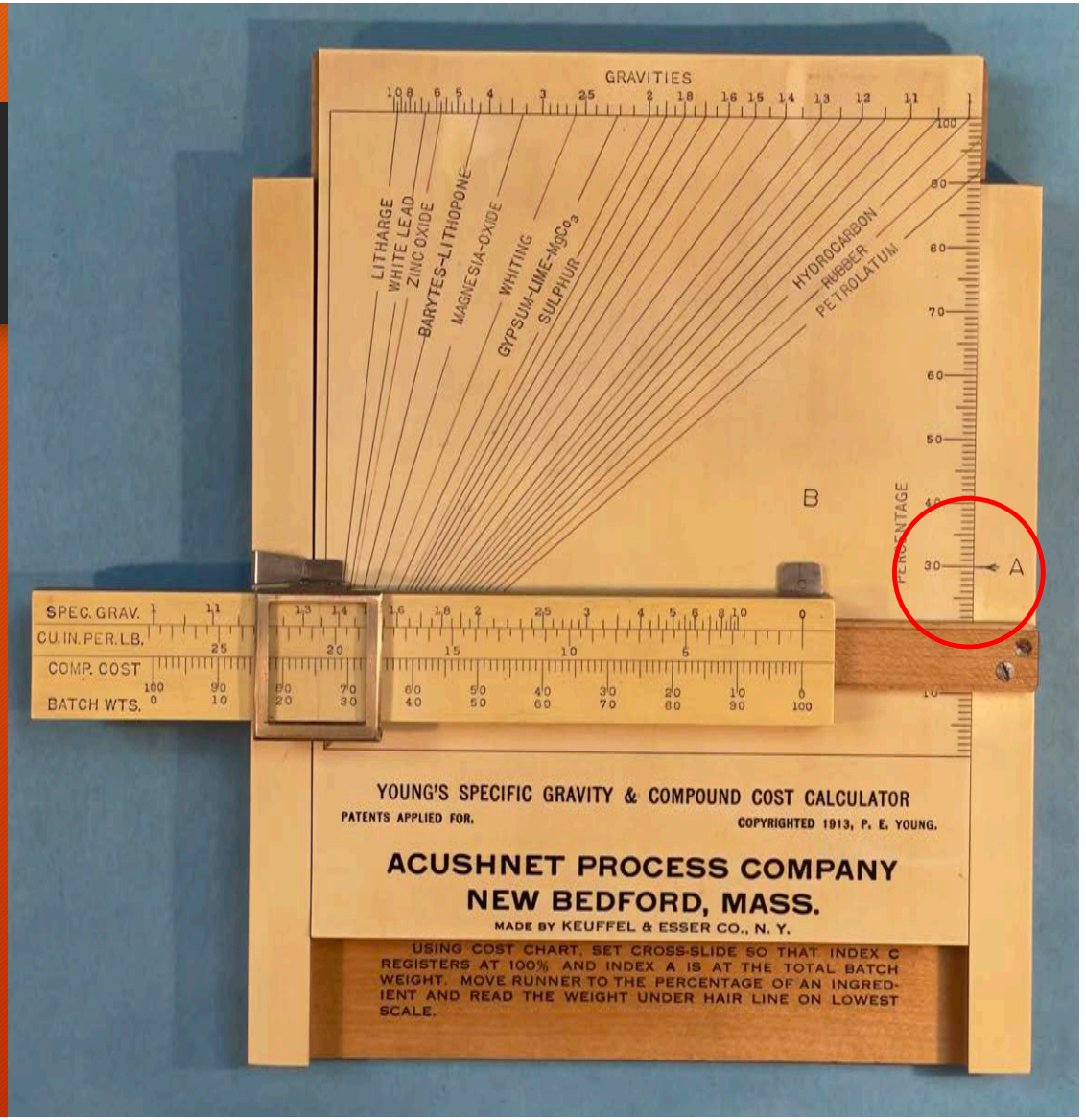
Step 3

- Move the Runner to the left stop



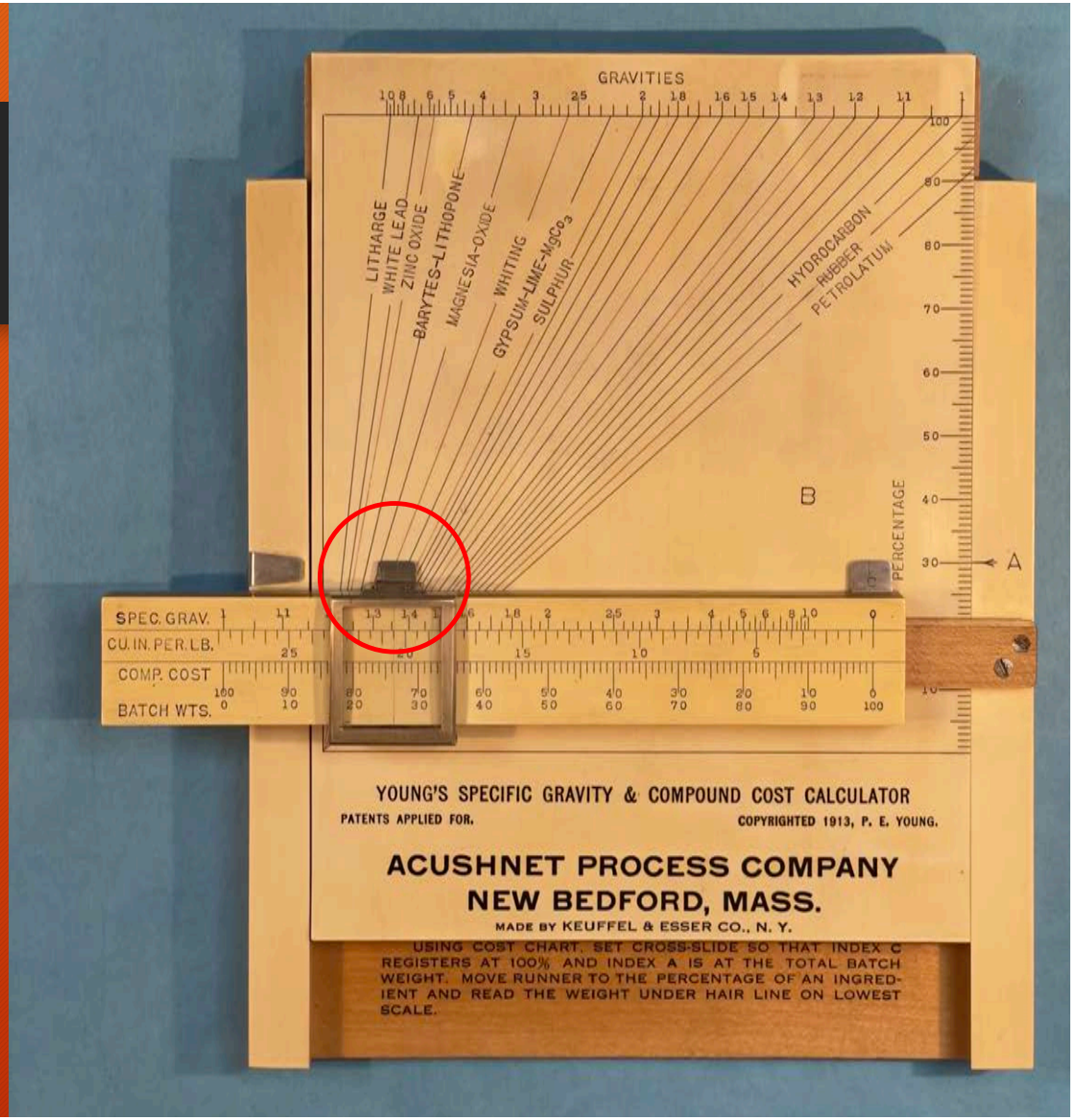
Step 4

- Then place the index A at the percentage of the next ingredient.
- 30%



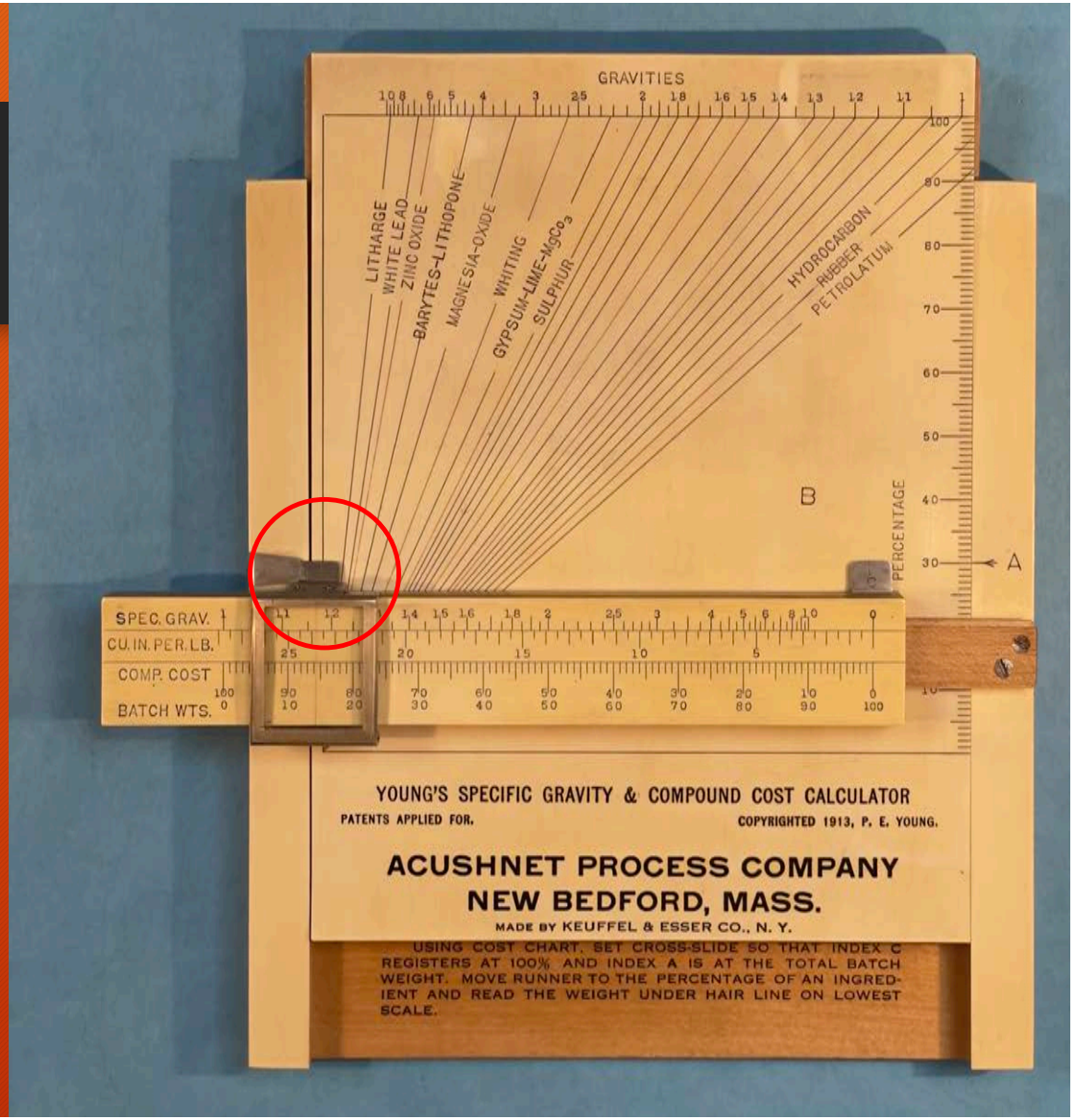
Step 5

- Move the Cross-Slide & Runner until the Runner is at the next ingredient line.
- Whiting



Step 6

- Move the Runner to the left stop.

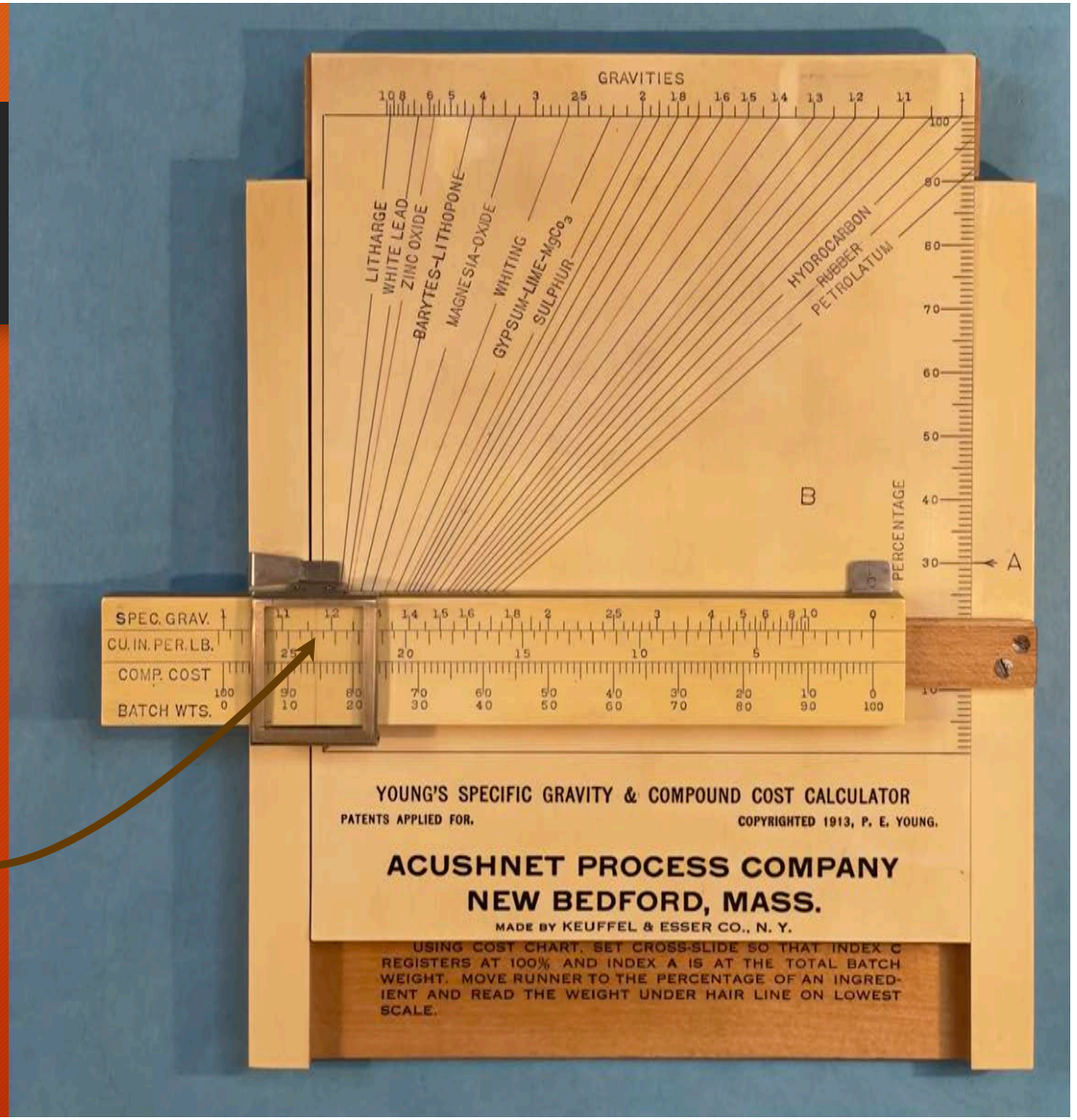


Step 7

- Read the Specific Gravity under the hairline position on the upper SPEC. GRAV. scale

1.16

- OR
- Repeat the from step 4 for the next ingredient. The runner will always end up at the batch Specific Gravity.



Calculations

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- Compound Cost
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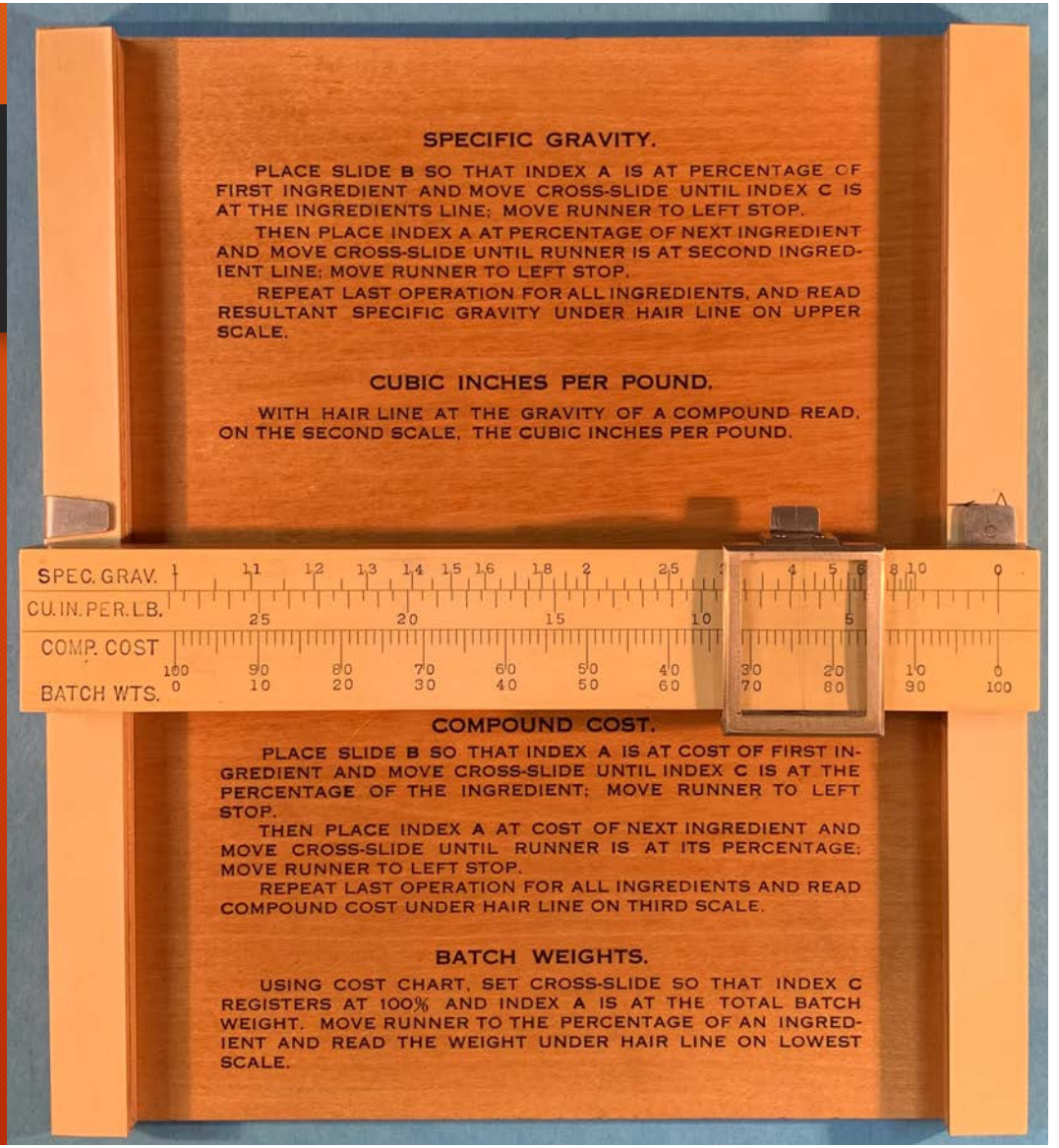
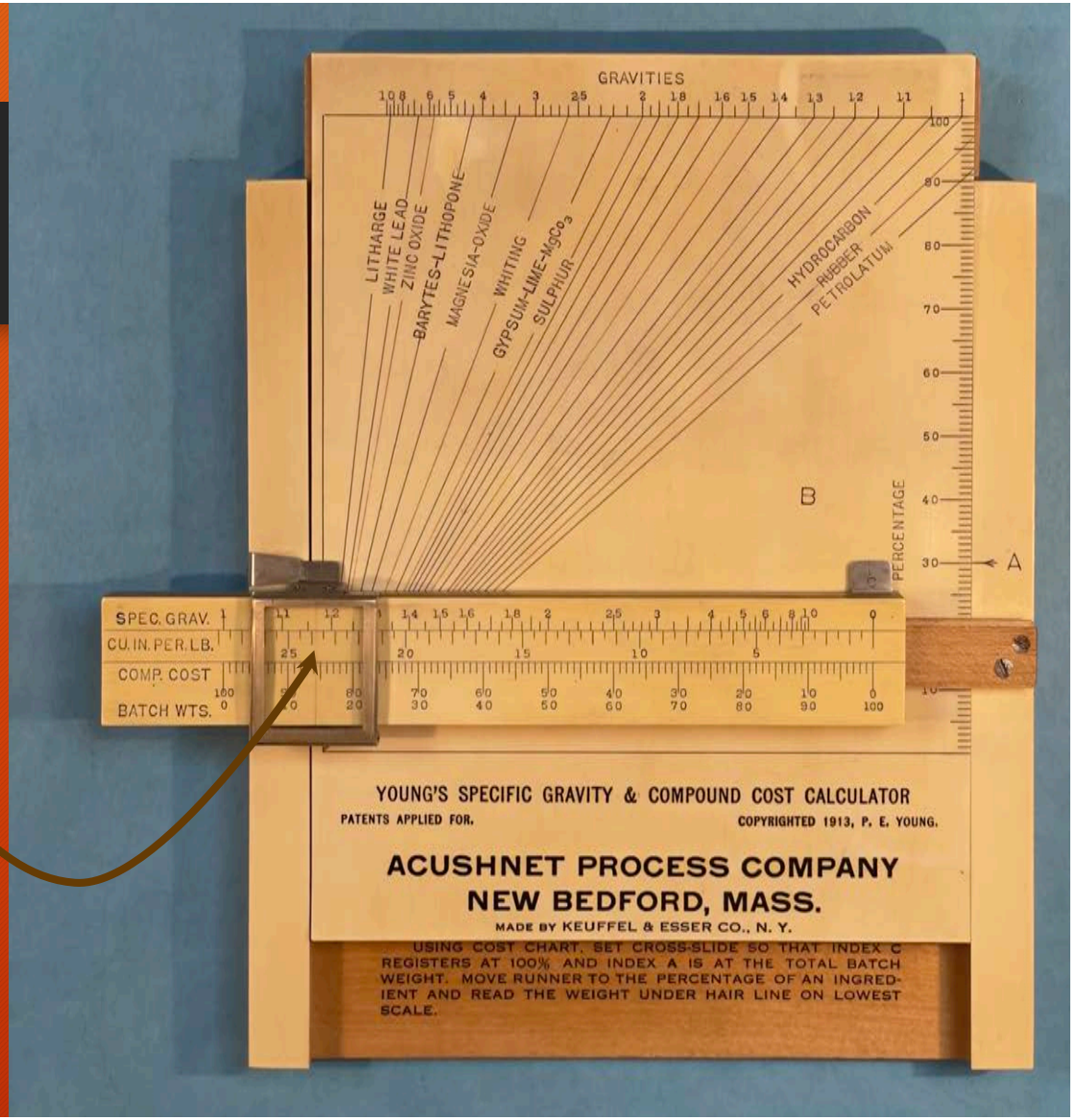


Cubic Inches per Pound

- With the hair line at the gravity of the compound read on the second scale the cubic inches per pound.

2.38 CU. IN. PER LB.



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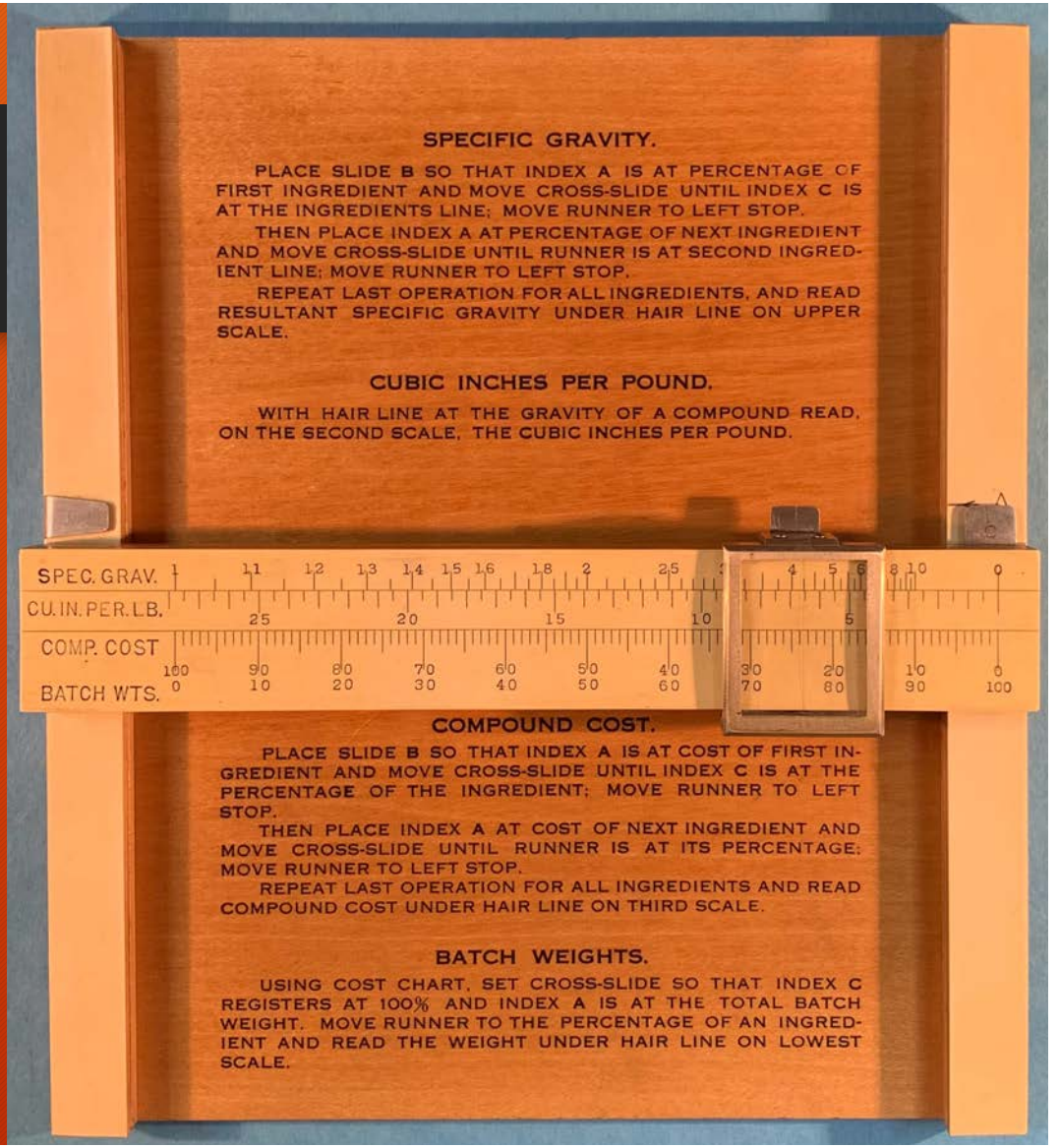


Compound Cost Calculation Example

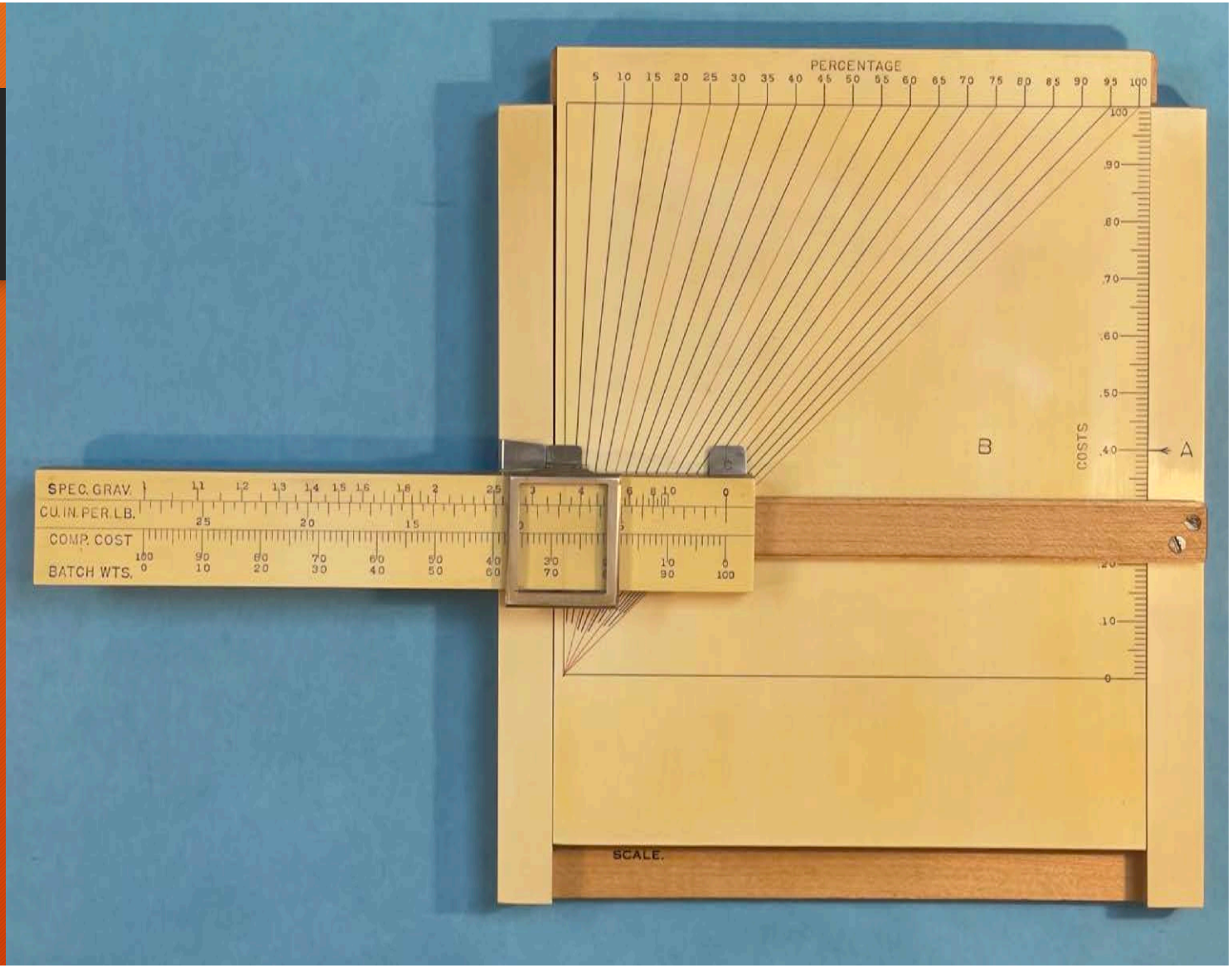
- Desired compounded rubber:
- 70% Rubber @ 0.40
- 30% Whiting @ 0.70

Cost	Formula	Unit Cost	Percent Mass	Comp. Cost
Whiting	$CaCO_3$	0.7	30	21
Rubber	Latex Rubber	0.4	70	28
Total				**49**

Compound Cost

- 70% Rubber @ 0.40

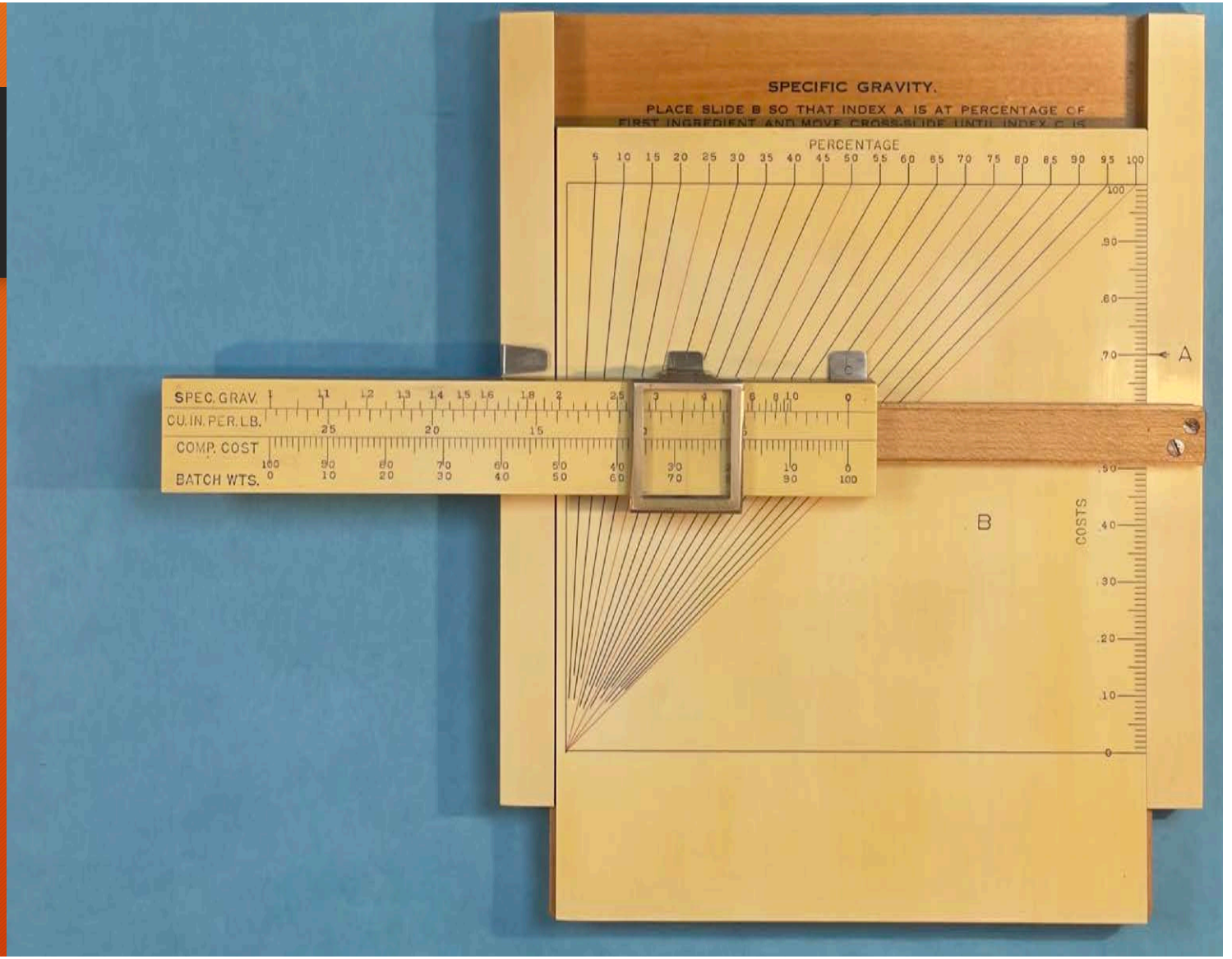
- Use Cost Chart Scale on back
- Set Cost 0.40 to A
- Set C to 70%
- Slide Runner to left



Compound Cost

- 30% Whiting @ 0.70

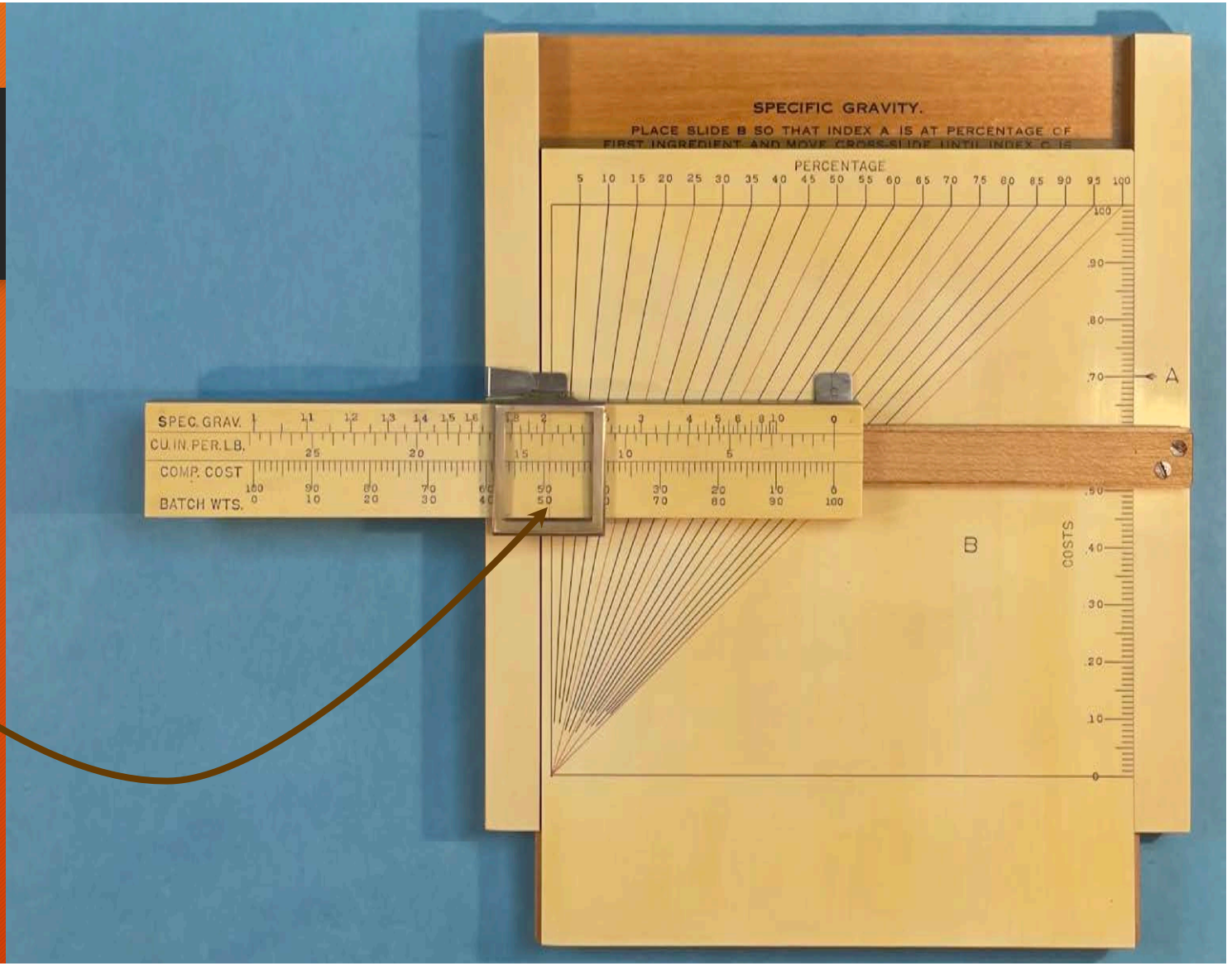
- Set Cost 0.70 to A
- Move Cross-Slide and the Runner to 30%
- Slide Runner to left



Compound Cost

- Read Cost at Runner on COMP. COST Scale

0.49 per 100 weight



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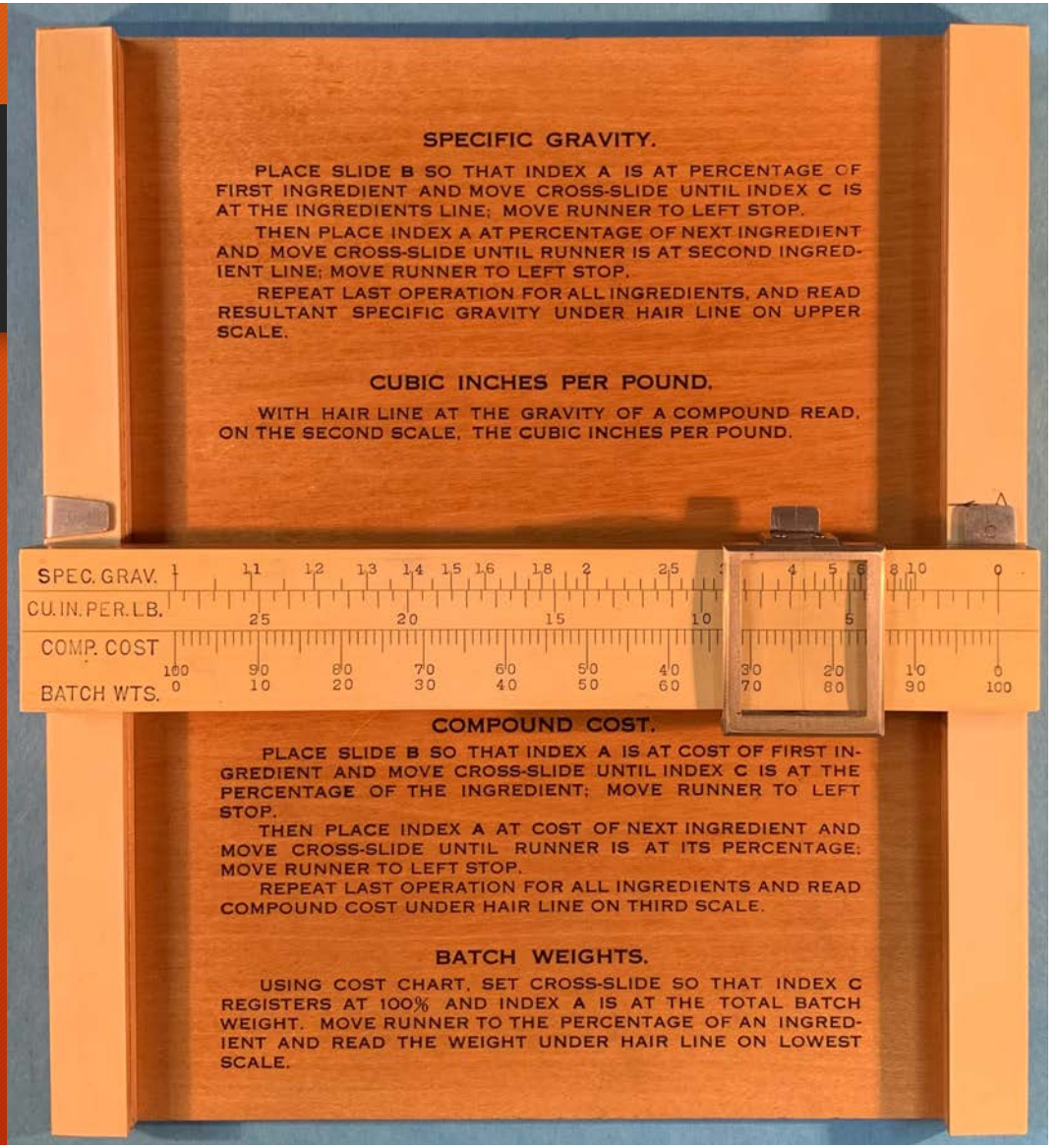
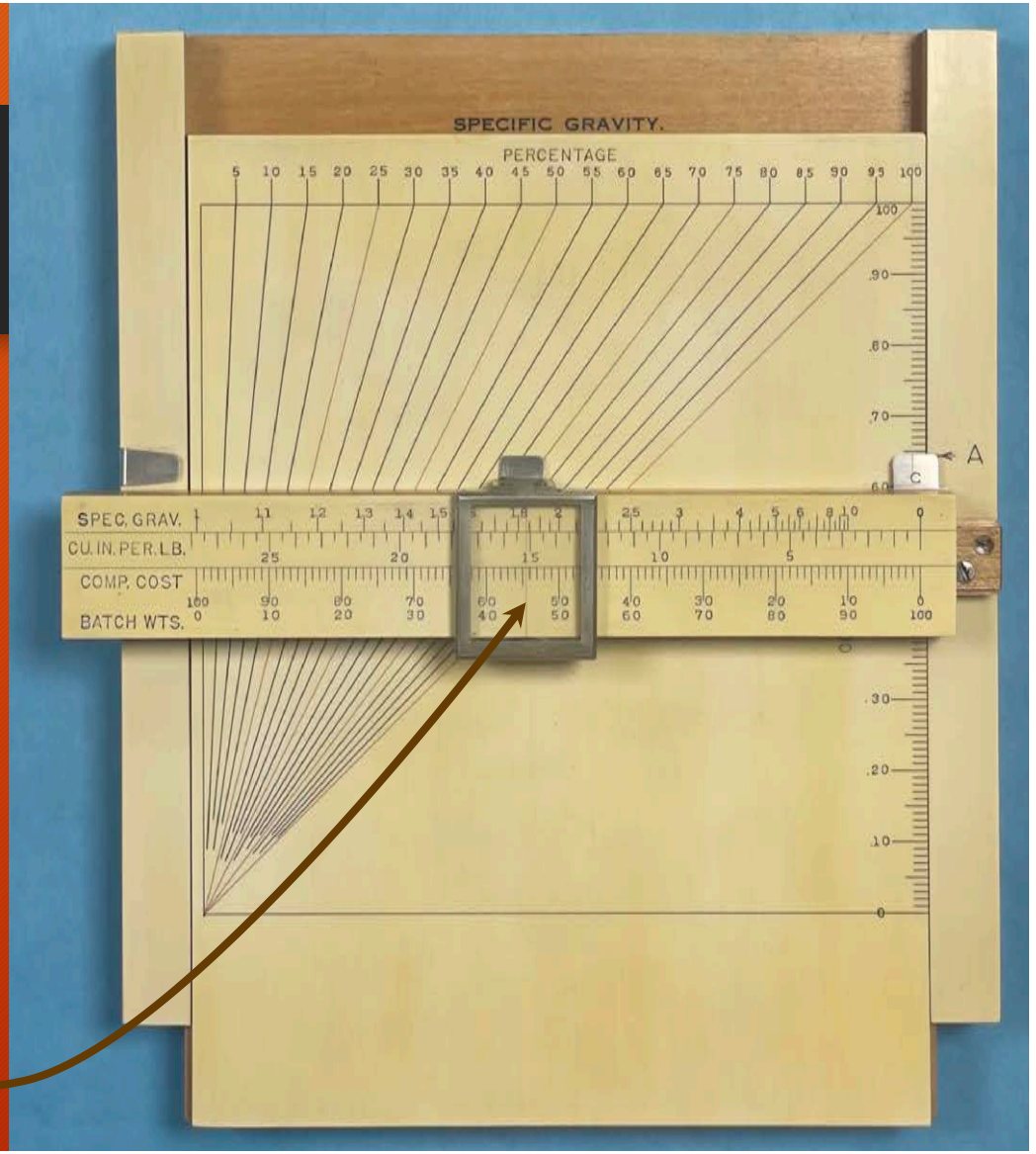


Batch Weight

- Use Cost Chart Scale on back
- Set Cross-Slide to 100%
- Set B to total batch weight at A
- Slide Runner to percent of batch
- Read Component weight on lowest scale

- 70% of 65 lbs = 45.5 lbs



Contemporary Literature

The India Rubber World
1914

A NEW SLIDE RULE FOR RUBBER MEN.

P. E. YOUNG, of the Acushnet Process Co., has devised a calculating machine for the rubber worker which is an adaptation of the slide rule to this particular business.

By looking at the cut it will be seen that there is a kind of slide rule placed over a sliding board with most of the compounding ingredients arranged on this board according to their specific gravity. The spacing is according to the logarithmic scale and the slide rule has a corresponding scale marked specific gravity which is complementary to the scale on the board.

ACUSHNET PROCESS COMPANY
NEW BEDFORD, MASS.

Each ingredient has a line on the board running to the zero point at bottom. Along the side of the board is a scale running to 100 and the fixed base board has an index mark at *A*.

On sliding out the face board directions for operating the apparatus are disclosed printed on the base board.

SPECIFIC GRAVITY.

To obtain the specific gravity of any proposed compound you first place the board in such position that the percentage of rubber is opposite the index *A*. Then move the slide across till the index *C* which is attached to the slide is on the line of the ingredient. Then move runner to left to the stop. Repeat the above operation for each mixing ingredient till the 100 per cent. of ingredients are accounted for and then read the specific gravity indicated under the hair line on the glass face of the runner.

As an example we make a compound of 45 per cent. rubber, 45 per cent. zinc oxide, 5 per cent. magnesium carbonate and 5 per cent. sulphur. By making two settings of the board and four of the slide we read off immediately 1.675 as the specific gravity of the compound. Of course, this is based on the idea that all the ingredients are simple mixtures in the compound and no chemical combination is formed which would have a setting be made for the percentage and specific gravity of each constituent and a table of specific gravities of each element must be at hand or known. Then each reading must be copied down and some figuring done on paper before the correct gravity is arrived at.

On the rule there is a second scale under the gravities which shows the cubic inches per pound.

The sliding board is reversible and on the other side there is a ruling of percentages. Using this table, it is only necessary to place the slide at cost of first ingredient and move the cross-slide till index *C* is at the percentage, then move runner to the left till it meets the stop. Then place index *A* at cost of next ingredient and repeat till each ingredient is accounted for. The total cost will appear under the cross-hair of the reading glass on the runner.

Another computation which may be made is that of batch weights. In this case, using the cost chart, set the cross-slide so that index registers one hundred and index *A* is at total batch weight, move the runner to the percentage of the ingredient wanted and the weight will appear under the scratch line on the runner at the lowest line on rule marked "Batch Weight."

It would appear that this would prove a time saver for any one whose duty or interest requires the calculations outlined above on rubber compounds.

This article is useful not only to the rubber industry, but to other like industries. For example: If linseed oil is substituted for "rubber," as its specific gravity is .937, which is close to that of rubber, the calculation for the specific gravity of mixed paints may be made. In fact, such an instrument has been used in England for a long time.

The article is made by Keuffel & Esser Co., of New York, and is made in their careful and accurate style.

AMERICAN COTTON INDUSTRY WITHOUT A TRUST.

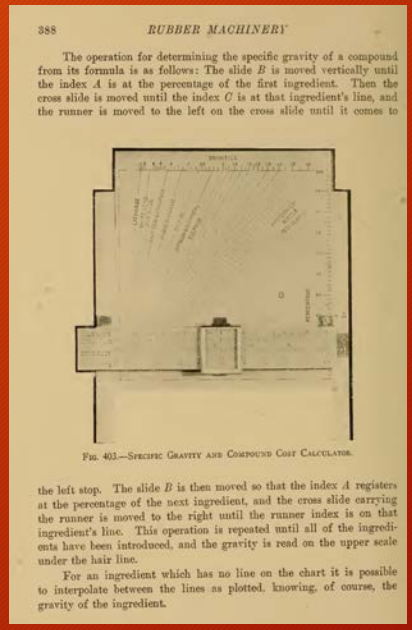
Mr. C. J. H. Woodbury, Secretary of the National Association of Cotton Manufacturers, is authority for the statement that those capable of giving sound opinions believe that there is an adequate cause for the superior quality of foreign cotton goods and for many of the economies in their production in the concentration of effort in the methods of cotton manufacturing, to which the law in Europe gives full acquiescence.

SKATING ON ROUGH ROADS.

Roller skating is a pastime that is exceedingly popular with young people everywhere, but for its thorough enjoyment it requires smooth walks or pavements. Application has been made for a patent that will enable a person to skate with comfort on rough roads. These skates are in reality a pair of ordinary bicycle wheels, a stiff iron rod being dropped from the hub and skating shoes being attached firmly to the iron rod, the sole of the shoe coming within about 3 inches of the ground. With this arrangement of shoe and firm attachment to the hub the skater is as secure as on the ordinary roller skates, while with the pneumatic tire he can, of course, go over fairly rough ground with perfect comfort. It is a rapid method of ground-covering, but as the weight of the skater naturally falls within the point of contact between the tire and the ground, it requires some practice to use this form of roller skate successfully.

While in this country cotton goods are packed for account of the mill, deliverable at some distant city, in England they are delivered to the customer in the cloth room of the mill. A different packing concern will then send its men to the cloth room, at the expense of the purchaser, packing the merchandise accord-

Rubber Machinery
1915 / 1920



388 *RUBBER MACHINERY*

The operation for determining the specific gravity of a compound from its formula is as follows: The slide *B* is moved vertically until the index *A* is at the percentage of the first ingredient. Then the cross slide is moved until the index *C* is at that ingredient's line, and the runner is moved to the left on the cross slide until it comes to

FIG. 403.—SPECIFIC GRAVITY AND COMPOUND COST CALCULATOR.

the left stop. The slide *B* is then moved so that the index *A* registers at the percentage of the next ingredient, and the cross slide carrying the runner is moved to the right until the runner index is on that ingredient's line. This operation is repeated until all of the ingredients have been introduced, and the gravity is read on the upper scale under the hair line.

For an ingredient which has no line on the chart it is possible to interpolate between the lines as plotted, knowing, of course, the gravity of the ingredient.

Ref: 7 & 8

References

1. A History of the Acushnet Company, The First 70 Years
   https://www.giftstogive.org/wp-content/uploads/2015/02/GiftsToGive_HistoryOfTheAcushnetCompany_DickYoungJr.pdf
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   1. Rubber Machinery by Henry C. Pearson, 1915 & 1920 eds. The India Rubber World, New York

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Thank you for your attention!

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Questions?