A

TREATISE

On the METHOD of Weighing

GOLD and SILVER,

Upon the true

Principles of HYDROSTATICS.

Whereby it manifeſtly appears

That the intrinſic VALUE of counterfeit COIN may be aſcertained to the greateſt Degree of Perfection, and the diſtinct Quantity of ALLOY proved with the greateſt Certainty and Exactneſs.

Which will be found at this Time extremely uſeful 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 intelligible, that it requires no Arithmetical Calculation, but may be detected after being weighed, having recourſe to the Tables here inſerted, by Inſpection only.

By *CHARLES SOMMERS.*

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M DCC LVI.

[Price Sixpence.]

THE

PREFACE.

THE 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-

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 *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*.

ADVER-

ADVERTISEMENT.

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*;

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A

TREATISE

On the Method of Weighing

GOLD and SILVER, &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 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.		dwts.	gr.
A Guinea, Value	1 :	1 :	—	ſhould weigh	5 :	9
A half ditto,	— :	10 :	6	——	2 :	$16\frac{1}{2}$

FOREIGN Coin uſed in *England*, are

	£	s.	d.		dwts.	gr.
A *Portugal* Piece of	3 :	12 :	—	ſhould weigh	18 :	10
Ditto ——	1 :	16 :	—	——	9 :	5
$\frac{1}{2}$ Ditto ——	— :	18 :	—	——	4 :	$14\frac{1}{2}$
$\frac{1}{4}$ Ditto ——	— :	9 :	—	——	2 :	$7\frac{1}{4}$
$\frac{1}{8}$ Ditto ——	— :	4 :	6	——	1 :	$3\frac{1}{2}$
A Moidore ——	1 :	7 :	—	——	6 :	22
$\frac{1}{2}$ Ditto ——	— :	13 :	6	——	3 :	11
$\frac{1}{4}$ Ditto ——	— :	6 :	9	——	1 :	$17\frac{1}{2}$

Though at preſent our *Standard Gold* is accounted worth only £ 3 : 18 : $1\frac{1}{2}$ ℔ 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

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	$90\frac{10}{21}$	$9\frac{11}{21}$
9	Copper	$88\frac{8}{9}$	$11\frac{1}{9}$
8	Braſs	$87\frac{1}{2}$	$12\frac{1}{2}$
7	Tin	$85\frac{5}{7}$	$14\frac{2}{7}$

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 $\frac{1}{6}$.

9 50

50 64|50

9) 64

$7\frac{3}{18}$

And again, as 100 : $94\frac{4}{9}$ :: 129 = $121\frac{15}{18}$, or $\frac{5}{6}$.

9 850

850 6450

1032

1096|50

9) 1096

121 : 7

If I would prove a *Portugal* Piece of £3 : 12; I find its Weight in Air to be 442 Grains, and in Water 414½, adding 3 Grains for the Hook, makes it 417½ Grains.

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

2 850

850 22100

3536

3757|00

9) 3757

417 $\frac{4}{9}$

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

9 50

50 221|00

9) 221

24 $\frac{5}{9}$

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 the 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 eighteens over, and by ſubtracting 7$\frac{3}{18}$ from the Weight of a Guinea, gives the Weight of 121$\frac{15}{18}$ as

as by this firſt Example, and by the *Portugal* Piece of £3 : 12 of 442 Grains; the 18 in 442 is 24 Times and $\frac{10}{18}$, which ſubtracted from its Weight in Air, gives the Remainder, its Weight in Water, of 417$\frac{8}{18}$, 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 weighed 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 Buſineſs ſhall be to diſcover the *exact Quantity*, and of what baſer Metal ſuch *Adulteration* is made.

The moſt perfect Method I can find to diſcover 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 Pennyweight of Gold, and a Pennyweight of Silver is added in its ſtead, and evidently appears to be worth about 3*s.* 10½*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 Pennyweight 5 Grains, and by weighing them in Water

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 3*s.* $10\frac{1}{2}$*d.*

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

	£	*s.*		*s.*	*d.*
As $9\frac{1}{4}$	: 1	: 16	:: 1 = 3	:	$10\frac{1}{2}$
4	20		4		
37	36		4		
	12				
	432				
	4				
	1728				
	4				

37) 6912 (186
325/0
2/3 $46\frac{2}{4}$
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 11*s.* $7\frac{1}{2}$*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 15*s.* $4\frac{1}{2}$*d.*

If

If I prove the Weight of a *Portugal* Piece of £1 : 16 in Braſs, 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 Braſs loſes $13\frac{1}{2}$ more; therefore, if the *Adulteration* is of Braſs, each Grain deficient proves it 2*s.* 8*d.* baſe.

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

	£	*s.*		*s.*	*d.*
As $13\frac{1}{2}$	: 1	: 16	:: 1 = 2	:	8
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 Braſs, as 4 Grains of that Metal comes the nigheſt to the Value, *viz.* 10*s.* 8*d.*

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 $\frac{1}{10}$, 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° of Grains.	In SILVER.			In COPPER.			In BRASS.			In TIN.		
	£	s.	d.	£	s.	d	£	s.	d.	£	s.	d.
1	0	3	10½	0	3	—	0	2	8	0	1	11
2	0	7	9	0	6	—	0	5	4	0	3	10
3	0	11	7½	0	9	—	0	8	—	0	5	9
4	0	15	6	0	12	—	0	10	8	0	7	8
5	0	19	4½	0	15	—	0	13	4	0	9	7
6	1	3	3	0	18	—	0	16	—	0	11	6
7	1	7	1½	1	1	—	0	18	8	0	13	5
8	1	11	—	1	4	—	1	1	4	0	15	4
9	1	14	10½	1	7	—	1	4	—	0	17	3
10	1	18	9	1	10	—	1	6	8	0	19	2
11	2	2	7½	1	13	—	1	9	4	1	1	1
12	2	6	6	1	16	—	1	12	—	1	3	—
13	2	10	4½	1	19	—	1	14	8	1	4	11
14	2	14	3	2	2	—	1	17	4	1	6	10
15	2	18	1½	2	5	—	2	—	—	1	8	9
16	3	2	—	2	8	—	2	2	8	1	10	8
17	3	5	10½	2	11	—	2	5	4	1	12	7
18	3	9	9	2	14	—	2	8	—	1	14	6
19	3	13	7½	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 *Portugal* Piece of	3	12	—	24½ Grains.	417½
Ditto	1	16	—	12¼	208¾
½ Ditto	—	18	—	6	104½
¼ Ditto	—	9	—	3	52¼
⅛ Ditto	—	4	6	1½	26
A Moidore	1	7	—	9	157
½ Ditto	—	13	6	4½	78½
¼ Ditto	—	6	9	2¼	39¾
A Guinea	1	1	—	7	122
½ Ditto	—	10	6	3½	61

By this Calculation any Piece of Coin may be weighed with great Exactneſs: For if the ⅛ Part of a *Portugal* Piece of £1 : 16, or 4*s*. 6*d*; be proved, and it loſes juſt 4½ Grains, that is 3 for the Hook, and 1½ for the Gold, it is good; but if it loſes 5½, it is 1 Grain baſe, or 3*s*. 10½*d*. deficient in Gold, conſequently is worth but 7½*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.

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 Peice 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 ℔ 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.

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 £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 $9\frac{11}{21}$ 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*.

as in the Table, *Page* 10, I find 100 Grains in Air loſe $9\frac{11}{21}$ of its Weight in Water, ſo I find what 442 will loſe, *viz.* $42\frac{2}{21}$. ℔ Example,

As 100 : $9\frac{11}{21}$ :: 442 = $42\frac{2}{21}$

21 — 200

200 — 884|00

21) 884 (42

4|2

And again, if 100 Grains in Air, weigh only $90\frac{10}{21}$ Grains in Water, what will 442 Grains in Air weigh when immerſed in Water?

As 100 : $90\frac{10}{21}$ :: 442 = $399\frac{10}{21}$

21 — 1900

1900 — 397800

442

8398|00

21) 8398 (399

2009

2|1

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 $9\frac{11}{21}$, what will 1692 loſe?

As 100 : $9\frac{11}{22}$:; 1692 = 6 : $17\frac{3}{21}$

2 — 200

200 — 3384|00

21) 3384 (161

122|3

And

dwts. gr.

And again, as 100 : $90\frac{10}{21}$: 1692 = 68 : $13\frac{3}{21}$

21 — 1900

1900 — 1522800

1692

32148|00

21) 32148|. (1530 $\frac{18}{21}$

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

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

2

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 2*s.* 4*d.* what will 1 Grain be worth? = $8\frac{1}{2}$ *d.* as ℔ Example,

As

$$\text{As } 3\tfrac{1}{4} : 2 : 4 :: 1 = 8\tfrac{1}{2}$$

(*s.* *d.* *d.*)

$$\frac{4}{13}\quad\frac{12}{28}\qquad\frac{4}{4}$$

$$13\overline{)112}\,(8 \qquad 8$$

$$13\overline{)32}\,(2 \qquad 26$$

$$6$$

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.* ſo each ſingle Grain is worth very near $4\frac{1}{2}d.$

(*s.* *d.*)

$$\text{For as } 6\tfrac{1}{4} : 2 : 4 :: 1 = 4\tfrac{23}{25}$$

$$\frac{4}{25}\quad\frac{12}{28}\qquad\frac{4}{4}$$

$$25\overline{)112}\,(4 \qquad 100$$

$$48\,(1 \qquad 25$$

$$23$$

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.