Description and Use

OF THE

SLIDE RULE

FOR

Gauging, Ullaging, Valuing, and Reducing Spirits;

ALSO

Directions for Cask & Malt Gauging

TOGETHER WITH THE

METHOD OF GAUGING BY THE CALLIPERS,

As practised at the Port of London, &c.;

AND OTHER USEFUL INFORMATION RELATIVE TO GAUGING.

DESCRIPTION AND USE

OF THE

SLIDE RULE,

FOR

GAUGING, ULLAGING, VALUING, AND REDUCING
SPIRITS;

ALSO

DIRECTIONS FOR CASK & MALT GAUGING,

TOGETHER WITH

The Method of Gauging by the Callipers,

AS PRACTISED AT THE PORT OF LONDON, &c.;

AND

OTHER USEFUL INFORMATION RELATIVE TO GAUGING.

DESCRIPTION AND USE

SLIDE RULE.

———

IT will of course be understood that this little book is not intended as a full instruction on gauging, but merely as a little aid in the practical use of the Rules for Gauging.

The ordinary Slide Rule, as used by Gaugers and Traders, is a Rule containing two slides. On the one side it is divided at the top into two double radius logarithmic lines marked respectively A and B; on the lower part it is somewhat similarly divided into three lines marked respectively S.st, N, and S.^{ly}.

On the other side of the rule at the top it is divided into a single radius line marked D and a double radius line marked C; on the lower portion of this side it is divided into a line of gallons marked E and a line of prices

marked F, with the slide between divided into a scale of strengths overproof and underproof.

It is desirable first of all to direct the attention of the learner to the value of the divisions and figures, as without such information, he may find considerable difficulty in determining their value; attention to the following rules will render it quite plain.

If the first radius from 1 to 1 or 10 is units, then the second radius from 1 to 10 is tens; if the first radius is tens, then the second is hundreds; for whatever value is assigned to the first one on the left hand, whether 1, 10, 100, &c., then the following numbers, 2, 3, 4, 5, &c., will represent twice, thrice, four times, &c., as much, up to the second 1, which will be ten times the value of the first, the second 2, ten times the value of the first 2, &c. The values of the principal divisions and figures being thus determined, then the subdivisions may be easily known—for if the space between each principal figure is subdivided into 50 parts, each such part of course becomes equal to one-fiftieth of the value assigned to the previous figure; if into 10 parts, they are each equal to one-tenth; if into 5, equal to one-fifth, &c.; and must be valued and reckoned accordingly.

THE C D SIDE OF THE RULE — FOR CASK GAUGING, &c.

On this side of the Rule the upper line D is a single radius, marked from 1 to 10, and again subdivided; the slide marked C is a double radius, and is marked from 1 to 1, and again to 10; and is, in all respects, the same as the lines A and B for ullaging. When the lines D and C are set 10 to 10, or even at the ends, the line C exhibits square numbers, and the line D their roots; the small brass pins are the gauge points, the purpose of which will be explained later.

On the edge of the Rule are three lines. The first is a line of inches, decimally divided and numbered from 1 to 12; the second line is marked spheroid, and numbered from 1 to 7, being a line of differences for reducing the bung and head of a first variety cask or spheroid, to a mean diameter or cylinder; the third line is marked second variety, and numbered from 1 to 6, for the purpose of reducing casks of that variety to a mean diameter or cylinder.

It may be useful to point out here that the cask nearest to a spheroid, or first variety, is when the staves are regularly curved, and the

difference between the head and bung is not
so great, such as rum puncheons, hogsheads,
beer butts, and casks of like shape; cognac,
port, and Madeira pipes are about the second
variety, but are gauged as the first variety,
and an allowance made—third and fourth
varieties are rarely met with.

In cask gauging there are three dimensions
indispensable to be known, and these must be
very accurately taken in inches and tenths,
whether the cask is standing on its head, or
lying on its bulge.

1. The bung diameter.

2. The head diameter.

3. The length of the cask.

In taking the dimensions, particularly
observe that the bung-hole is exactly in the
middle of the cask, that the stave opposite is
regular and even, and that both heads are
circular, and of equal diameters.

For the head diameter take the distance
from the inside of the chime to the outermost
sloped edge of the opposite stave, which will
be very nearly the inside diameter of the cask
at the head.

The bung diameter, if the cask is lying, may be taken with a straight rod passed through the bung-hole, allowance being made for the thickness of the stave at the bung. If the cask is standing the bung diameter may be ascertained by passing a tape round the cask over the bung, determining its circumference and dividing by 3.14. The quotient will be the outside diameter at the bung, from which the thickness of the two staves must be deducted, thus giving the internal bung diameter. Or, set the diameter division (D D marked on the A B side of the rule), on slide B to 1 on A, and against the circumference on B is the diameter on A, as example :—Say circumference, found as before directed is 98 inches; set D D on the slide B to 1 on A, and against 98 on B is 31.2 on A, the outside bung diameter; then deduct for thickness of two staves, say 1 inch each, that is 2 inches from 31.2 leaving 29.2, the true bung diameter.

The length, if standing, is readily taken with a graduated dip rod, through a hole in the head, allowing for the thickness of the wood at the head. For the length, when the cask is lying, put any straight rod on the bulge of the cask lengthways, in such a posi-

tion that each chime of the cask shall be equally distant from the rod, then another straight rod being put perpendicularly across each end of the cask at the head, measure carefully the distance between the intersections of the rods, which will be the extreme length of the cask, from which subtract as much as the staves project over the two heads, together with the thickness of the two heads, and the remainder will be the internal length of the cask. Example:—

Say extreme length ... ... 49 inches.
Two heads, each 1 inch = 2 ⎫
Two chimes, each 1 inch = 2 ⎬ ... 4 do.

Internal length of cask ... 45 inches.

The same contrivance can be applied to obtain the bung diameter, but taking the circumference, as before directed, is preferable.

The whole of the dimensions are more readily and accurately taken by the regular Gauging Callipers and Head Rod (when they can be obtained), which will be described hereafter; having found the dimensions, proceed to cast the contents by the Slide Rule.

GENERAL DIRECTIONS.

First find the difference between the head and bung diameter, which note; then look on the edge of the rule for that difference, facing to which is a number (if the cask is a spheroid) on that line marked spheroid, or (if the cask is a second variety) on the second variety line, which must be added to the head diameter, to reduce it to a mean diameter or cylinder; then place the length of the cask on C, to the brass gauge point on D (marked G C), then facing the mean diameter on D is the contents or number of gallons the cask will hold on C.

EXAMPLE I.
Cask, Spheroid.

Suppose the dimensions of a cask, taken as before directed, to be in length ... 45 inches.

Bung diameter ... 31 do.

Head diameter ... 24.5 do.

Difference of bung and head ... 6.5

Then look on the upper edge of the Rule for the difference 6.5 facing which is 4.55 inches. on line marked spheroid, which added to head diameter ... } 24.5 do.

Mean diameter 29.05

Then place the length 45 on C to the gauge point on D, and facing the mean diameter 29 (omit the fraction), on D is 108 on C, the contents of the cask.

EXAMPLE II.

Spheroid.

Dimensions of a cask, length ... 40 inches.
Bung diameter ...   . 29 do.
Head diameter ...   . 23 do.

Difference of head and bung   ... 6

Facing which on the edge of the Rule is 4.2
which added to the head diameter   ... 23

Mean diameter 27.2
Then place the length 40 on C to the gauge point on D, and facing the mean diameter 27.2 on D, is 84 on C, the number of gallons the cask will hold.

EXAMPLE III.

Cask, second variety.

Dimensions of a cask, length ... 47 inches.
Bung diameter ...   . 32 do.
Head diameter ...   . 25 do.
Difference of head and bung ... 7 do.

Facing 7 on the edge of the Rule is 4.5 on the
line marked second variety,
which added to head 25

Mean diameter 29.5

Then place the length of 47 on C to the
gauge point on D, and facing 29.5, the mean
diameter on D, is 116 on C, the contents of
the cask.

For Gauging Oval Casks.

Reduce the transverse, or long diameter,
and the conjugate or short diameter of the
head and bung respectively to the mean
diameter of a regular-made cask, by placing
the transverse diameter on C to the transverse
diameter on D, and facing the conjugate
diameter on C is the mean diameter of a
regular shaped cask on D.

EXAMPLE.

Oval Cask.

Transverse bung diameter ... 42 inches.
Conjugate do. do. ... 30 do.
Transverse head diameter ... 34 do.
Conjugate do. do. ... 23 do.

For the bung place 42 on C to 42 on D, and facing 30 on C is 35.5 on D, the mean bung diameter. For the head place 34 on C to 34 on D, and facing 23 on C is 28 on D, the mean head diameter. The cask being thus reduced to a circular vessel of the following dimensions, proceed to cast the contents accordingly.

Bung diameter as before found 35.5
Head do. 28.0

Difference of head and bung 7.5
Facing 7.5 on edge of Rule is 5.3 nearly
Which added to head diameter 28.0

Mean or cylinder 33.3

Suppose the length or depth of cask 46 inches; place 46, the length, on C to gauge point on D, and facing 33.3, the mean, on D, is 146 gallons, the contents on C.

TO FIND THE CONTENTS OF A SQUARE VESSEL.

(*On the A B side of the Rule.*)

Set the diameter, or side of the square on B, to the square divisor for gallons on A, marked G S; against the side of the square on

A stands the area in gallons on B, at 1 inch deep—then set the area found on B to 1 on A; against the depth on A is the contents on B.

EXAMPLE.

Suppose a vessel 40 inches square,
                    32 do.   deep,
require the number of gallons it will hold.

Set 40 (the side of the square) on B to the square divisor on A; against 40 on A stands 5.76 on B, the area required, or 5 gallons and 76 hundredths of a gallon at 1 inch deep— then set 5.76 the area found on B, to 1 on A; against 32 on A is 184 gallons on B, the entire contents of the vessel.

(On the C D side of the Rule.)

Set the depth on C to the square gauge point (marked G S) on D; against the side of the square on D will be found the contents on C.

EXAMPLE.

Set 32 the depth on C, to the square gauge point on D; against the side of the square 40 on D is 184, the number of gallons on C as before.

TO FIND THE CONTENTS OF AN OBLONG OR PARALLELOGRAM.

(On the A B side of the Rule.)

Set the length on B to square divisor on A; against the breadth on A is the area on B, or number of gallons at 1 inch deep—then set the area found on B to 1 on A; against the depth on A is the contents on B.

EXAMPLE.

Let the Length of a vessel be 47 inches.

Breadth	do.	29	do.
Depth	do.	30	do.

Require the number of gallons.   Set 47, the length on B, to square divisor on A; against 29, the breadth on A is 4.92 on B, the area required—then set 4.92, the area found on B, to 1 on A; against the depth 30 on A is 148 on B, the contents required.

(On the C D side of the Rule.)

Set the length 47 on C to 47 on D; against 29 on C is 37 nearly on D (the mean), or the parallelogram reduced to a square—then place 30, the depth on C, to the square gauge point on D, and facing 37, the mean found on D, is 148 gallons on C, the contents required.

Divisors.

The small brass pins on A B side are divisors, or the cubic inches contained in an imperial gallon or bushel, being 277.274, and 2218.192, and are called square divisors; for any number of cubic inches a vessel contains being divided by those divisors, the quotient will be imperial gallons and bushels respectively. But for circular vessels it is necessary to divide the above divisors for squares by .7854 (the area of a circle whose diameter is 1), and the quotients are proper divisors for circles, in gallons and bushels respectively, being for gallons 353.04, and bushels 2824.29, and are called circular divisors, for the square of the diameter of any circle being divided by those numbers, will reduce the area to imperial gallons or bushels, which is also accomplished by the Rule, according to the preceding directions.

The pins or divisors on the A B side of the Rule are marked and placed,

FOR GALLONS.	FOR BUSHELS.
Square at 277.274 G S	Square at 2218.192 B S
Circles at 353.04 G C	Circles at 2824.29 B C

Gauge Points.

The gauge points on the D C side of the Rule are the square roots of the cubic inches in each gallon and bushel, and are marked and placed,

FOR GALLONS.

Square at 16.65 G S
Circles at 18.79 G C

FOR BUSHELS.

Square at 46.80 B S
Circles at 53.14 B C

Their use has been already explained in the preceding examples in gauging.

THE A B SIDE OF THE RULE FOR ULLAGING.

The lines marked A and B are a scale of logarithms, and in the hands of an expert almost any calculation in multiplication, division, the rule of three, direct and indirect, and, indeed, almost every rule in arithmetic, may be most readily performed by it.

The lines A B of this rule are lines of a double radius, graduated from 1 to 1, or 10 and again to 10, the respective values which have been already explained. The line marked S St. is a line of segments for ullaging stand-ing casks, and the lines S. Ly for casks lying on their bulge. The line marked N is a line of numbers, precisely similar to the lines A and B.

That which is called the ullage of a cask is the number of gallons of liquor remaining in it after any quantity has been drawn out, and has two cases :—first, when the cask lies upon its bulge; second, when it stands upon its head. But previous to ullaging it is necessary to know the full contents, or what the cask will hold when full; also the internal bung diameter, if it is lying on its bulge; or the internal length of it if a standing cask; likewise the number of inches of liquor in it, which are called the wet inches. Having found these particulars, proceed to work by the Rule.

General Directions.

To 100 or 10 on that line of the Rule marked A, set the full contents of the cask on slide B—to 100 on that line of the Rule marked Seg St (if a standing cask), or Seg Ly (if a lying cask), set the length, or bung diameter, on the slide marked N; then against the wet inches on the slide marked N, is the segment or number given on Seg St, if a standing cask, or on Seg Ly, if a lying cask; which number found is to be transferred to line A, facing to which is the remaining contents of the cask, or required ullage, on slide B.

EXAMPLE. I.

Standing Cask.

Suppose the contents of a cask when full to be 124 gallons, the entire length 52 inches, the wet inches 20; to find the ullage, or quantity of liquor in the cask, set 124 on slide B to 10 (or 100) on the line A; set 52 on the slide N to 100 on Seg St, then against the wet inches, 20, on slide N, is 37.5 (nearly) on Seg St, which number is to be transferred to line A, facing to which is 46.5, or 46½ gallons, on B, the ullage required.

EXAMPLE II.

Lying Cask.

Suppose the contents of a cask lying, when full, to be 120 gallons, the bung diameter 33 inches, and the wet inches 22—to find the ullage or quantity of liquor in the cask, set 120 on the slide B to 10 (or 100) on the line A; set 33 on the slide N to 100 on Seg Ly; then against the wet inches, 22, on slide N, is 73 (nearly) on Seg Ly; which number is to be transferred to the line A, facing to which is 87½ on B, the ullage required, or quantity of liquor remaining in the cask.

MALT GAUGING.

What is commonly called Malt Gauging, is the art of finding the contents of vessels, &c., in bushels as well as gallons, and is performed in precisely the same way as the latter, with the exception of using the bushel divisor or gauge point instead; but, as in general, malt floors or cisterns are considerably larger than vessels containing liquor, it becomes necessary to be very particular in setting the Rule and estimating the results; and as the line D of this Rule is only a single radius, in some cases the number on D will have no divisions opposite it on C; therefore it is advisable to find the area of the vessel in bushels by the line A B and use the divisors on that side of the Rule. For regular malt gauging, or where there is much practice, it is preferable to use a Veries' Rule, which has a line of malt depths expressly for that purpose. The following examples are given on both sides of the Rule.

EXAMPLE I.

On C D side of the Rule.

Take a circular vessel, whose diameter is 60 inches, and depth 28, required contents in imperial bushels. Place 28, the depth on C,

to the gauge point for bushels, marked B C on D, and against 60, the Diameter on D, is 35.75, or 35¾ bushels on C, the contents of that vessel.

EXAMPLE I.

Repeated on A B side.

Set 60, the diameter on B, to the circular divisor marked B C on A; against 60, the diameter on A, is 1.28 nearly on B, the area on bushels at 1 inch deep—then set the area 1.28, found on B, to 1 on A, and against 28, the depth on A, is 35.75 on B, same as the previous example.

EXAMPLE II.

On C D.

Suppose an oval vessel, whose transverse or largest diameter is ... ... 90 inches.

    Conjugate, or shortest ... 50 do.

    Depth ... ... 35 do.

First get a mean diameter, or reduce the oval to a cylinder, by placing 90, the length on C, to 90, on D; against 50, the breadth on C, is 67, the mean on D; then place 35, the depth on C, to B C on D, and against 67, the mean on D, is 55.75 on C, the contents of the vessel.

EXAMPLE II.

Repeated on A B.

Having found the mean diameter, as before stated, to be 67 inches, set 67, the mean on B, to B C on A; against 67 on A, is 1.59 on B, the area in bushels—then set 1.59, the area found on B, to 1 on A, and against 35, the depth on A, is 55.75 on B. Same as before.

EXAMPLE III.

On C D.

Suppose a square vessel, whose diameter is 54 inches, and depth 33, require its contents in bushels; place 33, the depth on C, to the square gauge point, marked B S on D—then facing 54, the diameter of the square on D, is $43\frac{1}{2}$ on C, the number of bushels required.

EXAMPLE III.

Repeated on A B.

Set 54, the diameter of the square on B, to B S, the square divisor on A, against 54; the square on A is 1.32, the area in bushels on B; then set 1.32 the area found on B, to 1 on A, and against 33, the depth on A, is 43.5 on B, same as by lines C and D.

EXAMPLE IV.

On C D.

An oblong, or parellelogram, whose length
is   ...   .   96 inches.

   Breadth ...   . 62 do.

   Depth   ...   . 35 do.

require its contents. First reduce it to a
square, by placing 96, the length on C, to
96 on D, and against 62, the breadth on C, is
77, the diameter (or a square) on D. Then
place 35, the depth on C, to B S on D, and
against 77, the square on D, is 94, the contents
in bushels on C.

EXAMPLE IV.

Repeated on A B.

Set 96, the length on B, to square divisor
B S on A, and against 62, the breadth on A,
is 2.68 the area in bushels on B—then place
2.68 the area found on B, to 1 on A, and
against 35, the depth on A, is 94 the contents
in bushels on B, as before found.

Floors of malt are generally laid in a square
or oblong form, and in some places deeper
than others, therefore take the depth in various
places, and add them together, the sum of
which divide by the number of depths taken,
and the quotient will be the mean depth. The
length and breadth are best taken with box
and tape measure, and the depth with a rod
and brass plate.

VALUING AND REDUCING OF SPIRITS.

The lower slide at the C D side of the Rule has the different strengths of spirits laid down on it, from 84 per cent. under proof, to 70 per cent. over proof, opposite to which, on line E, are gallons from 20 to 200, for the purpose of reducing from one strength to another, and the line F for showing the comparative value from 3s. to 30s. per gallon; to the right of proof (on the slide) is over, and the left under proof.

EXAMPLE IN VALUING.

Suppose a spirit, 20 per cent. over proof, worth 18s. per gallon; place the slide so that 20 per cent. over proof shall be facing 18s. upon the line F, then opposite every other strength will be found the value in proportion. Proof will be worth 15s. per gallon; 10 per cent. under proof, 13s. 6d. per gallon. Again, suppose 10 per cent. over proof worth 12s. 6d. per gallon, place the slide so that 10 per cent. over proof shall be facing 12s. 6d. on the line F, then the value of proof will be 11s. 4½d. per gallon; 10 per cent. under proof, 10s. 2½d.; 20 per cent. under proof, 9s. 1d. per gallon.

Again, if proof is worth 5s. per gallon, then
20 per cent. under will be worth 4s. per gallon,
&c., &c.

EXAMPLE IN REDUCING.

Suppose 130 gallons of spirits, 40 per cent.
over proof, is required to be reduced to proof,
place the slide so that 40 per cent. over proof
shall be opposite 130 on the line E, then
facing proof on the same line will be found
182, the number of gallons it is to be made up
to. If 100 gallons of spirits, 20 per cent. over
proof, is to be reduced to 20 per cent. under
proof, fix the Rule so that 20 per cent. over
proof shall be facing 100 on line E, then facing
20 per cent. under proof will be found 150,
the quantity required.   Again, if a cask of
120 gallons is to be filled with a spirit 30 per
cent. under proof, place 30 per cent. under
proof opposite 120, then the number of gallons
of any superior strength requisite to be put in
the cask is immediately shown by inspection;
if the spirit is 10 per cent. under proof, facing
10 per cent. under will be found 93 gallons
and $\frac{1}{3}$, the quantity required; if the spirits are
proof, opposite it will be found 84 gallons
(nearly), the quantity required; if 20 per cent.
over proof, 70 gallons will be the quantity of

spirits requisite, &c., &c.; the remainder to be made up with water.

By this side of the Rule stocks may be taken and charges estimated by placing the strength opposite the quantity, then opposite the strength the stock is to be taken at, will be found the exact quantity of such spirits.

Suppose in 170 gallons of spirit 40 per cent. under proof, how many gallons of proof. Place 40 under proof, on the slide, to 170 on E, then facing proof will be found 102 gallons, the number of gallons contained in 170 of 40 under proof. If any lesser quantity than 20 gallons, 100 may count for 10 gallons, 180 for 18, 90 for 9, &c., to any small quantity, in which case the whole gallons count as tenths.

The preceding observations and examples are more particularly applicable to the before described Rule, but the examples will answer to any Rule that has a similar line of gradations.

HOW TO USE THE STRAIGHT DIPPING ROD.

To find the Contents of a Spheroid Cask by the Diagonal Line only.

Put the rod in the cask at the bung-hole so that the brass end meets the intersection of the head and stave on the opposite side, then

whatever number on the diagonal line is just in the centre of the bung-hole, on a level with the inside of the cask, is its contents in imperial gallons (if the bung-hole is in the centre), to determine which put the Rule in the opposite direction, and observe if it gives the same diagonal, if so, the content given is correct; if not, add one-half of the difference to the shortest diagonal.

The diagonal line will not give the exact content of a cask unless it is of the true spheroidal shape for which it was constructed, as there are many different forms and magnitudes of casks which have the same diagonal, and yet differ in their contents; but still it is very useful in expediting transactions of very little import, and where the true contents is not very material, and will also serve as a check on cask gauging in general.

THE METHOD OF GAUGING BY THE CALLIPERS, AS PRACTISED AT THE PORT OF LONDON, &c.

The instruments requisite for this purpose are four :—

1. A pair of long callipers, for taking the length of the cask.

2. A pair of cross callipers, for taking the diameter at the bung externally.

3. A bung rod, for taking the diameter internally.

4. A head rod for taking the diameters of each head, and computing the contents and ullages.

The long callipers are so constructed as to allow for the thickness of the wood at the head.

The cross callipers do not allow anything for the thickness of the staves, as they are used for taking the outside diameter at the bung, in order to make a comparison with the inside bung diameter taken with the bung rod; for if the outside diameter exceed the other more than the fair thickness of the top and bottom staves, without doubt there is deception practised; perhaps a piece of wood fixed in the inside, opposite the bung, to make the diameter appear less than it really is, which is frequently the case in casks imported, and is placed in such an artful manner, by being gradually tapered each way from the centre, and terminating with such a thin edge, that the bung rod will not be obstructed in its passage at the bottom, which renders the detection

very difficult, unless the external diameter is also taken and a comparison between the two made.

The brass on the bung rod is one inch, to allow for the thickness of the stave at the bung —the lines on the head rod are computed for a cask of the first variety, and if it is considered to be of that shape no allowance need be made.

1st.—Take the length with the long callipers and note it.

2nd.—Take the head rod and set the crooked brass thereon, just within the chime of the cask, and extend the upright brass on the slide to the middle of the sloping edge of the opposite chime, and against the same will stand the head diameter, on the lower line of the head rod; apply it the same to the other head, and should there be any difference in the diameter of the two heads, make such alterations as will bring them to a mean, which note.

3rd.—With the cross callipers take the external bung diameter, and note it.

4th.—With the bung rod take the dip at the bung, or internal bung diameter, and observe at the same time the wet inches (which note), and also if there is a greater difference between the external and internal bung diameters than

the thickness of the wood will warrant, and make such alterations as may be necessary to bring it to a circle. Then, to find the contents, set the upright brass on the slide of the head rod to the head diameter on the lower line of the stock, and against the bung diameter on the same line stands a number on the middle line of the slide, against which number on the lower line of the slide stands the mean diameter on the lower line of the stock. Then set the brass gauge point on the top line of slide (marked at 18.80) to the length of the cask on the upper line of the stock, and against the mean diameter on the upper line of the slide will be found the contents of the cask on the upper line of the stock. When the cask is gauged, and not full, proceed to ullage in the usual way.

EXAMPLE BY THE CALLIPERS.

	Inches.
Cross bung diameter, from outside to outside	35.0
Internal bung diameter	32.5
Difference of the diameters	2.5
Thickness of the two staves, 1 inch each, to be taken from the external diameter	2.0

Inches.

Difference of the two diameters (which
   may be caused by the flatness of the
   cask at the bung), to be added to the
   internal diameter 5

Before taken 32.5
True bung diameter 33.0
Wet inches, observed at the same time   30.0
Head diameter (both heads being alike)   27.0
Length of cask 45.0

To cast the Contents by the Head Rule.

Set the upright brass on the slide of the head
rod to 27, the head diameter, on the lower line
of the stock, and against 33, the bung diameter
on the same line stands 4.2 nearly, on the
middle line of the slide; and against which 4.2
nearly, on the lower line of the slide, stands
31.2 nearly, the mean diameter on the lower
line of the stock. Then set the brass gauge
point on the top line of slide (marked at 18.80)
to 45, the length on the upper line of the stock,
and against 31.2, the mean diameter, on the
upper line of the slide, stands 124 on the upper
line of the stock, the number of gallons the
cask will hold—the wet inches as found before
is 30.

To find the Ullage, or number of Gallons in the Cask on the reverse side of the Head Rule.

Set 33, the bung diameter, on the lower line of the slide mark C, to 100 on the lower line of the stock marked Seg Ly ; and against 30 on the slide, the wet inches stands 96.75 on the lower line of the stock—then set 124, the full content on the line B, to 1000 on A, and against 96.75 (before found on the lower line) on A, is 120, the quantity of liquor in the cask.

Observations on Cask Gauging.

If the cask is very high quartered, that is, if the diameter of the cask at some distance from the bung is equal to the bung diameter, and the diameter by the cross callipers exceed the internal diameter by more than the thickness of the timber, the diameter must be increased from .7 to 1.4 inch, more or less according to the nature of the case, to give a true diameter.

Every cask should be rolled at least half over before it is gauged, in order to form an idea of its flatness or curvature.

If there be any irregularity in the length, by the head not being parallel, it is best to take the least and greatest lengths, and give half of the difference to the shortest, for a mean or

true length, which is the same as taking the
length in the centres of the two heads.

Dip Rules in General.

They are variously constructed, either
straight or with folding joints—some with
sockets and others with screw joints—and
usually contain a line of inches, divided in
tenths, and a diagonal line; also a number of
ullage dips—that is, the gallons of various
casks are graduated and marked on the respec-
tive lines of the Rule, so that by putting it in
the cask perpendicularly the number of
gallons contained in it is immediately shown
by inspection, only observe to look on that
line marked the same and corresponding with
the full contents of the cask under trial. They
are in general for the smaller casks, and for
such are quite near enough for usual purposes,
as the casks are made of the same respective
dimensions. Some Rules have larger casks
marked on them, such as pipes, puncheons,
&c., but are by no means correct, nor indeed
can they be, unless the whole of such casks
were made of the same dimensions, which is
not the case, as there are scarcely two of the
like capacity or contents; but the same does
not apply to the Brewers' Dip Rules, which

have the regular ullage dips of casks, from a firkin to a butt, standing and lying, which casks are made uniformly to their respective dimensions, consequently the dips on them may be depended upon.

The author constructed these dips from dimensions furnished to him by the London Coopers (at the time of the adoption of the new imperial measures), who make all their casks to correspond uniformly with the lines as laid down on the Rule. ———

The following are their respective dimensions :—

Imperial Beer Butt.

Length ... ... 45.5 inches.
Bung diameter ... 31.1
Head do. ... 24.3

From which the content is found to be 108.2 gallons.

Imperial Puncheon.

Length ... ... 35.8 inches.
Bung diameter ... 28.3
Head do. ... 23.4
Content, 72 gallons.

Imperial Hogshead.

Length ... ... 31.7 inches.
Bung diameter ... 26
Head do. ... 21.5
Content, 54 gallons.

Imperial Half Hogshead.

Length	... ... 23 inches.
Bung diameter	... 21.5
Head do.	... 18

Content, 27 gallons.

Imperial Barrel.

Length	... ... 26.7 inches.
Bung diameter	... 23
Head do.	... 19.3

Content, 36 gallons.

Imperial Kilderkin.

Length	... ... 20.3 inches.
Bung diameter	... 18.6
Head do.	... 15.3

Content, 18 gallons.

Imperial Firkin.

Length	... ... 16.6 inches.
Bung diameter	... 14.8
Head do.	... 12

Content, 9 gallons.

Imperial Short Butt.

Length	... ... 43 inches.
Bung diameter	... 31.75
Head do.	... 25.5

Content, 108 gallons.

The foregoing dimensions will give a little excess in quantity, which was done at the request of the coopers and brewers, to allow for driving the hoops, &c.

DESCRIPTION AND USE OF VERIES' FOUR-SLIDED RULE FOR MALT GAUGING.

This Rule is constructed with four slides, with a single radius; the line A is graduated from 1 to 10, and the line M D is also a single radius, divided and marked from 2218.2 to 2218.2, being the content in inches of an imperial malt bushel, and is called the line of malt depths. The two slides marked B have each a single radius, but as they have the divisions continued from one to the other, and are both put in the same grooves to work together, they form a double radius, and move between A and M D, by which means it answers the purpose of a Rule double the length. The second face of the Rule has the line D graduated on the upper part of the stock, from 1 to 32; and on the lower line it resumes as it leaves off on the upper, and continues to 10; and if the two slides are put together in the groove, and unity on the slide put to unity on the stock, all the numbers on

the stock, both top and bottom, are roots of the numbers opposite them on the slide.

The third face has the line S S, or segment standing, also occupying both the upper and lower line of the stock.

The fourth face has the line S L, or segment lying, divided in the same manner; the two slides marked C are each a single radius, and work together in either groove alternately, the same as the slides B, as they may be required. The lines S S and S L are for ullaging casks, directions and examples of which have already been given. The brass pins are the gauge points and divisors. On the back of one of the slides is a line of varieties for reducing the bung and head diameters of a cask to a mean, as before explained. On the back of another slide is a table of gauge points, divisors, and factors. The examples on cask gauging, already given, can be applied to this Rule if it is required; but perhaps it would be as well to give one example on malt gauging, by the line M D.

To gauge a couch or floor of malt by Veries' Rule, set the length of floor or couch on B, to depth on M D, against the breadth on A is the content in imperial bushels on B.

EXAMPLE I.

Suppose a couch of malt, length 150 inches.

<div style="text-align: right">breadth 130 do.</div>

<div style="text-align: right">depth 18 do.</div>

require the number of bushels.

Set 150, the length on slide B, to 18, the depth on M D, and against 130, the breadth on A, is 158 nearly on slide B, the contents required.

EXAMPLE II.

Say a floor of malt, length 720 inches.

<div style="text-align: right">breadth 210 do.</div>

<div style="text-align: right">depth 4 do.</div>

Set 720, the length on B, to 4, the depth on M D, and against 210, the breadth on A is 272½, the content on B.

On the whole, Veries' Rule is not so simple nor convenient, nor so readily understood for general purposes of gauging as a Rule with a double radius, particularly to the learner, the divisions breaking off at one line and resuming again on another, and borrowing the slides, that is, removing a slide from one groove, and working the two in another, renders it very complex and difficult to be understood at first, although the method of computing the divisions and figures is the same as with a Rule

with a double radius; it certainly has the advantage of being more portable in proportion to the width of the graduations, as the divisions on a 12-inch Veries' are as distant apart as on a 24-inch Rule, with a double radius; but by having the latter made of ivory, only 12 inches long, the divisions will be as distinct and legible, and can be estimated as accurately as with a Veries' 12-inch Rule, and with much more expedition; though, no doubt, in the hands of an experienced officer, it can be worked with great accuracy and despatch of business, but is principally used by them in malt gauging, as by one setting of the slide the contents of a floor or couch of malt is at once ascertained, which cannot be done without the Rule has a line of malt depths.

THE SLIDE RULE, FOR VALUING AND REDUCING SPIRITS,

All Slide Rules for the above purpose are similarly constructed, although the graduations are carried to higher and lower prices, and to greater and lesser quantities on some than on others; but in all cases the strengths are on the slide, the divisions to the right of proof being over, and to the left under proof.

After what has already been stated in the former part on this subject, it would be unnecessary to give any further examples, but merely to state, that with any comparative Rule the relative value of spirits, and the quantity of water requisite for reducing from one strength to another, is most readily found by placing the strength on the slide to the price on the stock, and facing any other strength on the slide is the value of that strength on the stock; or by placing the strength on the slide to the quantity on the stock, and facing any other strength (that it is required to be reduced to) on the slide, is the number of gallons it will make of that strength on the stock, &c.

The valuing side is readily distinguished from the reducing by the general arrangement of the figures, and the distance between the shillings being divided into 12 parts, whereas the distance between the figures on the reducing side is only divided into 10 parts.

CONTENTS.