May 31, 1949. C. MESAVAGE 2,471,491

TREE VOLUME CALCULATOR

Filed April 26, 1946 2 Sheets-Sheet 1

Fig. 1

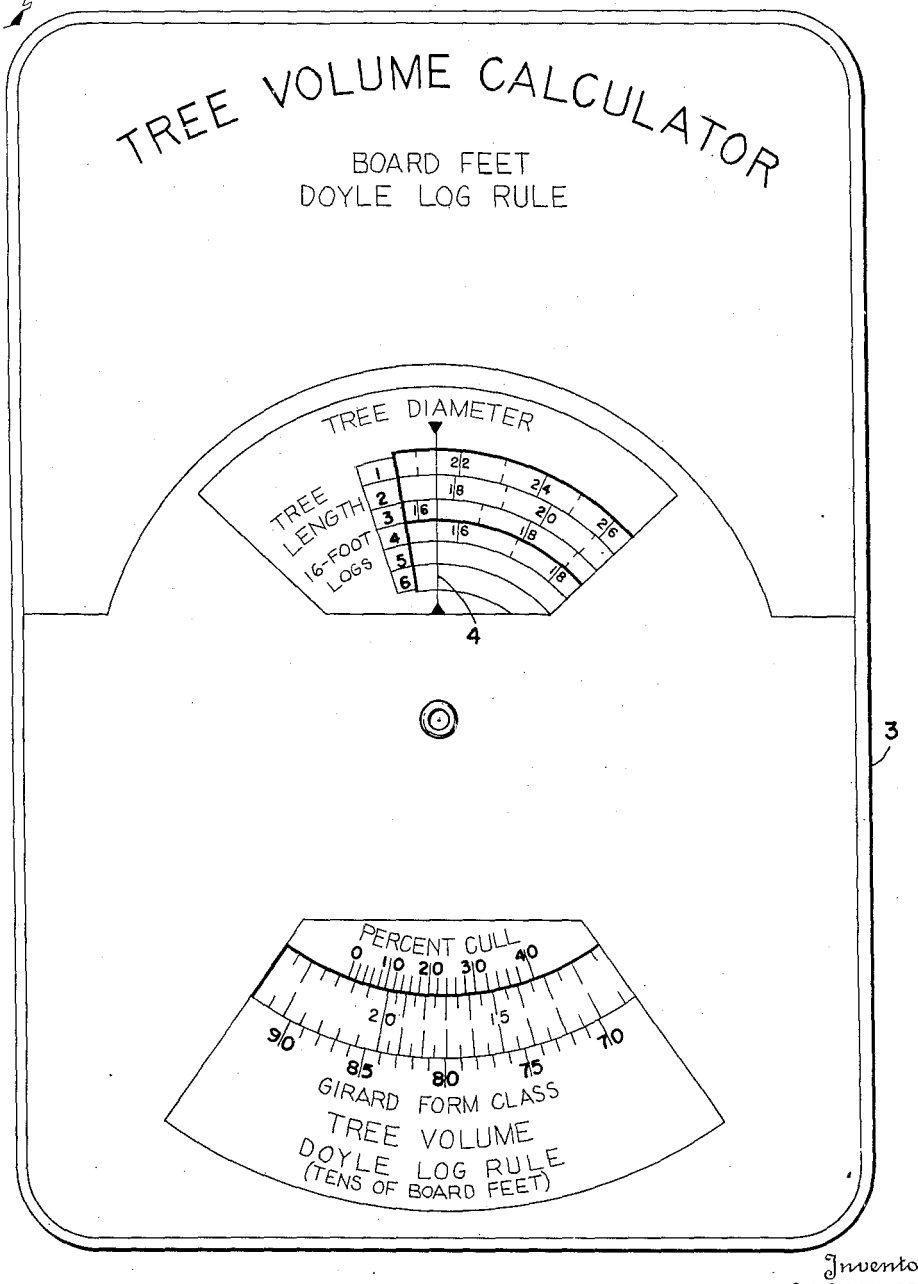

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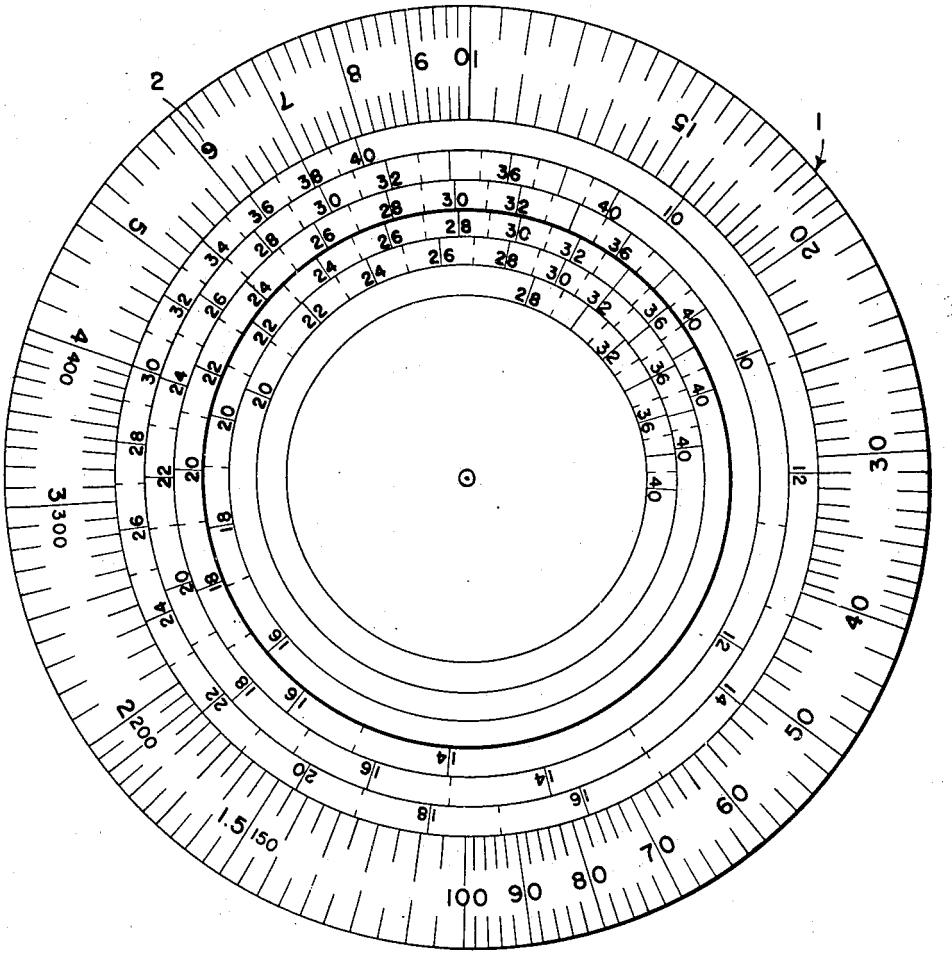
Fig. 2



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2,471,491

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2,471,491

TREE VOLUME CALCULATOR

Clement Mesavage, New Orleans, La.; dedicated to the free use of the People in the territory of the United States

Application April 26, 1946, Serial No. 665,036

3 Claims. (Cl. 235—84)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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This application is made under the act of March 3, 1883, as amended by the act of April 30, 1928, and the invention hereindescribed, if patented, may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment to me of any royalty thereon.

I hereby dedicate the invention herein described to the free use of the people in the territory of the United States to take effect on the granting of a patent to me.

This invention relates to the determination of the board feet contents of standing trees, and the general object is an instrument which facilitates the calculations which ordinarily are required.

The board foot is a common unit of volume in forestry work in the United States. It is a board 1 ft. long, 1 ft. wide, and 1 inch thick, or its equivalent. The board-foot volume of a tree log is an estimate of how much lumber the log should produce.

A "log scale" is an estimation of the probable yield of sawed lumber.

A log rule is a table stating the expected product in lumber to be derived from logs of various diameters and lengths. To scale a log is to estimate its board-foot contents by means of a log rule. A number of log rules are in use in this country, viz., the Doyle log rule and the International log rule. Such log rules are commonly known in the art and are found, for example, in Bruce and Schumacher's Forest Mensuration (1935), McGraw-Hill Book Company, pages 152 to 160 and 349 to 351.

The term "tree-volume content" means the sum of the board-foot volume content of all the logs into which the merchantable sawtimber portion of a tree may be divided. It is an estimate of how much lumber the log should produce, ignoring the wood defects referred to below.

In the said log rule tables may be read the board-foot volume of logs of given length and known diameter of the small end of the log inside the bark.

The form class particularly referred to herein is the ratio of the top diameter, inside the bark, of the first 16-foot log to the diameter breast high, usually 4½ feet above the ground, outside the bark. If a tree is 24 inches in diameter outside the bark at breast height and 19.2 inches in diameter inside the bark at the top of the first 16-

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foot log, its form class is 19.2 divided by 24, or 0.80. To calculate the top diameter of logs above the first or butt log, the taper may be estimated.

With form class based on specifications as listed above, Girard form class species averages for eastern species are: Beech, old growth southern pines, 84. Poplar, upland ash, cherry, basswood, walnut, second growth southern pines, 81. Other common hardwoods, 78. Northern conifers: old growth, 80; second growth, 78. Cypress, 75. Tupelo, 80. Form class varies locally. These averages are for rough estimates only.

The expression "tree length" is employed here to mean the estimated number of logs of a given length that can be derived from the tree, preferably the number of 16-foot logs as utilized in conservative operating practice.

A widely accepted taper index is that known as the Girard form class, defined as stated above. Tables showing volume in trees varying in diameter, length, and form have been prepared and are in use. Such tables are known as Girard form class volume tables. Their theoretical error in application to individual trees is due to differences in taper above the first log.

The instrument described herein has been based upon such tables. The errors due to differences in upper-log taper have, moreover, been reduced by adjusting to allow for the said differences. The tables have proven to be satisfactory as a basis for estimating board-foot contents of nearly all commercial species in this and foreign countries where tests have been made, irrespective of locality, for trees having not more than 96 feet of merchantable sawlog portion length.

Although these tables have advantages of wide applicability, they are unwieldy for use under field conditions, since they embody a separate table for each of 26 form classes.

The tree volume calculator dispenses with the need for such multiplicity of separate tables and introduces instead, a single, compact instrument which fits into a vest pocket.

The invention is illustrated in the drawing in which Figure 1 is a view of the face of the calculator, and Figure 2 is a view of the slide mounted for rotation on the center of the calculator. This calculator employs the Doyle log rule; however, calculators employing other log rules are similarly made.

As shown in Figure 2, the slide 1 comprises a circular dial having logarithmic scales arranged on arcs of progressively larger concentric circles. The outermost scale 2 corresponds to the "tree volume," according to the Doyle log rule, in tens of board feet. Inside the "tree volume" logarithmic scale are six concentric logarithmic scales of "tree diameters." "Tree diameter" is usually measured breast high, or 4½ feet above the ground, outside the bark. Each of the tree-diameter logarithmic scales is designed to register with one of the six "Tree length—16-foot log" divisions shown on the face plate 3 in Figure 1, to which the circular dial is riveted.

In face plate 3 are upper and lower windows. Through the lower window is visible a portion of the outermost scale 2; that is, the logarithmic tree volume scale in tens of board feet. Through the upper window, which is covered by a transparent sheet, is visible a portion of the six tree-diameter logarithmic scales. On the face plate and aligned with the said six scales are the six "tree length" divisions corresponding to the estimated number of 16-foot logs that can be derived from the tree. When the dial is rotated so that a given tree-diameter graduation is intersected by hair-line 4 on the transparent sheet, Figure 1, drawn across the upper window, the gross board-foot volume of a tree of given length, i. e., of a given number of 16-foot logs, is read directly in the lower window opposite the graduation of any given Girard form class, in the range of 70 to 90 percent. The reading of the volume in the lower window may be facilitated by a movable cross line attached to the center of the instrument.

The percent cull scale on the face plate above the lower window is likewise a logarithmic scale concentric with the other scales. The percent cull scale increases in the opposite direction to the tree-volume scale; that is, it is in subtractive relation to the latter.

The afore-mentioned details refer to the calculations of gross volume in a tree, it being assumed that no wastage accrues from wood defects such as rot, sweep, crook, splits, breakage, and so forth, indications of which are visible in external portions of the tree. Allowance for such defect is based on ocular estimates. The proportion of the tree lost to defect is commonly known as "percent cull." To facilitate such estimates, the table labeled "Percent total tree volume in each log" may be inserted on the reverse side of the movable dial. When both gross volume and percentage of gross volume lost because of defect are known, "net" tree volume may be established by computing the volume lost and subtracting it from the gross volume. This calculation is directly performed by the instrument by rotating the dial so that the gross volume of the tree is set opposite a graduation tabulated "0" on the scale above the lower window. Net tree volume is then read on the volume scale opposite the pertinent "percent cull" graduation.

Percent total tree volume in each log

Tree Length No. of Logs	Log Position					
	1st	2d	3d	4th	5th	6th
1	100					
2	58	42				
3	42	33	25			
4	34	29	22	15		
5	29	25	21	15	10	
6	24	23	20	16	11	6

For convenience, on the reverse of the dial and face plate, there may be provided circular logarithmic scales for multiplication and division. A movable cross line attached to the center of the instrument may be provided on the reverse side to facilitate calculations. The two movable cross lines may be attached to each other.

The circular dial may be replaced by one of rectangular outline, the face plate being then made of circular outline to facilitate rotation with respect to the fixed rectangular dial.

Correction factors for other tree species may be applied by using a second or a third hair line adjacent to the upper window.

To facilitate use of this device, the following further directions are given for calculating net board-foot tree volume.

1. Rotate dial until tree diameter appears in upper window opposite tree length.

2. Read gross volume in tens of board feet in lower window opposite form class.

3. From inspection of logs in tree and table, estimate percentage of gross volume deduction for defect.

4. Reset gross tree volume opposite "0" on upper scale in lower window. Read net tree volume opposite cull percentage of tree.

This may be applied without correction to all species except northern conifers. For these, correction is made by deducting 3 points from the form class (75 instead of 78).

Tree diameter is measured outside-bark, 4½ feet above ground, except flare-butted swamp species such as cypress and tupelo. These may be measured at 8 feet.

Having thus described my invention, I claim:

1. A calculator for solving problems in the determination of tree-volume content of lumber involving variable relating to: "tree length," that is, number of logs of a given length into which the tree can be cut; tree diameter measured outside of the bark at a given height, which height is less than the said given length; and the ratio of the top diameter of the first log, that is, of the butt log, of said given length, to the said tree-diameter measurement, said ratio being the "form class"; said calculator comprising two plates pivotally attached to each other for rotary motion with respect to each other, one over the other; one of said plates having a number of logarithmic scales arranged on arcs of progressively larger concentric circles, one of said logarithmic scales corresponding to "tree volume," the others of said logarithmic scales each corresponding to a series of "tree diameters"; the second of said plates having an opening through which a section of the tree-diameter scales is visible, said opening having "tree length" divisions each of which is adjacent to a "tree-diameter" scale, said second plate having a second opening through which a section of the "tree volume" scale is visible, and having an arcuate "form class" scale which is adjacent to the latter opening and is concentric with the "tree-volume" scale, the scales being so arranged that, upon setting a chosen "tree diameter" adjacent to a selected "tree length," the "tree volume" appears adjacent to the selected "form class."

2. The calculator of claim 1 in which the "tree-volume" scale is outside of the "tree-diameter" scales, in which the "tree-length" divisions are arranged radially in sequence, the largest "tree-length" being innermost, and in which the "tree-

volume" scale increases in the direction opposite to the "tree-diameter" scales.

3. The calculator of claim 1 in which there is a "percent-cull" logarithmic scale on the second plate adjacent to the second opening, concentric with the "tree-volume" logarithmic scale and increasing in the opposite direction to the latter.

CLEMENT MESAVAGE.

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