

J. W. FREE.

SCALE.

APPLICATION FILED MAR. 20, 1908.

2 SHEETS—SHEET 1.

Fig. 1

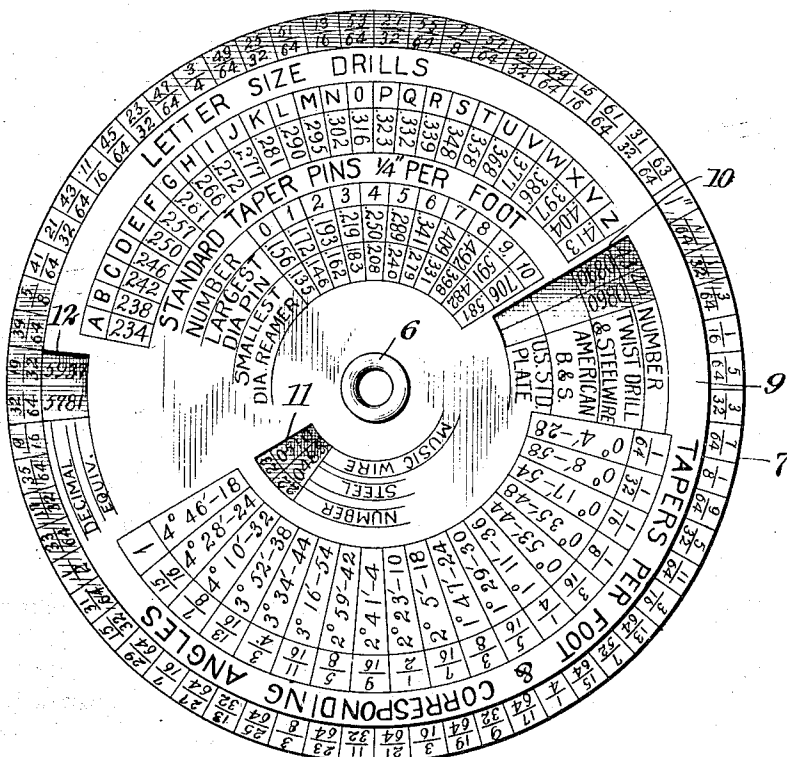


Fig. 2

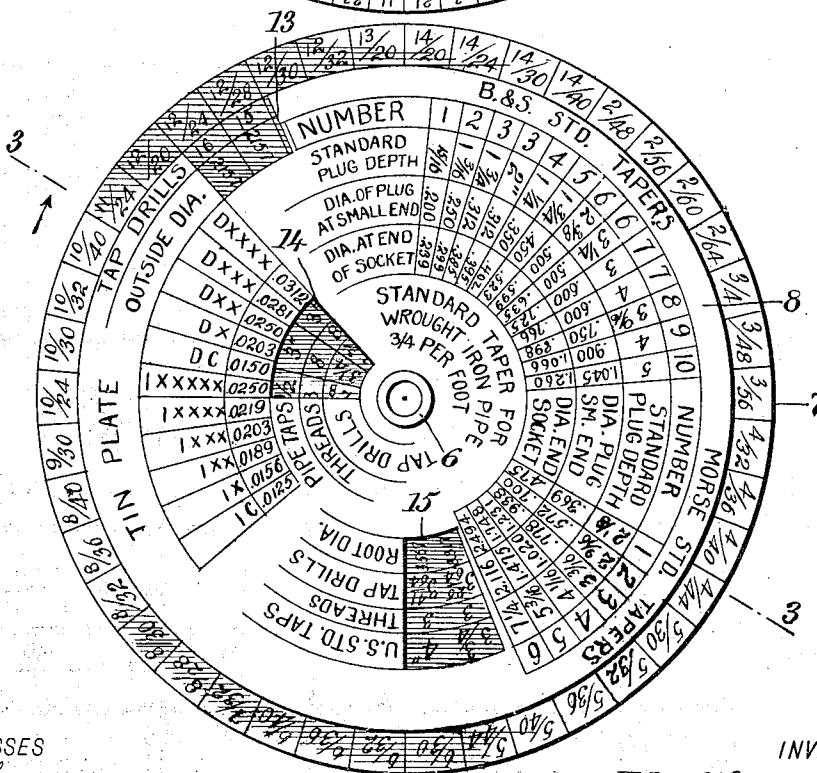
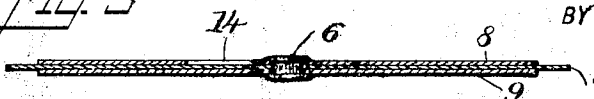


Fig. 3



WITNESSES
E. G. Bromley,
Walton Harrison

INVENTOR
John William Free
BY *Mum & Co.*
ATTORNEYS

Fig. 4

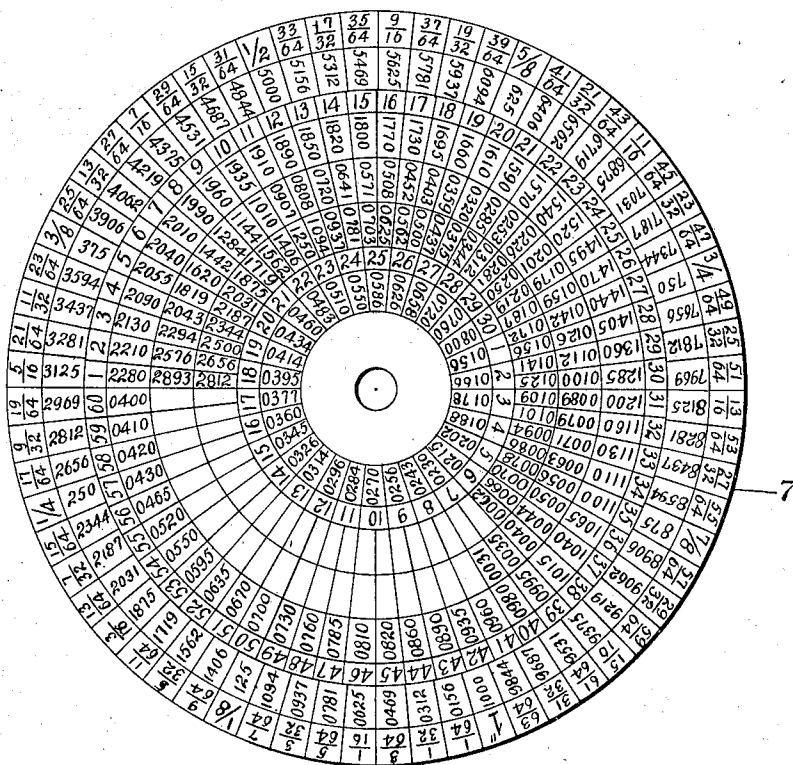
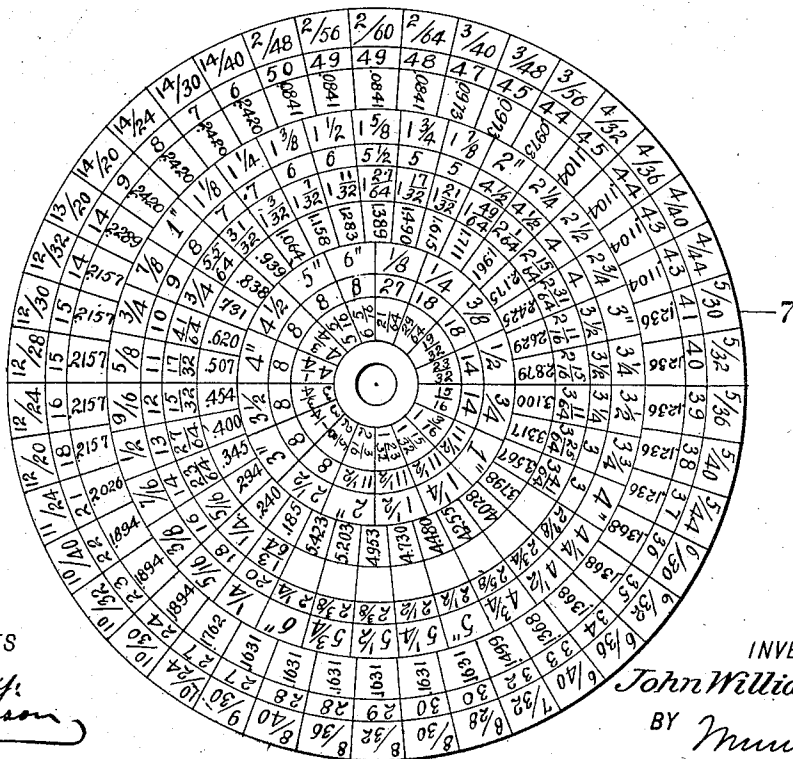


Fig. 5



WITNESSES
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Walton Harrison

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John William Free
 BY *Munn & Co.*
 ATTORNEYS.

UNITED STATES PATENT OFFICE.

JOHN WILLIAM FREE, OF SWISSVALE, PENNSYLVANIA.

SCALE.

No. 896,002.

Specification of Letters Patent.

Patented Aug. 11, 1908.

Application filed March 20, 1908. Serial No. 422,298.

To all whom it may concern:

Be it known that I, JOHN WILLIAM FREE, a citizen of the United States, and a resident of Swissvale, in the county of Allegheny and State of Pennsylvania, have invented a new and Improved Scale, of which the following is a full, clear, and exact description.

My invention relates to scales used for determining sizes of tools, wire, sheet material, and the like, my more particular object being to provide a construction having intelligible characters placed thereon and admitting of a large variety of general uses.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a plan view of the gage complete, shown as resting upon one of its sides; Fig. 2 is a plan view showing the gage as turned over so as to rest upon its side opposite the one shown in Fig. 1; Fig. 3 is a reduced cross section upon the line 3—3 of Fig. 2, looking in the direction of the arrow, and showing the three disks of the scale, these disks being pivoted at their centers and thus movable relatively each to the other; Fig. 4 is a plan view showing one face of the middle disk; and Fig. 5 is a plan view showing the opposite face of said middle disk.

Mounted upon an eyelet pivot 6 are three disks 7, 8 and 9, the middle disk 7 being slightly larger than the other two disks. The disk 9 is provided with openings 10, 11, 12, of arcuate form, the opening 12 being cut in from the outer circumferential edge of the disk. Somewhat similarly the disk 8 is provided with openings 13, 14, 15; the opening 13 being cut inwardly from the outer circumference of the disk 8. By turning the disks 8, 9 relatively to the disk 7, the various openings above mentioned may be brought into registry with appropriate portions of the middle disk so that intelligible characters thereupon are rendered visible. The various disks carry a suitable amount of numerical data.

Referring now to Fig. 1, it will be noted that the disk 9 carries lettering A to Z, together with the legend "Letter size drills", and also carries in proximity to the various letters A to Z a number of decimals, such as .234, .238, .242, .413. The purpose of this arrangement may best be understood by reference to a phase of shop practice. It is very

often necessary to pick out a drill, the diameter of which is not precisely $\frac{5}{16}$, $\frac{9}{32}$, $\frac{1}{4}$, or any other principal fraction of an inch, but is say a few thousandths of an inch less or more than $\frac{1}{4}$, or a few thousandths of an inch less or more than some other definite principal fraction representing the standard size of a drill. Suppose, now, that a workman wishes to select a drill slightly less than $\frac{1}{4}$ of an inch in diameter. Turning to the part of the disk 9 last above described he finds by the decimal .250 that the letter E represents a diameter of $\frac{1}{4}$ of an inch, and consequently, if he wants a drill the next size smaller, he takes the one marked D, which he sees by the scale has a diameter of .246 of an inch. If he desires a drill of a diameter slightly greater than $\frac{1}{4}$ of an inch, he selects, by aid of the scale above referred to, the next size larger. This he finds to be an F drill having a diameter of .257 of an inch. The part of the scale described, therefore, enables a workman to readily determine in decimals the precise portion of an inch for a drill, the size of which is represented by any given letter of the alphabet and also enables him to tell easily and in decimals the precise difference in diameter between any two drills of given size.

The disk 9 is further provided with the legend "Standard taper pins $\frac{1}{4}$ " per foot". Beneath this legend are numerals 0 to 10 representing the standard sizes of taper pins which are usually thus designated by number. It will be understood, however, that pins of this kind taper in diameter, and, consequently, the size ascertained by the number merely has reference to the larger end of the pin. In order, therefore, to determine what number of pin is to be used in a given case, it is also necessary to know the smallest diameter of the reamer to be used for making the hole to receive the pin. Unless this is done the workman will not know what size drill to employ for the purpose of reaming. On the disk, therefore, below the legend "Standard taper pins $\frac{1}{4}$ " per foot", I place the word "Number" and beneath this the two legends "Largest dia. pin" and "Smallest dia. reamer". If, now, the workman wishes to use a pin of about $\frac{1}{4}$ of an inch diameter, he finds this to be the one designated as number 4 which is marked upon the scale as $\frac{1}{4}$ " or .250. For the largest diameter of the pin and for the smallest diameter of the reamer the size is .208. The workman is thus apprised by the scale as to the proper

size for both pin and reamer to match the same.

Upon the disk 7 adjacent to the outer edge thereof there are decimal equivalents for various fractions, and by rotating the disk 9 so as to bring the opening 12 into proper position, we disclose the decimal .2031 as the equivalent of $13/64$ of an inch. The workman is thus shown that this is the nearest fraction of the decimal .208 representing the smallest diameter of reamer possible to use in connection with the particular pin to be used. If, now, he desires greater refinement in the diameter of the drill, he can use a so-called "number drill" which is still nearer the ideal size. The opening 10 in the disk 9 is so placed that the outer portion of this opening is always in registry with some portion of a circle of numbers ranging from 1 to 60 upon the disk 7. By turning the disk 9 relatively to the disk 7 the different numbers between 1 and 60 can thus be brought to view.

Upon the disk 9 and always registering with the circle of numbers 1 to 60, appears the word "Number". The circle of numbers 1 to 60 is the third circle from the circumference of the disk 7 (see Fig. 4). Inside of this circle of numbers there are several other circles of numbers and relating to these are placed upon the disk 9 several legends, as follows: "Twist drill & steel wire", "American B. & S.", "U. S. std. plate". These legends mean that the circles of numbers in registry with them, but located upon the disk 7, are related respectively to the legends.

Turning the disk 9 so that opposite the word "Number" appears the symbol 4, and noting, adjacent to this figure, the decimal number associated with the legend "Twist drill & steel wire", we find such number to be 2090, which means .209, indicating a drill of .001 larger diameter than the reamer measured at its smaller end. Again, suppose we turn the disk 9 until through the opening 10 we find the number 14. Looking now immediately to the left of the legend "Twist drill & steel wire" we see the number 1820. This indicates the decimal .182 as the nearest approximation to the size of number 14 drill. Almost the same steps are pursued in regard to the use of the legend "American B. & S." For number 14, referring say to number 14 American Brown and Sharp's gage wire, we find adjacent to the legend American B. & S. the number .0641. This approximates the decimal .064 and means that this decimal represents substantially the diameter of the particular wire or other stock concerning which data is required. Data for sheet metal is obtained in the same way as data for wire.

From the above explanation the use of the legend "U. S. std. plate" will be readily understood. Following the same steps we find that number 14 corresponds to the deci-

mal .0781, this decimal thus representing the nearest approximation to number 14 which number is applied to United States standard plate stock.

Near the outer edge of the disk 9 appears the legend "Tapers per foot & corresponding angles". These angles are stated immediately below the legend in common fractions arranged in a row of arcuate form, the fractions running from $1/64$ up to unity and indicating measurements ranging from $1/64$ of an inch up to one inch, these fractions further indicating degrees of taper to each linear foot of measurement. For instance, in rods of tapering diameter the degree of taper may be $1/64$ of an inch to the foot, or it may be $1/32$ of an inch to the foot, up to one inch to the foot. Now, opposite each of these common fractions is an expression of degrees, minutes and seconds, indicating the particular angle of inclination expressed in another way by the fraction. For instance, opposite $1/64$ appears the expression $0^{\circ} 4' 28''$ which means that for a taper of $1/64$ of an inch to each linear foot the angle of taper is 4 minutes and 28 seconds, reckoning, of course, from an imaginary circle of 360° . Again, if we wish to obtain similar data in regard to a piece having aggregate measurements of $\frac{3}{4}$ of an inch to $1/64$ of an inch, we would separately determine angles for $\frac{3}{4}$ of an inch and $1/64$ of an inch, and add together the two angles. We find that

for $\frac{3}{4}$ of an inch the angle is	$3^{\circ} 34' 44''$	100
for $1/64$ " " " "	$0^{\circ} 4' 28''$	
and adding these two angles we have	$3^{\circ} 39' 12''$	

Adjacent to the opening 11 upon the disk 9 are the legends "Number" and "Steel music wire". The opening 11, at a point adjacent to its outer edge is in registry with a circle of numbers placed upon the disk 7 and ranging from 1 to 30.

Suppose, now, that we wish to find the decimal diameter in inches, of number 9 music wire. We turn the disk 9 relatively to the disk 7 until we disclose, through the opening 11, the number 9. We see through the opening 11 that this number corresponds with the decimal .0256 which is the fact we wished to ascertain. Turning the instrument over so that it appears as indicated in Fig. 2, we find in the second circle from the circumference of the disk 8 the legend "B. & S. std. tapers", and immediately inside of this legend we find the word "Number" together with numerals 1 to 10 inclusive. Inside of the word "Number" and substantially in registry therewith are other legends, and opposite the same are decimal numbers arranged in rows of arcuate form disposed concentrically.

If, now, we wish to ascertain data relating to a socket measuring .750 of an inch at the bottom of the hole, and .898 of an inch at the top thereof, and knew the plug depth to be

3-9/16 inches, we could readily see, by a glance at the legends and numbers last above described, that these measurements correspond to a number 8 socket. Upon the same disk similar data is given in relation to Morse standard tapers which are designated by the legend "Morse std. tapers", and adjacent to this legend there being other legends relating to the plug depth, the diameter of the plug at its smaller end, and the diameter at the end of the socket, the legends last mentioned being associated with appropriate fractions all arranged in the form of a table. From this table we can readily ascertain the number corresponding to any group of measurements given, and as these are standard measurements the workman can readily find a group as indicated.

Upon the disk 7, adjacent to the outer edge thereof, we have numbered size taps ranging from 2 to 14 with the most practical threads per inch, and by rotating the disk 8 so as to bring the opening 13 into proper position, we find the tap drills to be used with various taps, also the outside diameter in decimals of the numbered taps. The opening 15 in the disk 8, is so placed that the outer portion of this opening is always in registry with some portion of a circle of sizes ranging from 1/4" to 6" upon the disk 7; by turning the disk 8 relatively to the disk 7 the different sizes between 1/4" and 6" can thus be brought to view. Upon the disk 8 and always registering with the circle of sizes 1/4" to 6" appears the abbreviations U. S. std. taps; the circle of sizes 1/4" to 6" is the third circle from the circumference of the disk 7 (see Fig. 5); inside of this circle of sizes there are several other circles of sizes, and relating to these there are placed upon the disk 8, several legends as follows: "Threads", "Tap drills", "Root dia." These legends mean that the circle of sizes in registry with them, but located upon the disk 7 are related respectively to the legend. Now if the workman wishes to tap a standard hole, he is thus shown the size of "tap drill", and if he was to thread a standard tap he would see by the scale the threads per inch for a given diameter, also the root diameter. In this same disk we have the opening 14 with pipe taps which are measured in the same way, the threads per inch and the tap drills running 1/8" to 6". Referring to this same disk 8 it will be noted that it carries (tin plate) sizes ranging from IC, IX, IXX, to DXXXX, such as .0125, .0156, 0189, 0312, also on this disk we have

near the center (standard taper for wrought iron pipe 3/4" taper per foot).

From the above description it will be noted that a large amount of data is collated into the form of a table and placed within this instrument which is sufficiently compact to be carried in the vest pocket.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. A device of the character described, comprising disks movable relatively to each other, one of said disks being provided with legends indicating numerical relations between the different measurements of a standard tool, the other of said disks being provided with openings through which said legends may be observed, said openings being off-set with respect to each other, the aggregate radial length of the openings being equal to the radius of the disk, said second disk being further provided with legends disposed adjacent to said openings for indicating to the observer the point to which said first disk should be turned.

2. A device of the character described, comprising a plurality of disks rotatable with respect to each other, one of said disks being of greater diameter than the other, and provided with legends indicating numerical relations between the different measurements of a standard tool, the other of said disks being provided with openings through which said legends may be observed said openings being off-set with respect to each other the aggregate radial length of the openings being equal to the radius of the disk, said second disk being further provided with legends disposed adjacent to said openings for indicating to the observer the point to which said first disk should be turned.

3. A device of the character described, comprising a pair of disks rotatable with respect to each other one of said disks being provided with a table, and with a series of openings off-set with respect to each other, the aggregate radial length of the openings being equal to the radius of the disk, and the other of said disks being provided with numbers associated with the table.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN WILLIAM FREE.

Witnesses:

ERNEST S. CRAIGHEAD,
A. A. CROCK.