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T R E A T I S E

On the METHOD of Weighing
G O L D and S I L V E R,

Upon the true
Principles of HYDROSTATICS.

Whereby it manifestly appears

That the intrinsic VALUE of counterfeit
C O I N may be ascertained to the greatest
Degree of Perfection, and the distinct
Quantity of A L L O Y proved with the
greatest Certainty and Exactness,

Which will be found at this Time extremely use-
ful to prevent any Person's being imposed on
by those counterfeit Pieces of Gold Coin, which
are so frequent, as well *British* as *Portugal*: and
the Method of discovering the Fraud so in-
telligible, that it requires no Arithmetical Cal-
culation, but may be detected after being
weighed, having recourse to the Tables here
inserted, by Inspection only.

By CHARLES SOMMERS.

L O N D O N:

Printed for the AUTHOR; and may be had at the *Hand and
Scales*, two Doors below St *Dunstan's* Church, *Flec.-street*.

M D C C L V I.

[Price Sixpence.]



T H E

P R E F A C E.

TH E greatest Inducement I had to attempt a Work of this Nature was, the Utility of the Hydrostatic Scales I have hitherto made and sold, the many counterfeit Pieces of Gold Coin that have been detected by those Scales, and that I might render them of still greater Use to the Public, by giving the true Difference of the Quality of the several Metals wherewith our Coin may be adulterated.

There are at this Time many Pieces of Coin that are so basely corrupted as to have little or no Gold at all in them, yet pass very current in this Kingdom, because they weigh very near their full Weight by a common Pair of Scales, but the accustomed Method of weighing them will not prove their Good-

The P R E F A C E.

ness with regard to their Adulteration, for some are so perfectly imitated, and so artfully disguised, by being well made, and struck with a good Relievo, that the most discerning Eye may be deceived.

Many Persons who pass these base Pieces are, I believe, intirely ignorant of their being Counterfeit, and by that Rule imagine, that as they received them not knowing it, they might with Ease pass them again: But such Imaginations may lead them into great Errors, and perhaps occasion some considerable Loss; for this base Coin cannot circulate long, as so many Pieces have already been detected.

It is owing to the Want of Knowledge in the Use of Hydrostatics, or of proving them properly, that such Pieces pass current with so much Ease; but by having recourse to the Instruments here described, and the Rules here inserted, not any one counterfeit Piece can escape, but must be detected; and the Method of discovering them so intelligible, that they may be proved to the greatest Degree of Truth, by a Person intirely unacquainted either with the Laws of Hydrostatics, or even with the common Rules of Arithmetic.

The

The P R E F A C E.

The *Africans* * are said to be so very dextrous in gilding of Metals, as to gild Brass so that the Gold shall follow the Sheers, but those gilded Pieces cannot stand the Test of these Experiments.

We stand indebted to that justly famous Mathematician *Archimedes*, for the Invention of these Principles of Hydrostatics; but had they not been greatly improved by Mr *Boyle*, Dr *Desaguliers*, and others, we had been still left in a very great State of Uncertainty in the Use of them; but particularly for the Purposes herein shewn, which could never have been so serviceable as at this Time.

* See CLARE'S Book *Of Fluids*.



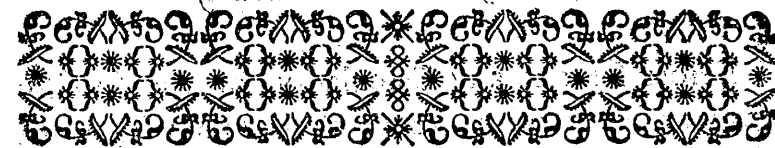
A D V E R -

A D V E R T I S E M E N T.

THE Apparatus for proving the following Experiments, are made and sold by the Author, at the Hand and Scales, two Doors below St Dunstan's Church, Fleet-street; where all other Sorts of Scales, Weights, and Steelyards, are made after the neatest and most approved Method;

And for Foreign Use,

Scales with respective Weights, or Coins, as Spanish and Portugal Gold Coin, Barbadoes, Virginia, and all the West-India Silver Currency, Turkey Scales and Rotola's, Scales and Weights for the East-Indies, Venice, and Guiney Scales and Weights, Diamond Scales and Weights of the true Standard, Assay Scales, and all other Sorts for Exportation, at the most Reasonable Rates.



A

T R E A T I S E

On the Method of Weighing

G O L D and S I L V E R, &c.

IT will be necessary before I give any Account either of the Utility of the Laws of Hydrostatics, or of the Necessaries requisite to prove these Laws experimentally, to give some little Account what the Principles of Hydrostatics are.

Viz. All Solids that are equal in Magnitude, though their specific Gravities are found to be different, being immersed into the same Fluid, will lose equal Parts of their Weight, and the Fluid into which they are immersed, will gain the same Weight which the Solid loses.

The specific Gravity of any Solid heavier than Water may be known, by comparing its Weight in Water to its Weight in Air.

The Loss of its Weight in Water will be equal to the Quantity of Water that will fill the Space which the immersed Solid takes up.

Before

Before I make any Calculation of the specific Gravity, or the Difference of Metals wherewith our Coin may be adulterated, it will not be amiss to give the Reader an Account what Instruments will be required, to prove the Examples with.

The first Thing necessary to be observed, is the Balance to be used in such Operations; which must be made in the most exact manner, and is necessary should be fixed to play freely on a Stand, by reason, that to hold them as is usual in the Hand, is not sufficiently steady; for on a very nice Observation, I have found a material Difference between the Weight of a small Piece, when the Scales have been held in the right Hand, and when in the left; which is owing, as I observed before, to the Hand not being so steady: therefore consequently fixed must be most adviseable.

At the one End of the Balance must hang a fixed Scale, as common, at the other a small Scale made considerably shorter in the Strings than the fixed Scale, the better to place the Water under; from the middle of the small Scale must hang by a silk String or Horsehair a spring Hook, which is to hold the Gold when weighed in Water; which Scale and Hook must be adjusted to the exact Weight of the fixed Scale; that they may be used as well Statically, or in Air, as Hydrostatically, or in Water.

A

A Set of Gold Weights will be requisite, and a sufficient Number of Grains, with the half and quarter of a Grain, to make the Proofs answer as nigh as may be to the Calculations here made. When thus far furnished I shall proceed to give the Standard of the Coin current in England, and then, the Use of these Scales and Weights.

	£	s.	d.		dwt.	gr.
A Guinea, Value	1	1	—	should weigh	5	9
A half ditto,	—	10	6	—	2	16½

FOREIGN Coin used in England, are

	£	s.	d.		dwt.	gr.
A Portugal Piece of	3	12	—	should weigh	18	10
Ditto	—	1	16	—	9	5
½ Ditto	—	—	18	—	4	14½
¼ Ditto	—	—	9	—	2	7¼
⅛ Ditto	—	—	4	6	1	3½
A Moldore	—	1	7	—	6	22
½ Ditto	—	—	13	6	3	11
¼ Ditto	—	—	6	9	1	17½

Though at present our Standard Gold is accounted worth only £ 3 : 18 : 1½ ~~pp~~ Ounce, yet it will be necessary to value it at £ 4, on account of Wear; few Pieces answering their exact Weight, unless just new: a Pennyweight at Four Shillings, and a Grain at Two Pence.

- The Value of Standard Silver is as follows,
- The Ounce at Five Shillings and Two Pence.
- The Pennyweight at Three Pence.
- The Grain at Half a Farthing.

To prove the Weight of any of the Pieces of Coin, place the Gold in the Hook, or in the small Scale, as may be thought proper, though

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it is intirely immaterial which; and, putting the proper Weight of such Piece of Coin in the fixed Scale, (as the Gold Weights all bear a particular Mark, it will be very easy to perceive which is the proper Weight of the Piece to be weighed) if the Piece of Coin is its exact static Weight, or, its full Weight in Air, the Balance will be even; but, if it is worn and not of full Weight in Air, the Balance will decline in favour of the Weight; and, as many Grains as you put in the small Scale to bring it even, so many *Twopences* it is deficient.

The next Thing that comes under Consideration, is to know the *specific Gravity* of the several *different Metals*, with which the *counterfeit Gold Coin* may be adulterated, which, for Brevity's sake, I shall here express in a Table, in a manner as concise as possible, so as to be intelligible.

A Table to prove the *specific Gravity* of the following different Species of Metals, each weighing in Air 100 Grains; and the Proportion they bear to that of Water.

Proportion to Water.		What 100 Grains will weigh in Water.	What 100 Grains will lose in Water.
18	Standard Gold	$94\frac{4}{9}$	$5\frac{5}{9}$
$10\frac{1}{2}$	Standard Silver	$90\frac{1}{2}\frac{0}{1}$	$9\frac{1}{2}\frac{1}{1}$
9	Copper	$88\frac{8}{9}$	$11\frac{1}{9}$
8	Brass	$87\frac{1}{2}$	$12\frac{1}{2}$
7	Iron	$85\frac{5}{7}$	$14\frac{2}{7}$

Before you prove any Piece of Gold in Water, you must first know the *specific Gravity* of the Hook; and you will find by immersing that in

in Water it will lose nearly three Grains, which must be added to the Weight any Piece of Coin will lose in Water, (for the Hook, being specifically lighter than Gold, may render the Experiment liable to Mistakes): when you have proved any Piece of Coin in Air, and found its exact Weight in Water, adding the three Grains for the Hook, you will find by comparing the Difference whether such Piece is *true Standard* or not: this Rule is proved in a more clear manner by the following Example.

Example.

I find a Guinea to weigh in Air 5 Pennyweights 9 Grains, and in Water only 4 Pennyweights 23 Grains, but adding 3 Grains for the Hook, makes 5 Pennyweights 2 Grains, which is just what a good Guinea should weigh, losing 7 Grains.

For if 100 Grains of Gold lose $5\frac{5}{9}$, what will 129 Grains lose?

As $100 : 5\frac{5}{9} :: 129 = 7\frac{3}{18}$, or $\frac{1}{6}$.

$$\begin{array}{r} 9 \quad 50 \\ \hline 50 \quad 64 \mid 50 \\ \hline 9 \mid 64 \\ \hline 7 \frac{3}{18} \end{array}$$

And again, as $100 : 94\frac{4}{9} :: 129 = 121\frac{1}{18}$, or $\frac{5}{8}$.

$$\begin{array}{r} 9 \quad 850 \\ \hline 850 \quad 64 \mid 50 \\ \hline 1032 \\ \hline 1096 \mid 50 \\ \hline 9 \mid 1096 \\ \hline 121 : 7 \end{array}$$

A Treatise on the Method of

If I would prove a *Portugal* Piece of £ 3 : 12 ; I find its Weight in Air to be 442 Grains, and in Water $414\frac{1}{2}$, adding 3 Grains for the Hook, makes it $417\frac{1}{2}$ Grains.

$$\text{As } 100 : 94\frac{4}{9} :: 442 = 417\frac{4}{9}$$

$$\begin{array}{r} \underline{850} \quad \underline{22100} \\ \underline{} \quad \underline{3536} \\ \underline{} \quad \underline{375700} \end{array}$$

$$\begin{array}{r} 9) 3757 \\ \underline{000} \\ 417\frac{4}{9} \end{array}$$

$$\text{And again, as } 100 : 5\frac{5}{9} :: 442 = 24\frac{5}{9}$$

$$\begin{array}{r} \underline{9} \quad \underline{50} \\ \underline{50} \quad \underline{22100} \\ \underline{00} \quad \underline{221} \\ 9) 221 \\ \underline{00} \\ 24\frac{5}{9} \end{array}$$

These Examples may be worked another Way, which will come as nigh the Truth, and tallies exactly with the foregoing Method; which is, by finding the $\frac{1}{18}$ Part of the Quantity of Grains in the Piece when weighed in Air: if the Gold is Standard it will lose about the $\frac{1}{18}$, and subtracting that from the Number of Grains, will give its Weight in Water, as ff Example. A Guinea in Air weighs 129 Grains; What is the $\frac{1}{18}$ Part thereof? The 18 in 129 is 7 Times and 3 eigh- teens over, and by subtracting $7\frac{3}{8}$ from the Weight of a Guinea, gives the Weight of $121\frac{1}{8}$ as

weighing GOLD and SILVER. 13

as by this first Example, and by the *Portugal* Piece of £ 3 : 12 of 442 Grains; the 18 in 442 is 24 Times and $\frac{1}{9}$, which subtracted from its Weight in Air, gives the Remainder, its Weight in Water, of $417\frac{8}{9}$, or $\frac{4}{9}$.

Therefore having shewn these two Methods of finding what *Standard Gold* should lose, I will leave it to every one's Option to use which pleases him best.

If in these, or any other Quantity of Gold to be proved, the Difference is found as 18 to 1, or of losing $\frac{1}{18}$ Part of its Weight in Air, by being weigh- ed in Water, such Gold may be depended on to be *true Standard*; but if it loseth more than $\frac{1}{18}$, it is then certainly *adulterated*; and my next Busi- ness shall be to discover the *exact Quantity*, and of what baser Metal such *Adulteration* is made.

The most perfect Method I can find to disco- ver the *exact Quantity* of the *Adulteration*, is by comparing the specific Gravity of *Silver*, to that of *Gold*; by which I find, for every Grain it loses more than $\frac{1}{18}$, there is a Deficiency of a Penny- weight of Gold, and a Pennyweight of Silver is added in its stead, and evidently appears to be worth about 3s. $10\frac{1}{2}d.$; but this is proved by the following Method more clearly:

If I adjust half a Crown to the Weight of a *Portugal* Piece of £ 1 : 16, which is 9 Penny- weight 5 Grains, and by weighing them in Wa- ter

ter separately, as I know the exact Quantity of each Metal, so I discover the Value of the additional Grains in the hydrostatic Weight; for as 9 Pennyweights 5 Grains of Gold loses $12\frac{1}{4}$, so I find that weight in Silver to lose $21\frac{1}{2}$; and, as the Difference is $9\frac{1}{4}$ Grains, I find the Value of each Grain, by the following Method, to be $3s. 10\frac{1}{2}d.$

If therefore $9\frac{1}{4}$ Grains are worth £ 1 : 16, what is 1 Grain worth?

As $9\frac{1}{4}$:	£	s.	s.	d.
4	20		4	
37	36		4	
	12			
	432			
	4			
	1728			
	4			
37) 6912 (186				
	325/0			
	2/3		46 $\frac{2}{3}$	
			3 : 10	

A Moidore should weigh in Air 6 Pennyweights 22 Grains, or, 166 Grains; and lose (as will appear by a Table in Page 17) 9 Grains in Water; allowing 3 for the Hook it then should lose 12; but, if upon Trial I find it loses 15, it is 3 Grains base, and by the Table, Page 16, 3 Grains amount to $11s. 7\frac{1}{2}d.$ therefore that Piece has but 3 Pennyweights 22 Grains of Gold, and 3 Pennyweights of Silver in it, and is worth no more than $15s. 4\frac{1}{2}d.$

If

If I prove the Weight of a *Portugal Piece* of £ 1 : 16 in Brafs, as I did the half Crown, by weighing them in Water as before, the *Quantity* of each are still the same, though the *specific Gravity* is different, for as in weighing Silver in the first Example I find it loses $9\frac{1}{4}$ Grains more than Gold, so I find the Brafs loses $13\frac{1}{2}$ more; therefore, if the *Adulteration* is of Brafs, each Grain deficient proves it $2s. 8d.$ base.

For if $13\frac{1}{2}$ Grains amount to £ 1 : 16, what is 1 Grain worth?

As $13\frac{1}{2}$:	£	s.	s.	d.
2	20		2	
27	36		2	
	12			
	432			
	2			
27) 864 (32				
	5/			

If therefore I had a Piece offered for a half Guinea, and its Weight in Air is 2 Pennyweights $16\frac{1}{2}$ Grains; in the Table, Page 17, I find it should lose in Water $3\frac{1}{2}$ Grains, and allowing 3 for the Hook, makes it $6\frac{1}{2}$; but if, upon Trial, the Loss is $10\frac{1}{2}$, which is 4 Grains more than if Gold, I find there can be neither Gold nor Silver in it, but by the following Table it appears to be intirely Brafs, as 4 Grains of that Metal comes the nighest to the Value, *viz.* $10s. 8d.$

And

And to prove a Ring, or any other Piece of Metal supposed to be Gold; in order to discover what it is, let it be weighed in Air by Penny-weights and Grains, and having found its Weight in Water, by comparing those two Weights together and finding the exact Difference, if it is about $\frac{1}{18}$ Part, it is *Standard Gold*; if about $\frac{1}{16}$, it is Silver; $\frac{1}{9}$ Copper, $\frac{1}{8}$ Brass, or $\frac{1}{7}$ Tin; and by this means any Piece of Metal may be proved, for let the Shape or Make be whatsoever, it causes no Difference of its Weight in Water.

A TABLE to prove by the Number of Grains any Piece of Coin may be deficient of its Weight in Water (more than allowed) how much it is deficient in its Value, by shewing the Value of each Grain from 1 to 20 in the following several Species.

N ^o of Grains.	In SILVER.			In COPPER.			In BRASS.			In TIN.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
1	0	3	10 $\frac{1}{2}$	0	3	—	0	2	8	0	1	11
2	0	7	9	0	6	—	0	5	4	0	3	10
3	0	11	7 $\frac{1}{2}$	0	9	—	0	8	—	0	5	9
4	0	15	6	0	12	—	0	10	8	0	7	8
5	0	19	4 $\frac{1}{2}$	0	15	—	0	13	4	0	9	7
6	1	3	3	0	18	—	0	16	—	0	11	6
7	1	7	1 $\frac{1}{2}$	1	1	—	0	18	8	0	13	5
8	1	11	—	1	4	—	1	1	4	0	15	4
9	1	14	10 $\frac{1}{2}$	1	7	—	1	4	—	0	17	3
10	1	18	9	1	10	—	1	6	8	0	19	2
11	2	2	7 $\frac{1}{2}$	1	13	—	1	9	4	1	1	1
12	2	6	6	1	16	—	1	12	—	1	3	—
13	2	10	4 $\frac{1}{2}$	1	19	—	1	14	8	1	4	11
14	2	14	3	2	2	—	1	17	4	1	6	10
15	2	18	1 $\frac{1}{2}$	2	5	—	2	—	—	1	8	9
16	3	2	—	2	8	—	2	2	8	1	10	8
17	3	5	10 $\frac{1}{2}$	2	11	—	2	5	4	1	12	7
18	3	9	9	2	14	—	2	8	—	1	14	6
19	3	13	7 $\frac{1}{2}$	2	17	—	2	10	8	1	16	5
20	3	17	6	3	—	—	2	13	4	1	18	4

A

A TABLE to prove what each Piece of current Coin (if Standard) should lose of its Weight in Water: and the Difference between its *Static Weight*, or its Weight in Air; and its *Hydrostatic Weight*, or its Weight in Water.

	£	s.	d.	Should lose in Water.	And will weigh in Water.
A <i>Portugal Piece</i> of 3	12	—	—	24 $\frac{1}{2}$	Grains. 417 $\frac{1}{2}$
Ditto	1	16	—	12 $\frac{1}{4}$	208 $\frac{1}{4}$
$\frac{1}{2}$ Ditto	—	18	—	6	104 $\frac{1}{2}$
$\frac{1}{4}$ Ditto	—	9	—	3	52 $\frac{1}{4}$
$\frac{1}{8}$ Ditto	—	4	6	1 $\frac{1}{2}$	26
A <i>Moidore</i>	1	7	—	9	157
$\frac{1}{2}$ Ditto	—	13	6	4 $\frac{1}{2}$	78 $\frac{1}{2}$
$\frac{1}{4}$ Ditto	—	6	9	2 $\frac{1}{4}$	39 $\frac{1}{4}$
A <i>Guinea</i>	1	1	—	7	122
$\frac{1}{2}$ Ditto	—	10	6	3 $\frac{1}{2}$	61

By this Calculation any Piece of Coin may be weighed with great Exactness: For if the $\frac{1}{8}$ Part of a *Portugal Piece* of £ 1 : 16, or 4s. 6d; be proved, and it loses just 4 $\frac{1}{2}$ Grains, that is 3 for the Hook, and 1 $\frac{1}{2}$ for the Gold, it is good; but if it loses 5 $\frac{1}{2}$, it is 1 Grain base, or 3s. 10 $\frac{1}{2}$ d: deficient in Gold, consequently is worth but 7 $\frac{1}{2}$ d.

The Apparatus required for these Experiments will be found so extremely useful, that it is necessary every Person in Trade should be furnished with one, as the *Base* and *Counterfeit* Coin is so very current, that without a very strict Examination into the Gold Coin, any Person may be liable to a considerable Loss thereby; for, as I observed before in the Preface, there are many *Pieces* so well imitated, that it is impossible to know the Difference by the Eye, between some *good*, and some *base* Pieces, but THESE will with Ease discover the Difference, though ever so perfectly disguised.

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And

And for the Use of People in Trade, who it is to be supposed cannot give themselves the Time of proving every Piece (they may think suspicious) according to the Rules here laid down, I have calculated another *Method* of proving them, which will come so near the Truth, and the Difference so very inconsiderable, that it cannot lead any one into an Error.

The greatest Advantage of this *Method* of proving them is, (that which in my Title Page I have mentioned) in ascertaining the *intrinsic Value* by Inspection only.

I proved in the Table, Page 17, what each Piece of Coin (if Standard) should lose in Water, and allowing 3 Grains for the Hook, but for the Sake of Expedition, instead of calculating the Number of Grains every time, I have made a small Weight adapted to every Piece of current Coin, of the exact Number of Grains each Piece should lose, allowing also for the Hook, and this Method of using them may be somewhat easier understood; as for Example,

Suppose I would prove a £ 3 : 12 that is full Weight in Air, I place the Weight of that Piece in the fixed Scale, and the Gold in the Hook, and the Balance will be even; I then place a Glass or Tumbler of fair Water under the small Scale, and having covered the Piece and Hook in Water, instead of putting 24½ Grains for the Gold, and 3 for the Hook, I only put a small Weight

marked

marked £ 3 : 12 in the small Scale, which is the exact Calculation *viz.* 27½ Grains, if then I perceive the Balance to be even, the Gold is the perfect Standard, but if it is not Weight, I put in Grains till it is, and reckon those nearly at Four Shillings $\frac{1}{2}$ Grain, without any mention of the Hook, for that is allowed as I observed before in the small calculated Weight.

Another Observation must be made, that these small Weights are calculated to Pieces that are of full *Static* Weight, or of full Weight in Air, therefore if a *Piece* is to be proved, that by Wear, or otherwise, is too light in Air, it must be made of full Weight before it is immersed in Water, so that if a Moidore is to be proved, which is too light in Air, by 6 Grains, it must have 6 Grains put in the small Scale, or if proved in Water before it is made its full Weight in Air, it will appear to be base when perhaps it is not so, only light; and 6 Grains in any Piece above a Guinea, is not regarded, but is esteemed passable.

It may be observed, that when any *Gold Coin* is not of full Weight in Air, if proved in Water without being made full Weight, the small adapted Weight may appear to be too much, and the Gold have the Advantage, instead of the Balance being even, the Reason is, because the *Gold* being diminished of its Weight in Air, the Body is less when weighed in Water; in such Case therefore, if the Gold is 18 Grains too light in Air, before it is immersed in Water 1 Grain may be put in the fixed Scale.

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Though this *Method* is exactly calculated to the former Rules, it is material only where the Experiment is to be proved in a very exact and accurate Manner, and the Value desired to be found to a greater Nicety than in the common Currency of Money is required.

I have in all the foregoing Examples proved them as nigh as I well could by Whole Numbers, because I would have them adapted to all Capacities, which they probably would not have been, had I worked my Examples by Decimals; tho' I must own, I approve most of Decimals, knowing them to be much the best Way to find any Rule to a Certainty: but had I proved them Decimally in Calculation, they could not have been proved so Experimentally, therefore I thought this Way the most convenient.

According to the Calculations of the *specific Gravity* of Gold by most Writers on *Hydrostatics*, I find them differ from mine a little; for as I reckon the Proportion of Gold to that of Water as 18 to 1, so I find some Tables to be near 19 to 1, and by others not above $17\frac{1}{2}$ to 1: but in proving the Examples practically neither of those Calculations will be just, for by some the proper adapted Weight to a *Portugal* Piece of $\text{£} 3 : 12$, should be more than 25 Grains, and by others not quite 24, but I find $24\frac{1}{2}$ to be the nighest, or I might venture to say the exact Weight.

I

I have not calculated these very Scales, &c. to the *British* and *Portugal* Coin only, but also to the *Spanish*, having been informed there are many Pistoles, Doubloons, &c. which are as basely corrupted as the Coin current in *England*. And these *Hydrostatic Balances* would also be found very useful in the *Guiney* Trade, for determining the Genuineness of *Gold Dust*, or to every Person that traffics in any Sort of GOLD or SILVER, but are particularly recommended to such as Travel, as Captains, &c. * for had Captain *Dampier* known this Method of determining the Value of *Gold*, he had perhaps ventured to traffic with the *Indians* at the *Bashee* Island for some of their yellow Rings, which in his Voyages he observes he had no great Encouragement to do, not being able to determine whether they were *Gold* or not.

On the METHOD of weighing SILVER on the Principles of Hydrostatics.

ACCORDING to most Calculations in the Tables of *specific Gravity*, it is agreed that *Standard Silver*, when immersed in Water, should lose 1 in $10\frac{1}{2}$ of its Weight in Air; and by that Calculation it agrees with the Table, Page 10, where 100 Grains of *Silver static Weight* loses $9\frac{1}{2}$ Grains; and which agrees experimentally to be as near the Truth as may be required.

If therefore by this Rule I would prove the Genuineness of a Piece of Silver weighing in Air 18 Pennyweights 10 Grains, or 442 Grains, and

as

* See CLARE on *Fluids*.

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as in the Table, Page 10, I find 100 Grains in Air lose $9\frac{1}{2}$ of its Weight in Water, so I find what 442 will lose, viz. $42\frac{2}{21}$. ¶ Example,

$$\text{As } 100 : 9\frac{1}{2} :: 442 = 42\frac{2}{21}$$

21	200
200	884 00
21	884(42
	4 $\frac{2}{21}$

And again, if 100 Grains in Air, weigh only $90\frac{1}{2}$ Grains in Water, what will 442 Grains in Air weigh when immerfed in Water?

$$\text{As } 100 : 90\frac{1}{2} :: 442 = 399\frac{1}{21}$$

21	1900
1900	397800
21	442
	8398 00
21	8398(399
	200 9
	21

Suppose I wanted to know if a Piece of Plate is Standard or not, weighing in Air 3 Ounces 10 Pennyweights 12 Grains, I reduce its Weight into Grains, and I find it to be 1692 Grains.

As before, if 100 Grains lose $9\frac{1}{2}$, what will 1692 lose?

$$\text{As } 100 : 9\frac{1}{2} :: 1692 = 6 : 17\frac{3}{21}$$

2	200
200	3384 00
21	3384(161
	122 3

And

weighing GOLD and SILVER. 23

And again, as $100 : 90\frac{1}{2} : 1692 = 68 : 13\frac{3}{21}$

21	1900
1900	1522800
21	1692
	32148 00
21	32148 (1530 $\frac{1}{21}$
	116 1
	161 $\frac{3}{21}$
	1692

Or these Examples may be proved by this Method, but are much alike, for if $10\frac{1}{2}$ lose 1, consequently 21 must lose 2, therefore I state the Case

$$\text{As } 21 : 2 :: 1692 = 161\frac{3}{21}$$

2	21
21	3384(161
21	128
	126
	. 24
	21
	3

If therefore having proved the Piece of Plate by weighing it in Air, and then in Water, I find it loses 6 Pennyweights 17 Grains and near $\frac{1}{4}$, such may be depended upon to be good Silver, and not in the least *adulterated*.

If therefore a Piece is *adulterated*, to find the exact Quantity, I prove it (in the manner I did that of Gold), by comparing their *specific Gravities*; for if a Piece of Silver weighing in Air 9 Pennyweights 5 Grains loses $21\frac{1}{4}$ Grains, so I find a Piece of Copper of that Weight to lose $24\frac{1}{2}$ Grains, the Difference therefore is $3\frac{1}{4}$ Grains; if then $3\frac{1}{4}$ Grains are worth 2s. 4d. what will 1 Grain be worth? = $8\frac{1}{2}d.$ as ¶ Example,

As

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$$\begin{array}{r}
 \text{As } 3\frac{1}{4} : 2 : 4 :: 1 = 8\frac{1}{2} \\
 \frac{4}{13} \quad \frac{12}{28} \quad \frac{4}{4} \\
 13 \overline{) 112} (8 \\
 \underline{8} \\
 4 \\
 13 \overline{) 32} (2 \\
 \underline{26} \\
 6
 \end{array}$$

A Shilling weighs in Air 3 Pennyweights 22 Grains, it should lose in Water $8\frac{1}{2}$ Grains, but if it is found upon Trial to lose $9\frac{1}{2}$ such Shilling is *adulterated*, and there is no more than 1 Pennyweight 22 Grains of Silver, and 2 Pennyweight of Copper in it, and is defective of its Value $8\frac{1}{2}d.$

And according to the foregoing Rule, if *Standard Silver* in weighing 9 Pennyweight 5 Grains, loses $21\frac{1}{4}$, I find *Brass* of that Weight to lose $27\frac{1}{4}$, and as the Difference of $6\frac{1}{4}$ Grains is 2 s. 4 d. for each single Grain is worth very near $4\frac{1}{2}d.$

$$\begin{array}{r}
 \text{For as } 6\frac{1}{4} : 2 : 4 :: 1 = 4\frac{1}{4}\frac{2}{3} \\
 \frac{4}{25} \quad \frac{12}{28} \quad \frac{4}{4} \\
 25 \overline{) 112} (4 \\
 \underline{100} \\
 12 \\
 \underline{12} \\
 0 \\
 48 (1 \\
 \underline{48} \\
 0 \\
 23
 \end{array}$$

Is is therefore evident, any Piece of *Silver* losing more than is allowed, *viz.* 1 in $10\frac{1}{2}$ is *adulterated*, and for each Grain its Value is defective by $4\frac{1}{2}d.$ very near.

But as *Silver* is alloyed with *Copper*, and it is found to be the next Metal with regard to the *specific Gravity*, so few Pieces of *Silver* are *adulterated* with *Brass*; but if any Piece is to be proved, and it loses $\frac{1}{8}$ Part, there can be no *Silver* at all in it, but is intirely made of *Brass*: And thus may any Sort of Metal be proved to the greatest Certainty.

F I N I S.