RATIONALE

OF

OUR PRESENT SUBDIVISION

OF THE

POUND STERLING,

WITH

STRICTURES ON A DECIMAL COINAGE.

"Perfection, therefore, in metrical subdivision consists in the selection of such [divisional] numbers, *that the integer may be divided by the* greatest *possible variety of numbers, with quotients of the* smallest *possible number of words or figures.*"

PUBLISHED BY HOULSTON & STONEMAN, LONDON:
JOHN WRIGHT & CO., STEAM-PRESS, BRISTOL:
AND SOLD BY ALL BOOKSELLERS.

Entered at Stationers' Hall.

1855.

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SUBDIVISION OF THE POUND STERLING.

Metrical subdivision, or the appointment of an "integer of account," and of the numbers by which it shall be subdivided, is in all nations undoubtedly an act of sovereign authority, exercised for the common benefit, and to which obedience is enforced by law. When, indeed, we observe the strange numbers in some countries used for this purpose, we cannot always associate with sovereign authority the idea of sovereign wisdom. In the imperfection of history during those ages in which the appointed subdivision of money and of various weights and measures was made in different nations, we are driven upon conjecture as to the reasons (by courtesy) which may have indicated the very strange numbers selected. Of these reasons, it is perhaps not extravagant to suppose that sometimes regal caprice, a superstitious belief in the "luck" of certain numbers, the number of the reigning family, sometimes even dreams, may have governed a selection, in which the future prosperity of a nation was materially concerned.

In modern Europe we can well account for the selection of very strange numbers, upon the supposition that, as the only persons possessed of the little learning of their time, the monks were consulted as to the division proper to be used. With these pious fathers, it would not be surprising that even in such a work, numbers derived from Holy Writ should be predominant. Upon this conjecture we may well understand that the number 3, as indicative of the Holy Trinity, and of the day of the Resurrection, should be in especial reverence. For the number 4, (in a mathematical view so desirable) we find the four "kingdoms" in Daniel, ii. 31—40; the four children of Israel, Daniel, Shadrach, Meshach, and Abednego; and the four beasts, mentioned in Revelations, iv. 6—10. For the number 7, the charm to a monastic mind would be irresistible. The seven days in the week; the Seven Churches in Asia; the seven "seals," in Revelation v.; the seven heads, in Revelation xiii.; the seven angels, the seven vials, in Revelation, xiv.; the seven hills of Rome, all probably concurred in dictating the number, which forms the pivot of our larger quantities in Avoirdupois weight. For the selection of 12, the twelve tribes of Israel, and the twelve Apostles, were abundant attraction; and for the number 24, the four and twenty elders, in Revelation iv. We can reverence the piety which sought thus, in their daily and hourly business, to bring before the minds of the people a remembrance of sacred things; but in our happier day, blessed with access to the Sacred Volume itself, and with its doctrines fully disclosed to us, these artificial remembrancers of it are not necessary, nor perhaps, in this secular form, quite reverential.

While, in the scantiness of history, we may conjecture that in remoter times the subdivision of the integer often was effected with no attention to mathematical propriety, we are not hastily to assume that this was always the case. To have no metrical subdivision, and on all occasions to simply write in Arabian notation the *number* required of the minimum quantity, is an act so simple, so level with the meanest capacity, and which so idly rejects all the aids of science, that where we find in a great and enlightened nation a practice more refined, and, apparently, more difficult, we are inclined to ask whether there is not " some reason" for this. We see a great people, who, in all arts that are honorable, stand in the first place; can it be that such men have been content for centuries to go on with impediments in their work, which *may* have been imposed under a mistaken sense of religion, but which now, under a clearer light, we see to compromise no religious duty? We are led to this enquiry by its intrinsic value; by the force of a movement now in progress to alter our system in money; and by a belief that, if there had not been some valid reason for selecting the numbers used in our present subdivision, they would long since, by the wisdom of great men who have lived before us, have been rejected. Under a strong impression that this is the case, we now proceed to state the reasons, which we conceive to have prevailed in the subdivision of English money.

In all those collections of minor quantities into one "concrete integer," and subdivisions of the integer down to the smallest quantity, by which different weights or measures are distinguished, the object is with *one* word in utterance, or with *one* figure in writing, to denote quantities which, otherwise, would require *several* words, or *several* figures to represent them. As, in weight, we say, or write 1 ton, instead of 35,840 ounces; and 1 ounce, instead of 1-35,840 of a ton; and so of other weights or measures. To utter in negociations between parties, or to write in accounts, this superfluity of numbers, would be practically a great hindrance of business. The importance, indeed, of brevity in expressing quantities is not, in its full extent, generally understood. Facility for calculation is certainly important; but as, among merchants, the figures produced by *one* calculation are afterwards copied in numerous documents, or books of account of parties concerned, conciseness in expression of quantity is even more important than some abridgment of calculation.

But besides this, as in the work of accounts large figures give more trouble in Addition, Multiplication, and Division,—figures above 5 than figures below 5 in power,—it is a secondary, but by no means immaterial object, to express every quantity in figures of as low power as can serve the purpose. The great object being, then, to use *one* word or *one* figure instead of many, and small numbers instead of large numbers, it is clear that to use *more* figures than are necessary,—as two or three where one may suffice,—or figures of higher power, is an error, and indicates failure in mathematical science

For ascertaining by what numbers the integer may, according to these requisites, be most conveniently subdivided, we must keep in view that in the exigencies of business it becomes necessary to deliver or to receive all conceivable portions of the integer: the grain, or any imaginable number of grains; the farthing, or any imaginable number of farthings, may become the subject of any of these contracts: and we must express all these various portions of the integer in the smallest possible number of words, or figures. Perfection, therefore, in metrical subdivision consists in the selection of such [divisional] numbers, *that the integer may be divided by the* greatest *possible variety of numbers, with quotients of the* smallest *possible number of words or figures.*

Now in England the integer of money is "the pound," of the value nearly of 4 ozs. of silver; and this, it is agreed on all hands, ought always to remain the integer. Let us then examine its subdivisions, commencing with the smallest coin. In the extremes of wealth and poverty incident to our social condition, there are large masses of the people in whose purchases the farthing is a material instrument; and one the value of which in our economy is little understood, and will therefore be here explained. The humbler classes in this country purchase their supplies of tea, sugar, and other necessaries of life in small quantities, by the ounce, quarter lb., &c. Now the price of the pound of these articles is *fixed by competition,* so that it cannot be more or less; and it is such, that with the help of the farthing the price of the minute quantity required is (in almost every case) *exactly* defined. With a Decimal Coinage, however, [which it is proposed to introduce,] the figures which denote the same price for one pound are such that, divided to produce the price of these small quantities, there is almost invariably a "remainder," which is some portion of a "mil." This portion of a mil the tradesman cannot afford, on every purchase of 1d. or 2d. in value, to lose: he must, therefore, charge it as 1 mil.* But to subject for ever the millions of deserving people who form the humbler classes in this country, to loss such as this,—a loss of about 1s. in 15s. of their scanty means,—would be monstrous. The farthing, therefore, of 1-960th of the pound, is indispensable.†

* Wherever the price of 1lb. in £. s. d. is not equal to 8s. or some exact multiple of 8s., in a decimal division of coins, this remainder, with the ounce, occurs. In answer to this it may be said that the price, instead of something recognised in our present coinage, may be converted into multiples of 16 mils,—as 3c. 2m.; 4c. 8m., &c.;—and this brings us precisely to the pinch of the question. Goods are sold in competition; so that the tradesman cannot charge more than he now does for them; neither can he afford to sell them for less. For an article, therefore, which is sold at—say 2s. per lb., he must have 2s. per lb., of which 1½d. is the exact price of 1 ounce. Now 2s. are in decimals, 1 florin, or 100 mils; which, divided by 16, give 6 mils with the remainder 4. To avoid this remainder the shopkeeper must either charge 9 cents. 6 mils per lb., and so lose nearly one penny in two shillings; or he must charge 1 florin, 1 cent. and 2 mils,—2d.—22-25 more than two shillings per lb. As he cannot, through the force of competition, do the latter, he must charge 1 florin per lb.; and then, not to lose by his business, he must, on selling one ounce, charge the "remainder" to his customer as 1 mil. And so of all other prices.

† A great deal has been said about reducing our weights and measures to a decimal scale, by which it is supposed that this difficulty would be removed. But the Commissioners on Weights and Measures say, in their Report, (section viii.) "We see at once that it is impossible to abrogate the Avoirdupois pound and

But the purchases of these classes are always of so small amount, generally with the humbler class of tradesmen, and rarely entered [except collectively, as the day's "takings,"] in accounts, that fractions of the penny are by common consent omitted in the books of merchants, bankers, and others, of considerable business. We have then, for the purpose of accounts, to deal with the pound [sterling] in its larger subdivisions. In this work of metrical subdivision, we must be content with, not all that we may desire, but with the best that mathematical science can discover. We may, for instance, *desire* that the integer be divisible without remainder by any conceivable number; but this would require that it consist of so many *millions of millions* of component parts, that the smallest coin would be scarcely visible through a microscope. But we may, by a proper selection of divisors, make the integer divisible by so large a variety of numbers, with quotients of one, or only two figures, that the instances in which this is not accomplished would shrink into almost exceptional cases: and in doing this consists the perfection of metrical subdivision. Now numbers, which may occur as occasional divisors in business, are of two kinds:—*Prime* numbers, which cannot be divided by any other number without a remainder; and *composite* numbers, which are two or more numbers multiplied toge-

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ounce." And if this were not the case, a decimal subdivision of the pound weight would rarely prevent this "remainder;" for, except where the price of 1lb. has no pence annexed, it contains mils, from which there would always be a remainder, consisting of tenths of a mil.

ther. Taking, of the former, only the small numbers 2, 3, and 5, and the composite numbers of which they are factors,—rejecting all other prime numbers, or even multiples of them,—we have, for subdivision, the great majority of cases which ever occur.

Examining upon these principles our present system, we find, first that the number 20 is divisible by 2, without a remainder; by 4, by 5, and by 10, with quotients of only one figure; and by 8 and by 16, with quotients of only two figures. Then, for division by 3 and its multiples, the shilling having 12 pence,—a combination of 3 and 4,—we have, with the divisors, 3, 6, 12, and 15, clean quotients from the integer, of two figures alone, with no remainder. The pound, therefore, is now divisible by three numbers, which are 4, 5, and 10, with quotients of only one figure; and by 7 other numbers, namely, 2, 3, 6, 8, 12, 15, and 16, with quotients of only two figures. These, except 9, 14, and 18, and the "prime numbers," are all the numbers up to 20: and the transactions of the humbler classes are provided for with an exact fidelity, which, it has been shewn, is impossible under a decimal division.

Besides this we have, in dividing the pound by 20 and by 12, the secondary advantage, which no other system will confer, of avoiding the use of *higher* figures than are necessary. The shillings being 20, in which tens are denoted by the unit figure coming in regular succession, a large number of shillings is added with much less than half the labour that the same number would exact, if shillings exceeding 9 could not be inserted. And in pence, the number being 12, we have the unit figure occurring twice, and a cipher once, for every single insertion of the others of the nine digits.

These are advantages to be found in no other combination of [divisional] numbers; and we may well rejoice in that subdivision by 20, 12, and 4, which we have now the good fortune to possess. Of the farthing, and its indispensable service to the millions, the value has been shown: and in wisely limiting it to 4 in number, we are relieved from the necessity of loading our books of account with insignificant sums. And though in a low number, 4, it is yet in a number capable of binary division; to which the mind, not only of the humbler but of the educated classes, will always resort with preference, because it is in its nature more easy than the others. By the use of the farthing we have, below the integer, 959 varieties in amount of money; and the division of the pound into 960 parts has all the advantage over a division into 1000 parts, that, except in very few cases, it admits of division by 2, by 3, and by 5, and by all multiples of those numbers, *with quotients of fewer figures* than must appear under any other subdivision.

The 960 parts, into which the pound is divided, having been thus divided by 4, we find 240 parts, for the proper distribution of which we are to provide. For this we may suppose various combinations, as 40 × 6, 24 × 10, 30 × 8, or 16 × 15, each = 240. Of these combinations, from the first three the pound yields with every divisor larger quotients than we now have; and with each of them we lose the facility that we now enjoy in addition of shillings. In 40 × 6 the shilling is not divisible by 4. With 24 × 10, we have the abomination of the number 24: the plague of which in Troy weight is the latent cause of the Bank Directors adopting, in their bullion transactions, a decimal subdivision of the ounce. Besides this, the pound, divided by 5 or by 10, gives a quotient of two figures; and the shilling, divided by 3, 4, or 6, would have a remainder. With 30 × 8 the divisor 4 gives a quotient of 7s.4d.! and the shilling will not divide evenly by 3 or by 6. With 16 × 15, the pound, divided by 5 or by 10, runs to two figures; while the shilling will not divide by 2, or by any of its multiples,—which so often is required in business,—without a remainder. The only other factors (of two numbers) which make 240, are 48 × 5; 60 × 4; 80 × 3, and 120 × 2: and to these the objections above stated apply with double force.

To all who have experience of the activity and promptitude required in business, the necessity is obvious, that money,—which is the thing transferred in all business,—be divisible into the *greatest possible* variety of portions; and that these portions be describable, in language, with the *smallest possible* expenditure of breath and time; and, in writing, with the smallest possible number of figures. Payments of money, in all conceivable quantities, are going on in this great country at the rate of thirty thousand *every minute of the day.* The rich and the poorest, the merchant, the banker, and the tradesman, all have something to do in the matter: and in every payment the attention of *two persons* is occupied. In all these transactions the sum of money—the quantity of silver—transferred is *uttered* between the parties, perhaps a dozen times; and is afterwards *copied* on the average twenty times in different books of account. Would any man seriously propose, that in each of these transactions people should be obliged, again and again, to pronounce twice or three times as many words, and to write twice or three times as many figures, as may serve the purpose?

If we are not to fall into this error, we must perceive that in the work of subdividing the integer something more is required than mere Arabian notation. It is a task, in which science is invoked for a purpose conducive to the immediate comfort, and even the commercial prosperity of mankind. That it is also no easy task, we have evidence in the barbarous and uncouth numbers selected as divisors in different nations. In our own favored land, mathematical science has evidently made, in this cause, exertions worthy of her most earnest studies. For the great purpose in view, the utmost that *can* be done is to grasp the divisors, 2, 3, 5, and their multiples—rejecting all other numbers—and to carry these *sufficiently* high, and *not higher*. That in the number 960 they are carried *sufficiently high* we may be assured in the fact, that although there is a coin of half the farthing, nobody will use it: that they are carried *not higher* than is sufficient, we have evidence in the frequent use of the farthing in purchases by the poor. The number 960 being, by the gradation farthing, reduced to 240, it has been shown, that of all the component parts of that number, no one combination is equally efficient, for the great purpose of subdivision, as that which has been selected: and the result of all inquiry is, that for construction of money and the subdivison of the integer, the Pound Sterling of its actual value, subdivided by 20, by 12, and by 4, displays the perfection of mathematical science.

EXTENSION OF THE PRINCIPLE.

This being ascertained of the English pound sterling, a question arises whether the same principle may, with advantage, be of universal operation; both in the money of all nations, and in subdivision of weight or measure of all quantities. In discussing this question we do not, of course, assume any interference with foreign powers, in a matter which in every nation is of sovereign jurisdiction: but as the impulse to progress, which marks the present age, thirsts for some universal assimilation of measure, not only in money, but in goods, it may not be improper to enquire how far what, in these particulars, is certainly desirable, is also possible. Of mathematical truth, those who speak in the abstract would say, indeed, that it is not of one age or nation, or of one metal or substance; but that it is truth for the universe and to the end of time, of substance or of liquid, or of anything that may be divided into parts. But when, seeking the useful—which alone sheds upon science its dignity—we look at the case practically, we shall find that what mathematically is the best, is not in all cases available for use. The great principle of metrical subdivision, so happily applied in England, shows indeed the numbers by which, *with some modifications*, the money of all nations may best be subdivided: but in Weight or Measure of other substances, a scale in accordance with that of money neither is possible, nor would afford material facilities in business.

Of Money, we have already said that for the *construction* of the integer—that is, the determination of what value it shall be—and the *subdivision* of it, the English system is of singular excellence. But if we contemplate the extension of this system to all nations, we are to remember that, besides the obstacle of, perhaps, national prejudices, and the difficulties of the "transition-state," money, or the metal of which it is composed, has, in different countries, very different exchangeable value. Hence it arises, that in some nations they have coins of far lower value than the English farthing; and as these coins are in use by the far most numerous portion of the people, it is indispensable that they be retained: whence it follows, that if the integer of money be the Pound Sterling, the division of the penny, in such nations, cannot, as with us, be by 4. A modification therefore is necessary: and in this, it is important that the last subdivision, (that of the penny), be by as low a number as possible.

Retaining, in all cases, the principal divisors, 20 and 12, the modification which, we believe, will meet nearly all requirements is this. Where the lowest coin is not less than one-eighth of a penny, take as the integer the Pound Sterling,* and divide the penny by such number as will give the lowest coin in popular use. But where the lowest coin is less than one-eighth of a penny, let the integer be exactly *half* of the Pound Sterling; and divide the penny into the required number of the lowest coins. By this arrangement the greatest advantages, for all the purposes of subdivision, that *can* be attained, would be enjoyed by all nations. Of value in all imaginable varieties the expression would be the most concise that can be found: and for the purpose

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* In some nations, in which the integer is from 10d. to about 5s., a decimal subdivision prevails; which, it is thence inferred, would be an improvement in this country. But in this inference there are three errors. *First.*—It is because there is not, in so small an integer, expansion for division into 960 parts, that they cannot in these nations have the best subdivision that may be devised. At the same time, if, where the integer is of as high value as 2s.6d., they divided it by 20, and then by 6, they would have, in expressing portions of the integer, fewer words and figures to use than they now have. *Secondly.*—In some of these nations in which a decimal system is lately adopted, the former subdivision of the integer was so absurd, that the satisfaction felt in the change leads hastily to the assumption that the new plan, because an improvement on the former, is the *best* that can be conceived; which is incorrect, both in fact and in logic. *Thirdly.*—All these nations, in expression of *any* quantity of money, labor under disadvantages, which may be avoided. For *large* sums, the integer being so small, a greater number of figures must be used; as, for £534, in France 13,350f.; in Russia 3372·63 roubles; and in New York 2563·2 dollars must be uttered or written. And for *smaller* portions of the integer, because 10 divided by any number except 2 or 5 must have a remainder, more figures must be used than may suffice. We thus perceive, that not only in nations which adhere to some old and ill-contrived system, but in those which have adopted what they consider the best, imperfection, both in the construction and in subdivision of the integer, is found to exist.

of exchange in foreign commerce—as fractions of the penny do not appear in foreign bills—with the *full* integer of £1, the same figures would in all nations denote the same value; and with the *half* integer, it would be only necessary to divide or to multiply the number by 2.

That these advantages, in whatever form obtained, are most desirable, will not be disputed; but we must not conceal the difficulties which intercept such a consummation. In all men attachment to long custom, in all nations a pardonable national pride, are passions with which a reformer of unwise institutions will have to deal; and the "transition-state," of *learning how* to compute in the new numbers, is an incubus of terror. With these difficulties, however, a legislator may grapple with some hope, if, as is here the case, his scheme is one of substantial benefit. But there is a farther difficulty, to be openly declared and fairly met.

In the larger accounts of merchants, bankers, &c., coins below the penny do not appear: but we are to remember that those very coins are the current money of "the millions" in every nation. They therefore cannot be tampered with; and they must be retained *at their exact value.* Now for the purpose of accounts—where these small coins are entered in accounts—wherever the coins are fractions (of a penny) having 1 for a numerator, as one-fifth, one-sixth, or the like, there will be no difficulty; it will be simply to write in the proper place the number of the coins received, and, in addition of the column, to divide the total by the denominator or lower number. But as the lowest coin *precisely* is to be retained, it will sometimes happen that the numerator cannot be 1—as in the case of two-ninths, three-sixteenths, or the like—and in dealing with *these* coins in account lies the only real difficulty of the case. The plan pursued must be, to enter numerically the various numbers of *the coins* received; as, suppose 2, 3, or 4 coins of two-sevenths of a penny to be received, to enter in the column those numbers, 2, 3, or 4. Then, in adding up the column, multiply the total by the numerator, and divide the product by the denominator: as, suppose in the column of coins of two-sevenths of a penny, the total to be 45. Then $45 \times 2 = 90$; $90 \div 7 = 12$, and 6 remainder. Here the quotient, 12, is so many pence, to be "carried" in addition, to the pence. But the remainder, 6, being not so many *coins*—of two-sevenths of a penny—but so many *sevenths* of the penny, must be divided by the numerator, 2, giving us 3 *coins* to be placed as part of the total in the column of small coins.

There is, however, another phase, in which this difficulty presents itself; the remainder (6, in the above example) may not always be a multiple of the numerator, by which it is to be divided: as, if the total of coins of two-sevenths of a penny had been 25; then $25 \times 2 = 50$; and $50 \div 7 = 7$ (pence) and 1 remainder. This 1, being not 1 *coin* (of two-sevenths of a penny), but one-seventh, must be placed, with a dot (·) to divide it, at the right hand of the coins, so as to be added to the total number of sevenths (not of coins), in the next page; and the 7 pence are to be "carried," in addition, to the pence.

What has just been stated forms, we believe, the only *practical* difficulty that would attend a universal assimilation of coins upon the best principles. This, among all nations, is become an important object, not only in satisfaction of the new-born craving for improvement which marks this century, but that the craving may be fed, not—as it too commonly is—with merely change, but with that which is, in fact, what it is called in name. In money, accordance in the *construction* of the integer is, for international exchanges, a cardinal object. The *subdivision* of the integer is a creature of mathematical science; in which truth is one, and nothing else. For both these purposes, it has been shown that the English system is the best. In the "pound," as our integer, we express large values passing in international commerce, in the most concise form. In our subdivision also of that integer, all fragments of silver, or copper, that are required to be used as money, are represented in fewer words or figures than can by any other system represent them. To spread over the world this unrivalled system; to carry to all nations what is no feeble help in commercial activity; and to have, in what most occupies them, one common language,—these are aims of which ambition may be proud. That they are aims which, in the sound sense of mankind, we may hope to see realised, is simply to believe that men will readily accept that which is manifestly better than what they have. We see in the way to this only one difficulty; let us then look it in face. In doing this, we are to remember that the cases in which fractions of the penny, with a plural numerator, would occur are not the general, but exceptional cases. Where they do occur, it is probable that few, if any, of those whose dealings lead frequently to the use of these small coins, enter in account singly each of the small transactions in which payment is made in this currency. The work required beyond that under any other system is, when once understood, by no means arduous. And when we remember, that of the whole time occupied in accounts a *very small portion* is devoted to addition of the columns; that each line in the page records a transaction, which has occupied considerable time either in conversation or in correspondence; and that each sum of figures has annexed to it particulars, which it takes considerable time to write,—we must be convinced that this very small addition of work, and of very rare occurrence, in one stage of the great process of accounts, is not sufficient reason for rejecting a system which, in other respects, is of universal benefit.

WEIGHTS AND MEASURES.

While for the purpose of money, the English system, modified as we have explained, is THE system which, for the advantage of mankind, should be universal, there are, unfortunately, invincible obstacles to the application of the same masterly subdivision to Weights and Measures.

I. While money is of cosmopolitan interest, and is used by all individuals in all nations, Weights and Measures are instruments technically used by different classes in trade. They are for use, and therefore, must be such as best suit the quantities commonly required of the goods sold by those who use them. In weight, the ounce and the pound; in length the inch, and the foot, the yard, and the mile; in liquids the pint, the quart, and the gallon; in land measure the acre and the perch, are quantities so interwoven with the natural wants and accustomed demands of purchasers, that to prescribe in these articles any other measurement, however scientific, would be to invert legitimate order, and make science the mistress, instead of the handmaid, of man in his operations.

II. Strange numbers, which we find in subdivision of some weights or measures, are perhaps adopted for a purpose; in promoting dispatch of business by an accordance with foreigners in the quantities in which they pack and export their native produce. The people of those other nations have, perhaps, reasons for selecting these quantities; but even if they have not, we cannot expect them to give up their favorite customs, when—as will hereafter appear—no useful object would be attained by doing so.

III. In purchases by retail,—which form 99 times in 100 that the scale is used—the mind always turns to some binary subdivision of the pound, gallon, or other popular standard. *And it always will do so*, because this phase of calculation is naturally the most easy. But binary, or any other division *alone*, cannot accord with subdivision which embraces the largest possible number of divisors.

IV. The expansion, from the minimum to the largest quantity, in measure of different commodities so varies,—in one case only 54, in another 573440, with all sorts of other varieties,—that no one subdivision can be common to all weights and measures. In goods sold by Avoirdupois, for instance, we require the ounce and the ton, an expansion of 35840 steps; in linen, of what use would be a measure of 100 yards, which, after all, would be only 3600 steps?

It is thus impossible to apply to weights and measures the same subdivision, however excellent it may be. Nor is this so much to be regretted as many persons suppose. The advantage expected from a uniform subdivision in goods and in money, is, that, where the price of the integer of goods is defined in the integer of money, the price of the second, third, and fourth subordinate quantities of of goods would be exactly *the same number* of the correlative quantities in coin;—that, for instance, if the price of the integer of tea was £4, the price of the second quantity would be 4s., of the next, 4d., and of the last 4 farthings. But the fallacy of this lies in the assumption, that the price of the integer of goods would be always some number of the integer of money. On the contrary, there is not one instance in ten thousand in which this would happen. Varying from time to time with supply and demand, and differing with every shade of difference in quality, the price of the integer of goods would be generally a combination of the integer, and some of the secondary coins of money. And in these cases, accordance in subdivision of money and of goods would evidently not assist in calculation of prices.

But it is supposed that this object might be attained, if we had a decimal division both of money and of weights and measures. On this question of weights and measures, it may be sufficient to say, that the learned "Commissioners for the Restoration of the Standard Weights and Measures" are most desirous of such a consummation, but admit that it is impossible. It appears, indeed, that there is nothing liquid or solid,* except bullion, to which these gentlemen find it practicable, in the business of life, to apply a purely decimal system. But if in *goods* the subdivision be not decimal throughout, (as there must be a "break" somewhere in the chain) a decimal *coinage* gives us no help in computing the price of compound quantities.

Of Weights and Measures the principal use is in

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* The Commissioners [Report, Sect. VII.] propose to retain the chain of 22 yards; the yard of its present length [*ib.* 21] to be subdivided into one-eighth parts [see 93]; the foot [see Sect. VII.]; the ounce 1-16th of a lb. [see 42]; the gallon, the quart, the pint, the half-pint, the gill, and the half-gill; for wine one-sixth of a gallon; the bushel, the half-bushel, and the peck. [See Sect. X.] Also, for medical prescriptions, the present scale in Apothecaries' Weight. [See 46.]

retail purchases; which, in the natural proneness of mankind, run always in binary subdivision, as one-half, one-fourth, one-eighth, one-sixteenth, &c. But in Money, many other divisions occur for which we must provide. The system therefore, which in Money is the best that mathematical science has disclosed, would, in Weights and Measures, impede business, and bring science into disrepute.

OF A DECIMAL COINAGE.

It was explained in the commencement of these pages, that

> "In all those collections of minor quantities into one 'concrete integer,' and subdivisions of the integer down to the smallest quantity, by which different weights or measures are distinguished, the object is, with *one* word in utterance, or with *one* figure in writing, to denote quantities, which otherwise would require *several* words, or *several* figures to represent them."

To those who appreciate the importance of this object, and who perceive, that for the attainment of it our present subdivision of the Pound is *the best* that can be devised, it may seem unnecessary to canvass the merits of any other system. An opinion, however, has lately gained ground, that a *Decimal* Coinage would confer greater facilities in the business of accounts. This opinion is shared by two classes of persons—gentlemen of high mathematical attainment, but who certainly must, in this case, have overlooked the *purpose* of all metrical subdivision; and others, whose knowledge of decimal arithmetic is extremely meagre. As the thing proposed is one which, in its practical effects, must seriously affect all classes, we purpose here to examine the merits of a Decimal Subdivision of the Pound Sterling. In doing this, we shall not touch upon the difficulties incident to the "transition-state;" that is to say, those attending the adjustment of conflicting interests in numerous payments, of taxes, tolls, &c., which are defined by law in pence; or the task which all persons must have *at first*, in *learning how* to calculate and keep accounts in coins of the new values. We propose simply to examine the plan *as a system*, and in its *permanent operation.*

Before we proceed to this inquiry, it is proper briefly to notice one document of high authority (but surely issued in error) on this subject; which is, the "Report of the Select Committee on Decimal Coinage," dated August 1st, 1853. In framing this Report, the Committee were doubtless guided by the evidence before them. That evidence may be divided into two parts—the one matter of opinion; the other, of arithmetic. Of the former, in many cases given by men eminent in science, we must be excused saying that, high as is the authority of the gentlemen examined, we find, in their answers, none of that demonstration of truth, which *proves* anything to be certain. The witnesses, throughout, declare that they consider Decimal Coinage an improvement: the Committee, throughout, appear to conclude that therefore it must be so: but this is precisely the point to be ascertained. We hear, indeed, a great deal about time that would be saved in various calculations, and diminution of labour in accounts; but *how* all this is to be accomplished, the learned witnesses do not explain. When, however, we come to the arithmetical portion of the evidence, we find matter which throws a clear light upon the subject; which removes any doubt that we might otherwise have entertained; and which, we believe, will strike the Committee with astonishment. For the purpose of showing the comparative facilities, in practice, of our present system and of that which is proposed, gentlemen present papers professing to show either the number of figures used in solving questions of money both in £ s. d. and in decimals, or the decimal figures which represent various sums of money. What must be the surprise of the honorable members of the Committee, when they hear that in nearly the whole of these examples the decimal figures presented to them are incorrect? Yet such is the fact, as will be found on reference to the following pages in the Report:—

In page 18,	£ 14·193 ought to be £	14	1	9	2·7083′
„	£ ·042708 - -	0	4	2·7083′	
„	£ ·00729 - -	0	0	7·2916′	
27,	£2067·377 - -	2067	3	8	5·416′*
64,	A "Table" of 96 items	92 items wrong†			
104,	A similar Table - -	64 items wrong‡			
111,	£2059·960 ought to be £	2059	9	6	8·75
112,	£70314·500 - -	70314	5	8	3·3′

* A question in £ s. d. is here solved in the figures £2067 7s. 8½d.; the *decimal* sum should be of the same value.

† A Table, of the value of each number of farthings, from ¼d. to 2s.

‡ 32 by omission of a figure, 32 by omission of the repetend mark.

In several other cases, forming in the whole nearly all those examples, in which the Committee would expect to find the figures necessary to be used in a decimal system, the same serious error prevails, of omitting figures, and omitting the repetend mark, so necessary for correct calculation. And when we consider that this is the portion of the evidence by which, probably, the minds of the Committee were most convinced; that on matters of opinion they might be uncertain, but that in figures they would consider there could be no doubt; we cannot but believe that the Report is one which these honorable gentlemen themselves would wish, if possible, to revoke.*

Leaving, with this statement of facts, the Report of the Committee to its *quantum valeat*, let us now proceed to examine the operation of a Decimal Coinage.

We may be certain that, under whatever name, people will continue to buy and sell the same quantities of the same goods for the same quantities of silver, or—if the legislature do not prevent them—of copper, as they now do: and the question is, in what form these quantities of silver or copper may be most conveniently expressed. In this, the *desi-*

* It is a singular fact, that in a question in which the working-classes are so materially concerned, as one in which the farthing is to be abolished, no person of that order was examined before the Committee. Men of science, gentlemen of high position, and even the Duke of Leinster, were asked how they thought the humbler classes would receive the measure; but not one person of those classes was examined. The question was put, certainly, to a few retail tradesmen; but they are probably the very last persons whom, on such a question, the working-classes would depute to represent them. If the Committee had called for the opinion of any Mechanics' Institution on the subject, we have little doubt that it would have been to effect stated above.—[See pages 7—8.]

derata are, first, conciseness in use of figures; secondly, facility in calculation. We say, *first* conciseness; because calculation is a process once required, and only once, in any transaction; but, in commercial accounts, the figures produced by the calculation are afterwards copied, at least twenty times, in different books or documents of the parties concerned. This is a point which, in any comparison of different subdivisions of the integer, should always be borne in mind.

Now it is manifest that in decimal arithmetic, as all divisors except 2 and 5 leave a remainder, we must almost always have, instead of conciseness, a prolixity of figures. To show exactly how it operates in this case, we subjoin

A TABLE,

Showing the figures, which, if a Decimal Coinage is established, it will be necessary to use in writing, and in utterance *vivâ voce*, instead of Shillings and Pence.

Shillings.	Flor.	cents	Pence.	Nearest Equivalent cents	Nearest Equivalent mils.	Actual Equivalent. cents	Actual Equivalent. mils.	
1		5	¼	...	1	...	1	·0416′
2	1	...	½	...	2	...	2	·0833′
3	1	5	¾	...	3	...	3	·125
4	2	...	1	...	4	...	4	·166′
5	2	5	2	...	8	...	8	·333′
6	3	...	3	*	*	1	2	·5
7	3	5	4	1	7	1	6	·6′
8	4	...	5	2	1	2	0	·833′
9	4	5	6	2	5	2	5	...
10	5	...	7	2	9	2	9	·166′
11	5	5	8	3	3	3	3	·333′
12	6	...	9	*	*	3	7	·5
13	6	5	10	4	2	4	1	·666′
14	7	...	11	4	6	4	5	·833′
15	7	5						
16	8	...						
17	8	5						
18	9	...						
19	9	5						

* In these cases, the *actual* equivalent including just half of a mil, we can assign no exact sum as likely to be the equivalent current in business. In other cases, when the fraction is less than half, we consider it as nothing; where it is more than half, as 1.

From these Tables it appears, that for all sums having pence we must, with a Decimal Coinage, use either *more* figures, (two instead of one,) in all our books, &c., or *higher* figures. With 1d., 2d., 10d., and 11d., we must use *higher* figures; with all other numbers of pence *more* figures—two where one now suffices.

In Shillings, the figure 5 annexed to each odd number (coming intermixed with all other figures in the column of cents) must make the work of adding sums *of the same actual value* considerably more difficult than it now is.

The cases in which these two evils of more figures and higher figures occur, may be thus numerically stated. All the varieties of money below £1--differing each from the next by 1d.—are 239: of that number, the only sums in which we are exempt from these evils are 9; namely, those in which there are only shillings, and of them an even number. So that 23 times in 24 in which this system operates at all, it operates to increase trouble; in transactions, which, on the average, are copied in writing 20 times.

Besides this, we have four columns instead of three, in which to enter sums of money. From all which it follows:—

I.—That using *more* figures, to record the same acts and represent *the same real values*, the clerk must be urgently pressed in his labour: of which, continuously to put proper figures in proper places is the most fatiguing portion. For, every figure is a word, seriously affecting the accuracy of the whole account, and therefore requiring close attention; but is not, like other words, so interwoven with the context, that it is retained in memory by the spirit of the sentence in which it is used. Generally a clerk now carries in his mind the whole sum of £ s. d. which he has to copy, after *once* looking at it. Under this plan, *generally*, he will not be able to do this; but must stop in the middle, and look *again* at the sum.

II.—With *higher* figures, the labor of adding long long columns must seriously increase; for, the inchoate number added soon mounts up to 100; after which, the addition of each successive figure causes twice the effort of the mind, and consequently twice the risk of mistakes, that we have before we reach that number.

III.—In business, sums of money must frequently be entered as quickly as possible. We are to have four columns instead of three in which to enter them. The error, then, of entering figures "in the wrong column" will be ten times as frequent as it now is.

Gravely considering these specified operations of the new project, we must perceive that, collectively, they will bring into the labors of the counting-house aggravation which it is really frightful to contemplate. To say that this will *increase by one hour and a half the daily labor of clerks*, is very much to understate the case. With all the exertions made to complete—within the limited time—portions of accounts which *must be* ready at stated hours, there is a strain for that time upon the faculties of the mind, which materially weakens its power for the duty next to be performed. Still, that duty comes, with (very unnecessarily) increased labor, to be somehow got through, with less than average power to do so. The result must be, that at the close of the day the consequences of all this needless straining of the faculties appear in "the books being wrong;" and then—*when will* business be over?

Such, in the business of nineteen hours in twenty that are devoted to accounts, is the operation of this new project. But, it is said, the system affords increased facilities in *calculations.* This, though a secondary, is an important object, and shall be examined.

Of decimal arithmetic, for calculations of a particular kind, the value is not disputed. With men of scientific profession, occupied in these calculations, that it should be in especial favor is natural. That others, who would stare at the words "similar repetends," should take for granted upon such high authority, that this arithmetic is the best for their business, is part of the homage commonly paid to great names. But the question is, not of calculations required only in a few scientific professions, but of those of all imaginable varieties, which occur in the business of the Exchange, the factory, or the shop; which must be made exactly, and must be made promptly.

Of these calculations we will commence with those which are most frequent. Probably nine times in ten that computations in money are actually made, they are in the purchase of the necessaries of life by the humbler classes; whose supplies are from ½lb. of cheap articles, to 1 ounce of others. Let us now set forth the ordinary price in £ s. d. of some of these articles:—Tea, 4s., 3s.8d., and 3s.4d. Coffee, 1s., 1s.2d., 1s.4d., and 1s.6d.; Sugar, 3½d., 4d., to 6d.; Soap, the same prices; Candles, 8d. to 9d. per lb. At these prices, there is probably not a poor person in England who cannot compute, at once, the price of the small quantity required of each article, and pay down the price of the whole assortment without any loss of time. But in Decimal Coinage, what sort of "calculation" must all these poor people accomplish?

	s.	d.		fl.	c.	m.	
For	4	0	they have to divide	2	0	0	by the required number.
	3	8	- - -	1	8	3	
	3	4	- - -	1	6	7	
	3	0	- - -	1	5	0	
	1	0	- - -	0	5	0	
	1	2	- - -	0	5	8	
	1	4	- - -	0	6	7	
	1	6	- - -	0	7	5	
	0	3½	- - -	0	1	5	
	0	4	- - -	0	1	7	
	0	4½	- - -	0	1	9	
	0	5	- - -	0	2	1	
	0	5½	- - -	0	2	3	
	0	6	- - -	0	2	5	
	0	8	- - -	0	3	3	
	0	9	- - -	0	3	7·5	

Now let us only suppose a poor man or woman having to discover, in these decimal figures, the price of one-quarter, one-eighth, or one-sixteenth of the lb.; and not only this, but afterwards to add in memory all these compound sums of cents and mils, which would form a purchase of 1s. or 1s.6d. in amount! The task is one which, we believe, few well-educated persons could accomplish. But the effect would be, that in every such purchase the tradesman and his customer must stand, on the average, half an hour discussing the knotty point. A shopkeeper would find, remembering all the while that "in business time is money," that under this *regime* he served two, or perhaps three customers, in the same time as he now serves twenty! And this, nine times in ten in which people calculate, is called saving time in calculations!*

But this is by no means the worst of it. After all their labors to decimalise things, the learned Commissioners of Weights and Measures find that in everything, except bullion, they are obliged to retain the measures of binary subdivision. Why is this? Because from the innate facility of that mode of calculating, it is, and ever will be irremovable from the popular mind. But of these 16 decimal prices, not one is divisible by 16 (the divisor for an ounce) and only one by 4, without a "remainder,"† some

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* Of all payments that are made, probably three-fourths in number consist of some fractional part of the shilling; which is divided into 48 farthings. 48 is divisible without remainder by 2, 3, 4, 6, 8, 12, 16, and 24, nearly all the numbers ever used in dividing so small a sum. *The same value*, under the name of 5 cents, will divide without remainder by no number except 2. With all other divisors, it must leave a remainder, *which cannot be paid in any lawful coin*. Which is quite sufficient to swamp Decimal Coinage.

† It may be said, indeed, that at present this sometimes happens: but the difference is, that it now is of so rare occurrence as not to excite notice; but with a Decimal Coinage, in *every* purchase below sixpence in value it must take place.

portion of a mil. Only four of them (namely 2flo.; 1flo. 5c.; and 5c. 8m.) are divisible even by 2. And what must be the consequence of this? Why that in nearly every one of the small transactions of the poor there must be a loss, averaging half a mil, to either the tradesman or his customer. This, no skill in science, no wisdom in legislation can prevent. Great things may be done by these faculties, but to vary truth—to make that in arithmetic appear true which is not true—passes even these transcendent powers. And upon whom must this serious loss—of about 1s. in 15s. of the *chose en action*—fall? Why upon the poor man certainly. To the tradesman, who pays probably 13s. or 14s. for the goods sold, such a sacrifice would be a passport to the *Gazette*. Here, then is a project by which, inevitably, and as long as the system lasts, the laboring millions must lose, as by abstraction by some invisible hand, one shilling in fifteen out of their hard-earned wages! It is not by a declared and understood confiscation; it is not by an avowed reduction of wages: but it is that by some mystery in arithmetic, to their simple minds incomprehensible, they find at the end of every week, that whereas they formerly had for their labour certain comforts of life—certain "real wages of labor"—now they have them not. And is it possible that the legislature should ever consent thus in perpetuity to grind down the poor? NO. We will not so defame English gentlemen, we will not so outrage the common decencies of life, as to believe such a thing.

To proceed in our question, the calculations next in frequency are those, exercising multiplication of money, which occur in purchases "across the counter" of *several* yards or pounds, &c., at per yard or pound. The complaint here is, that in our present system we have two operations—first to multiply the number purchased by (generally) the pence which form the price, and then to divide the product by 12. As, for five yards at 7d., first, $7 \times 5 = 35$; then $35 \div 12 =$ 2s.11d.* which, in decimals, would be reckoned, 2c. 9m. × 5 = 1fl. 4c. 5m. [In this case, to be sure, the decimal product 1fl. 4c. 5m. comes out wrong, as 2s.11d. are = 1fl. 4c. $5\frac{5}{6}$m. which in business would be called 1fl. 4c. 6m.; but to have made the *exact* product, we must have had 2c. 9·16′m. as the price, which would have made a calculation infinitely more difficult than we now have.] In another case of the same kind, seven yards at 9d. making 5s.3d.,* we should have, in decimals 3c. 7·5m. × 7 = 2fl. 6c. 2·5m.; which is, certainly, to most people a more troublesome affair than we have at present. But it is generally *not* necessary to work with this duplex movement of multiplication and division; for, as 12 pence make one shilling, the number of pence in most cases makes it easy to use the rule Practice. In both the foregoing cases, anyone accustomed to buy or sell goods would reckon thus:—in the first case, five sixpences are 2s.6d., and 5d. make it 2s.11d.; or, in the other case, seven sixpences are 3s.6d., and seven

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* We select here a case advanced before the Committee on Decimal Coinage, in proof of the *difficulty* of our present system.

threepences, (half of that) are 1s.9d. = together 5s.3d., which certainly is no great effort. Practically, and in fact, we do not find in shops any of this terrible difficulty, which men of science say that we ought to find; but if we have a Decimal Coinage, it will be necessary, in nearly all these cases, to multiply two, or perhaps three, figures—found in the Table, page 30—by the number of yards, &c., that are purchased. Suppose, for instance, so many articles at 1s.6d. or 2s.6d. each; any one who would boggle at this must be the dunce, and exception to the rule. But in decimals we should have to multiply the number of articles, in the one case by 75, in the other by 125. This is what very few people can do without setting down the figures in writing; and slates handsomely framed, and Multiplication Tables must be added to the furniture of retail shops. But of the purchasers at these shops nearly all are ladies. Only fancy one of them sitting down to "do sums" on the slate, *vis-a-vis* a smart assistant watching the operation, and in presence of a number of other ladies! Could the thing be tolerated; or would any lady in England, who had undergone the operation once, ever enter a shop again if she could help it? *That is the question* for shopkeepers of this class.

It is quite evident, that for the calculations required nineteen times in twenty a Decimal Coinage would be a positive evil. Let us, however, pass on to those which, though less frequently, are still on some occasions used in business. Of these calculations, one upon which great stress is laid is the Rule of Three, in which it is supposed that a Decimal Coinage would confer advantages in saving the trouble of reducing the money term, or terms, of the question into pence, or—once perhaps in six months—into farthings. But what is overlooked in this is, that after this reduction the figures produced are to be dealt with in two, generally long, sums in multiplication and division. It is then that comes the real work of the question; and to show what that work will be, in nineteen cases in twenty the decimal figures so heavily exceed the number produced by reduction, that the work is really more difficult in decimals than at present: which anyone may ascertain by experiment. The case is this. Where the sum has shillings only, and of them an even number, the decimal figures are only half the amount of those produced by reduction; but this is the one case in twenty. In other cases, where there are shillings alone, not in even number, the decimal figures denote 5 times the number produced by reduction. But in the general case—of shillings and pence—the profusion of decimal figures is quite alarming. For example

£24	13	8	is	5924 Pence; in decimals	£24.683·3'
1745	8	7		418903 - - -	1745.429·16'
736	15	3		176823 - - -	736.762·5
247	18	9		59505 - - -	247.937·5
3	17	9*		933 - - -	3.887·5
35	11	6		8538 - - -	35.575
3	17	10½†		3738 Farthings -	3.893·75

It were easy to multiply examples, all proving the

* The Bank price of gold. † The Mint price of gold.

same general fact; but what in this case is to be remembered is, that in arithmetical operations, the longer the mind continues exerted in *the same kind of labor* the more it becomes, in some organisations drowsy, in others giddy or doubtful. In this we speak from observation; and what we learn from it is, that in lengthening the process of Multiplication and afterwards of Division in the Rule of Three, a decimal expression of money must considerably increase the labor. Either the mind must work very much harder than it is now required to do; or there must be mistakes, and then the work is all to be done again. In the Rule of Three, a Decimal Coinage would sadly disappoint those who desire it. But after all, questions in this Rule, except in the transactions of a few select classes, rarely occur in business.

In Commerce, business to a large amount is done in goods such as cotton, spices, drugs, and articles called "small ware," which are sold at, often, a few pence and a fraction per lb., &c. In these transactions, the number of pounds, &c., being large, it is necessary that the price per pound be stated *with exactness.* Let us now show, in decimals, what numbers must be used in multiplication as these prices; and in doing this, we shall first exhibit sums presented (before the Select Committee on Decimal Coinage) as specimens of the *difficulty* of our present arrangement.

Page 15. $1\frac{7}{100}$ farthings is in decimals 0c. 1·114583'm.
" $4\frac{29}{100}$ - - - - 0c. 4·46875m.
Page 17, $3\frac{13}{32}$ pence - - - 1c. 4·1927083'm.

There are, we believe, no other examples of this "difficulty" in the Report; and these, perhaps, are sufficient? They serve at least to show, if the evils that we endure are grievous, what sort of comfort lies in the proposed remedy. But as the case is of business, let us exhibit some of those prices which really "come home to men's business and bosoms."

For $10\frac{5}{16}$d.,	we are to use	4c.	2·96875m.
$8\frac{3}{16}$d.	- -	3c.	4·114583̇m.
$4\frac{25}{32}$d.	- -	1c.	9·921875m.

These are, perhaps, sufficient examples of what merchants, who very properly require exactness in calculations, may expect during a Decimal Coinage in those calculations, for large numbers at low prices, in which precision is so important. Nor are these by any means exaggerated or extreme cases. Not long ago the writer was required, professionally, to state in decimals the price per gallon of a cask (93 gallons) of wine purchased for £16. The price extended to eighteen figures! If the case had been of 49 gallons for £12, we should have had a quotient of forty-three figures, all repetends, to be dealt with. Nor is that the utmost that may be. A repetend *may* extend to any number of figures short of the divisor; so that if we divide by 783 we may chance to have a repetend of 782 figures to deal with. And this is what is gravely proposed, as a *relief* to men of business!

We have thus shown, in those calculations in which 99 people in 100 are ever concerned, not only that this project of a Decimal Coinage would very much increase labor; but that in the special case of the poor and their slender purchases, it must operate as a standing confiscation. That there are other calculations, required by the Aristocracy of Commerce, or used in some learned professions, in which this system would sometimes afford assistance and sometimes increase trouble, we are quite sensible. But as these gentlemen, though of, no doubt, the highest respectability, are few in number, and form but a small proportion of the whole people, we may perhaps be excused a discussion of details, unavoidably of great length, but of interest only in cases in which they are concerned.

Of the arguments advanced against our present system, the most prominent is the difficulty, in addition of money, of dividing pence by 12 and shillings by 20; which has been described in most alarming terms. It is strange that our forefathers, for so many generations, never found out this difficulty; but they perhaps were benighted people, and the difficulty is one of the discoveries of "more advanced science." Still, experimentally we have not realised the discovery. We have spoken about it to at least twenty clerks, who have a great deal of this work to do; and they say that they have not yet found out the "difficulty." They actually stare at the mention of it; and are so simple as to believe that, having the work often to do, it becomes easy. However, if other persons, whom we have not yet met with in our travels, find this a task, with the help of a Shillings and Pence Table the "difficulty" is at an end. To speak seriously of this ghost of a "difficulty;" it is confined to work which occupies *possibly* as much as five minutes in two hours that are devoted to accounts; as a clerk generally adds in five minutes the sums which, with particulars annexed, it has taken him two hours to copy. And the relief proposed by advanced science is, to increase by about twenty minutes the work of the two hours, with four or five times as many errors, in a given number of pages, as he now has!

But we are told, and upon very high authority, that the instruction of youth in this mystery of numbers occasions great loss of time in primary education. How it does this is not explained; but, speaking always under correction, we should rather believe, that if in primary education youth are to learn the rules of addition and division, the exercise of those rules in adding shillings and pence is time strictly appropriated to its legitimate use. It is time, certainly, applied in acquiring knowledge which enables the youth in after life to fill many situations of usefulness and emolument; and to qualify him for the same work, under a decimal system of money, —with all its fractions and repetends to be correctly treated—would absorb *at least twenty times* as many hours from primary education. The gentlemen who complain of time lost in this important pursuit, gravely propose that Logarithms should be introduced,* "with a complete establishment of the Decimal Coinage," into the business of accounts; of course, by way of saving time in primary education?

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* See Report of the Select Committee on Decimal Coinage. Questions 709 and 602.

We hear a great deal about "Decimal Coinage," and nine people in ten probably suppose that it means one thing. On the contrary, it means not one thing, but four things: and they are all "Decimal Coinage." They stand as follows:—

No. 1, A plan for dividing the pound downwards by 10, into 1000 mils.

No. 2, One for multiplying the farthing upwards by 10, to 1000; making the pound £1 0s. 10d.*

No. 3, Another for dividing the penny by 10, and multiplying it upwards to 100 pence, or 8s.4d.

No. 4, A plan for multiplying the penny by 10, and that coin by 24, preserving the "pound" at its present value.

Of these plans, counsel for No. 1 reproves No. 2 and No. 3 for invading the sanctity of the pound. Counsel for No. 2 rebukes No. 1 for disturbing the value of the farthing. And to what, in common sense, does all this amount? To proof positive, that in both schemes there is a vice fatal to the whole project. To alter the value of the pound, would be to unhinge all settlements and contracts of an enduring character: it is doubtful, even, whether the National Debt could *legally* be exempted from the alteration. To abolish the farthing would be (infi-

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* While these pages were in the Press a very able exposition of this plan has appeared, under the title of "A System of Decimal Coinage and Currency without Fractions of the Lowest Denomination, in Exchanging for Sterling Money. By C. Vining." If the vice of decimal arithmetic in money were not incurable, we should say that Mr. Vining has exhibited that system in its least objectionable form. He wisely steers clear of the very hazardous experiment of tampering with the poor man's farthing, and treats his subject with perspicuity and temper. Still he does not, nor can anybody, remove the radical objections to decimal arithmetic in the subdivision of English money.

nitely worse) to subject "the millions" to that standing confiscation* which we have explained. These, on either side, are evils, of which no wise man would face the *consequences*. But no system, in which the two values of £1 and ¼d. are retained, can be decimal. What then is it but trifling in learned language, to talk of such a thing?

There are in the very nature of Decimal Arithmetic, defects which make it in all cases bad for the purposes of metrical subdivision. It is, in fact, not metrical subdivision; but simply an unwieldly exhibition of large quantities by cumulative statement of the *number* that they comprise of the smallest quantity, (as, in Avoirdupois Weight, to write 35840 ounces instead of 1 Ton). In English money, it would be to describe all sums under £1 by the number of mils that they contain; as if, at present, instead of 3s. we were to write 144 farthings. Hence it comes, that in 230 cases in 239 we must in this system use either more figures, or figures of higher power, to denote the same value.

But it is still more in the *Arithmetic* of decimal calculations that the vice of this system is incurable. Of money we must have quantity in all sorts of varieties:—which are found both by multiplication and by division. For the former, prices being stated in more figures than are necessary, in retail purchases (of so many yards, &c.), calculation will be a work, which must make busy times at Lord Mostyn's slate quarries: for division, except by the

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* See pages 7—8, &c.

numbers 2 and 5, the task will be sometimes intolerable. In business, especially where prices run to small fractions of the penny, calculation must be *exact:* fractions are produced by division: in decimals, where the divisor is multiple of any number besides 2 or 5, the fraction is a repetend decimal of *unknown length.* To say nothing of the number of figures used, to learn how to deal with these repetends, so as to meet all the requirements of business, would with most children absorb the whole time devoted to education: and then, to make use of all this intricate lore at the desk, would be to spend hours in doing what now is done in minutes.

Of the practical effect of this system, in the small purchases of the poor, we have spoken in pages 7—8; and with every lover of justice what is there shown will have its weight.

To counterbalance all these evils, the only advantage that we can perceive in this project is, that in calculations incident to some learned professions, and sometimes in ascertaining the value of foreign bills, this system would abridge labor; but how many in a million of the people of England have anything to do with these matters?

J. Wright & Co. Steam Press, 18, Thomas Street, Bristol.