where contracting parties meet upon fair and equal terms, the less the law interferes with them the better; and in all recent economical legislation this principle has been recognized.

I am, Sir,
Your very obedient Servant,
ARTHUR H. BAILEY.

Eagle Insurance Office, May, 1854.

DECIMAL NUMERATION AND DECIMAL COINAGE.*

Cardrona, Peebles, 27th April, 1854.

DEAR SIR,—I have read with much pleasure and approbation your pamphlet on *Decimal Numeration and Decimal Coinage;* and as during a long mercantile life, in various countries where a decimal coinage was the currency, I have used the decimal numeration in calculating, with my own hand, more than most merchants are in the habit of doing (they generally delegating that work to their clerks), I hope I may be excused for offering some of my experiences to your consideration.

But before entering upon that subject, I may state that I think favourably of your plan of the *shilling unit* for a new coinage, which would certainly "be the means of introducing the decimal system, with the minimum of change," as recommended in the Report of the Committee of Parliament. But I think that this might be effected even more simply than you propose—viz., by merely abolishing the penny and farthing, and substituting in their place *cents* of the shilling. This is in reality what you do, only you call them *mills* of a ducat. The introduction of a new denomination (the ducat) I consider both objectionable and unnecessary, as I shall proceed to demonstrate.

All authorities seem agreed that the pound sterling, as the highest denomination of our currency, must be retained; and my proposal is, that accounts should be kept in pounds, shillings, and cents of a shilling. This, though apparently a departure from a decimal system, is more so in appearance than in reality. In adding a number of sums together, it is *practically* as easy to *carry* to pounds from a column of shillings as from a column of florins on the decimal plan; and for purposes of calculation, it will be only necessary to make a preliminary reduction of the pounds into shillings (as simple an operation as reducing them to ducats on your system), and to reconvert the result into pounds, which is equally simple. Take, for example, the sum of 4 pounds 6 shillings and 9 pence. To express this decimally, in the pound unit, requires 5 *digits*, thus, £4·3375; whereas, to express the same sum in the ducat and the shilling units requires only four. Thus—

In the ducat unit	D.8·675;
In the shilling unit	Sh.86·75;

in both of which the *digits* are identical, and therefore the calculations made with them will be equally short and equally easy. This proves your introduction of a new denomination, the "ducat," to be unnecessary.

But after all (with due deference to the high authorities quoted by

* The following letters have been obligingly placed at our disposal by Mr. Thomson, and we gladly avail ourselves of his permission to lay them before our readers.

you), I must say that I consider the measure of a decimal *coinage* of no use or importance, unless all our weights and measures were also decimally divided; which I will afterwards show to be *impracticable*. Any schoolboy of twelve years of age can reduce shillings, pence, and farthings to the decimal of a pound "*by inspection*:" at least I was taught to do so, at that age, in a parish school fifty years ago, and have practised it ever since; and our schools are much improved since that day. When I afterwards went to my apprenticeship, at the age of 15, I recollect studying a book you so justly commend—*Leslie's Philosophy of Arithmetic*—and which I have not since seen; but I think it was from it I first learnt the *defects* of the *decimal* division; and that, if man had been created with twelve fingers in place of ten, we should have had a more perfect system of arithmetic—the *duodecimal*, with twelve digits or *Arabic numerals* instead of the present ten. This, however, is now hopeless: but the defects of the denary division remain—viz., that 10 has only two *factors*, 2 and 5; while 12 has four, 2, 3, 4, and 6, by which halves, quarters, thirds, and sixths can be expressed: and this is the reason why the shilling is conveniently divided into twelve pence, the foot into twelve inches, the troy pound into twelve ounces, &c. The division of the avoirdupois pound into sixteen ounces is also most convenient, because that division is made by repeated bisections. Ten can be halved, but it cannot be quartered, without another step in the decimal scale; while a third, a sixth, and a twelfth, cannot be expressed by any possible extension of the decimal notation. It can only be divided into halves, fifths, and tenths; and no one ever wants the fifth or the tenth of a pound of tea or of anything else. The reason seems to be that, in spite of our ten fingers, fifths and tenths are not *natural* divisions. Try, for example, to divide a piece of string, of any convenient length, into five or ten equal parts. It cannot be done, except by continued *guess* trials; and whether you hit upon it the first trial, or the hundredth, or the thousandth trial, it is impossible to say. But the same string can be easily and exactly folded into three equal parts, which, doubled, divides it into six; and these doubled again, divide it into twelve equal parts. Thus, however admirable the decimal division may be for facilitating calculations with the pen, it is of most inconvenient manipulation when you come to use it with material substances, such as weights or measures.

It is for some such reasons as these that the French, after having, with all the pride of science, introduced their *systéme metrique*, found that for many common purposes it was *unuseable*;* and they were obliged to substitute in its place what is called the *systéme usuel*, by which a half kilogramme is made into a pound, divided into twelve ounces, and the ounce into eight gros. Similar to our apothecary's weight, 8 drams = 1 ounce, 12 ounces = 1 pound. No decimally divided weights are used in any shop in France: if you were to ask for a hectogramme or a decagramme of tea or sugar, you could not get it. But all these matters were most ably investigated and considered many years ago, by Committees of both Houses of Parliament (particularly by the Lords!) on the subjects of weights and measures, and cash payments and currency. These reports and evidences are well deserving of being studied by our "modern philosophers" of the present day.

Even in the simpler matter of coinage, it is a most difficult thing for the

* It led to so many difficulties, that, by a Royal decree in 1816, the use of weights and measures decimally divided was absolutely prohibited in shops or any kind of retail business.

mind of man to comprehend a change. Of all men in the world, one would think that a Paris banker, after sixty years' experience, would have some *mental perception* of what a *centimme* is. But I will prove to you that he can only *think* in *sous.* Take any Paris lists of the Exchange on London, and you will find that it invariably rises and falls by intervals of sous and half sous, as follows:—

25·00	25·07½ = 1½ Sou.
25·02½ = ½ Sou.	25·10 = 2 „
25·05 = 1 „	&c. &c.;

and you will never find a quotation ending with 1, 3, 4, 6, 7, 8, or 9 centimmes!

In Marseilles (though the *systéme metrique* has been the law for sixty years), commercial transactions, even in wholesale, are still carried on in the *poid de table* and the *livre tournais,* the result only being reduced into francs. In Genoa, where the French metrical system was introduced thirty years ago, the old coinage called in, and francs now the only currency in the place; yet still, all mercantile transactions, both in wholesale and retail, are carried on with the old Genoese cantar and pound, and the price in *livres fuori banco,* the results being reduced into francs in the proportion of five to six in wholesale, and of four to five in retail! But a yet stronger instance of the pertinacity with which the *mind* retains its old *ideas of value* is found in Venice. There, in 1796 or 1798, the French totally extirpated the Venetian *lira piccola,* and substituted the *franc* as the only currency. About 1820 the Austrians introduced the half florin, or *lira Austrica,* which is now universally used as the money of commerce. But in retail shops, and small taverns frequented by "*the people,*" the account is still always made in *lire piccole,* which have not been in existence for more than sixty years, and which have to be converted into the *actual* currency by a most impracticable fraction, very difficult to manage with the *pen,* but which the natives perform *mentally* with the greatest facility.

I have mentioned these instances to show that, though it is very easy to make a law on the subject, yet it is very difficult to change men's *ideas* of measure and value. A hundred years' experience would not familiarize the nation to any great change in moneys, weights, and measures; and before that time expired they would again be altered, either by law or by usage. We have a melancholy instance of perverse alteration of a desirable regulation for uniformity of measure in our own country. In most markets of the kingdom corn is sold by the imperial quarter, or bushel; but in Liverpool, Hull, Glasgow, and some other places, though it is *nominally* sold by the *bushel measure,* in order to keep within the law, yet it is *actually* sold by the *pound weight;* so that no person, not in the corn trade, can form any idea of the relative prices of wheat in the markets of Edinburgh and Glasgow.

Without any legislative enactment or change of measures, the decimal system might be advantageously adopted voluntarily in mensuration. Why should the fractional parts of an *acre* be expressed in roods, perches, &c., when the instrument used in the measurement (the chain) is decimally divided, and the result of the calculation comes out in decimal parts (square chains and links), which it requires much trouble to convert into square roods, square perches, and square yards—all most impracticable and incomprehensible quantities? Again: if the common foot-rule used by carpenters

were divided, as at present, into inches and eighths of an inch on one side, and on the other side into tenths and hundredths of a foot, the using this last side would much facilitate all measurements where cubic or solid contents were required. It would be most convenient to the shipmaster, in measuring for freight—to the farmer, in gauging his manure heaps—and to the poor breaker of stones by the wayside, in measuring his piles of road-metal.

I could say a great deal on the facility with which foreign exchanges, and the value of commodities in different countries of the world, can be compared with one another by the use of the "chain rule" and by the German method of "fixed numbers," in which calculations *decimals* can be readily used with the pen, though the *things* themselves be not decimally divided; but I have already encroached too much on your time and patience, which I beg you to excuse, and to believe me, dear Sir,

Yours very truly,

ALEX. M. ROBERTSON.

To. Wm. Thos. Thomson, Esq., &c.,
Edinburgh.

Cardrona, 11th May, 1854.

Dear Sir,—In my letter to you of the 9th inst., I said that when I heard from you again I might give you my ideas on decimalizing our commercial weight. But I have since thought it as well to put my ideas on paper while they were in my head; and I now send them to you for what they are worth.

The basis of our metrical system, the seconds pendulum, is more elegant and more easily ascertained than that of the French system, which is the quadrant of the terrestrial meridian. A pendulum vibrating seconds at London, and at the temperature of 62°, was found to measure 39·13929 inches of the existing standard scale. This length of the pendulum might have been adopted as a *new yard*, or *metre*, and an entirely new system of weights and measures formed upon it, as was done in France. But our philosophers who conducted the investigation were wiser. They knew the danger and inconvenience of changing long established institutions; and as the length of the inch could at any time be easily verified by the pendulum, they resolved to retain the inch as the foundation of our imperial metrical system. Consequently, from it all our linear and square measures are formed—as feet, yards, miles, acres, &c. A cubic inch of water was found to weigh 252·458 troy grains; and 7,000 such grains were made the avoirdupois pound, whose subdivisions and multiples form our commercial weights—as ounces, hundredweights, tons, &c. Again: 10 such pounds of water form the gallon, from whose subdivisions and multiples all our measures of capacity are derived—as pints, puncheons, tuns; pecks, bushels, quarters, &c. A system more accurate, simple, and convenient, could hardly have been devised, and ought *never* to be altered.

But as there is now a very general desire to facilitate commercial calculations by the use of the decimal arithmetic, I think some small alteration *in the divisions* of our commercial weight might be advantageously introduced. Hundredweights, quarters, and lbs. are very troublesome in calculation, and they are almost the only quantities that *are* troublesome. There is no difficulty, for example, in finding the value of cloths by the yard, of

liquids by the gallon, or of corn by the quarter or bushel; no other denominations, indeed, being used in commerce. I therefore propose only to alter our weights by abolishing the hundredweight of 112 lbs. and its quarters, and adopting a new hundredweight of 100 lbs., and a new ton of 20 such cwts.; the new denominations to be tons, cwts., and lbs.: thus—100 lbs. =1 cwt.; 20 cwts.=1 ton.

I apprehend that the introduction of the new cwt. would be attended with no inconvenience whatever, but the contrary; the new ton, however, would at first be productive of some little confusion, and particularly in the estimated *tonnage* of ships. But as we have already *two* modes of measuring ships for tonnage, called *old* and *new* measurement, and are likely soon to have a *third*, if the proposed new ton were used in the intended new mode of measurement, no inconvenience would result. And if for any purpose it were desired to compare the new ton or new tonnage with the old, it could be easily done, the proportion being as 100 to 112.

The departure from the decimal division in making the higher denomination to consist of 20, in place of 10, of the next lower, instead of being a defect, is an advantage, when taken in connection with the division of money that I advocate—viz., pounds, shillings, and cents; because the divisions of both the money and weight would be equal and similar—thus:

1 pound=20 shillings; 1 shilling=100 cents.
1 ton =20 cwts.; 1 cwt. =100 lbs.

This arrangement is productive of the very great advantage, that the price in money and weight of a lower denomination is the same as in the money and weight of the higher denominations, and *vice versâ*: thus,

5 cents. per lb.=5 shillings per cwt.=£5 per ton;
£8 per ton =8 shillings per cwt.=8 cents per lb.

By making the very small alterations I recommend (at the bottom of the moneys and at the top of the weights), I consider that every necessary facility of calculation would be attained; and certainly with "the *minimum* of change," as recommended by the Parliamentary Committee.

I remain, dear Sir,
Yours truly,
ALEX. M. ROBERTSON.

To Wm. Thos. Thomson, Esq., &c.,
Edinburgh.

NOTE.—Take an example of calculation by the present and proposed weights and money. Required the cost of 2 tons 16 cwts. 2 qrs. and 23 lbs. pig iron, at £5 per ton. The usual way of calculating it by "practice" would be—

Tons	cwts.	qrs.	lbs.	
2	16	2	23	
	× 5			
£14	0*s.*			
	2	6*d.*	= 2 qrs.	
		$7\frac{1}{2}$	=14 lbs.	
		$3\frac{3}{4}$	= 7 lbs.	
		$1\frac{1}{14}$	= 2 lbs.	
£14	3	$6\frac{1}{4}$ & $\frac{1}{14}$*l.*		

Here the quarters and pounds are very troublesome, and in some cases they are even more so. The foregoing fractional parts of the cwt. are nearly equal to $\frac{71}{100}$ of a cwt., and therefore would be expressed as 71 lbs. in the proposed new division; and the operation would be simply,

Tons.	cwts	lbs.
2	16	71
		× 5

£14 3*s.* 55 cents.

I have purposely left the tons and cwts. unaltered, in order to show the correspondence of the calculations; but the same *quantity* of iron (6,351 lbs.) would be expressed in the proposed new weight as 3 tons 3 cwts. 51 lbs.