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Memo. No. 18.

I.

The communication addressed by His Excellency, the Envoy for France, treats of the process by which the size and weight of everything that may be of interest to man living in a state of civilization, can be ascertained in the most uniform and comprehensive manner. In this respect, it is a subject of the utmost importance, connected as it is with agriculture, industry, commerce, and the military art, which respectively furnish the means of existence to nations, develope their resources, cause them to become rich, and enable them to defend themselves.

The process of measuring things in every country is commonly regulated by some standard of nature. It is stated in the *Izumo Fudo-ki* that in Japan, it originated by repeating sixteen times, or twenty times, the breadth of the five fingers in the open hand, and the number of the repeated fingers being eighty or one hundred, the measure was named *Hasso-Musubi*, (eighty holds of a hand), or *Momo-Musubi*.

(one hundred holds of a land). According to Euler, in European countries, it came from the height of a man, which is about six times the length of his foot, his foot being twelve times the length of his thumb. It was this, probably, that gave the idea of the "toise" in France, and of the 'fathom' in England, and which, it is believed, was the height of the Emperor Charlemagne. The toise or fathom was divided into six equal parts named "pied" in France, and "foot" in England, and this was again subdivided into twelve equal parts called 'pouce' in the former country, and 'inch' in the latter.

Now as both the breadth of the hand and the height of a man vary, not only in individuals of different nationalities, but in almost every person of any one country, and as, besides, the several Emperors, Kings, Princes, or chiefs of each nation had been in the habit of fixing arbitrarily the way these various measures should be made and used in their dominions, there has resulted a great inequality in the

various units of measurement in vogue throughout the different countries of the world. In 1793 the French Assembly, wishing to put an end to all this confusion within the limits of the Republic, decreed that a new system of weights and measures should be established, in which decimal numbers alone should be employed, like those that had, I believe, always been in use in Japan.

The new system of measurement, like all those that had preceded it, was regulated from some standard of nature. But instead of taking, as the foundation of their system, the height of a man or the width of his hand, which, as we have seen, varies according to individuals, they took the circumference of the earth, which is always the same no matter at what time or in what country the calculation is made. They divided this circumference into forty millions of equal parts, and proposed that one of these parts should be the unit of measure, which they called a 'metre'.

From the metre they derived all the other measures, those of area, capacity, weight, and money. But as there was much difficulty in accustoming the people, particularly those of the Country districts, to the adoption of the new system, a sort of compromise was made, by which the Government sanctioned the retention of the old names, but required that their contents should be calculated by a reference to the new standard.

The unit of area for lands is the "are", or a square having ten metres on each side. See Figure A.

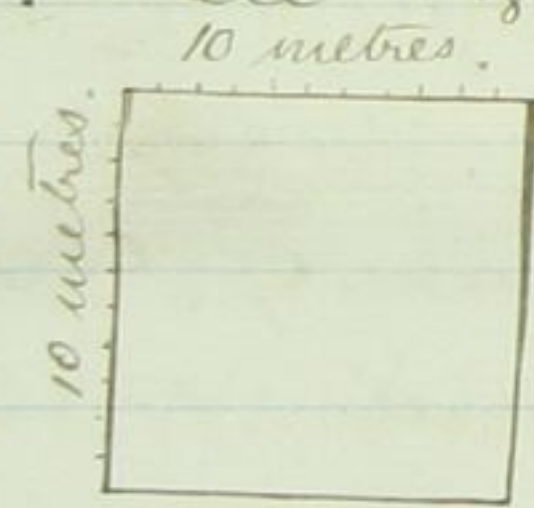


Figure A

The unit of capacity for liquids is a "litre" which is equal to a cube, one side of which is the tenth part of one metre, so that a box one metre in height, one metre in width, and one metre in depth, or a cylinder of equal capacity, would contain one thousand

litres. See Figure B.

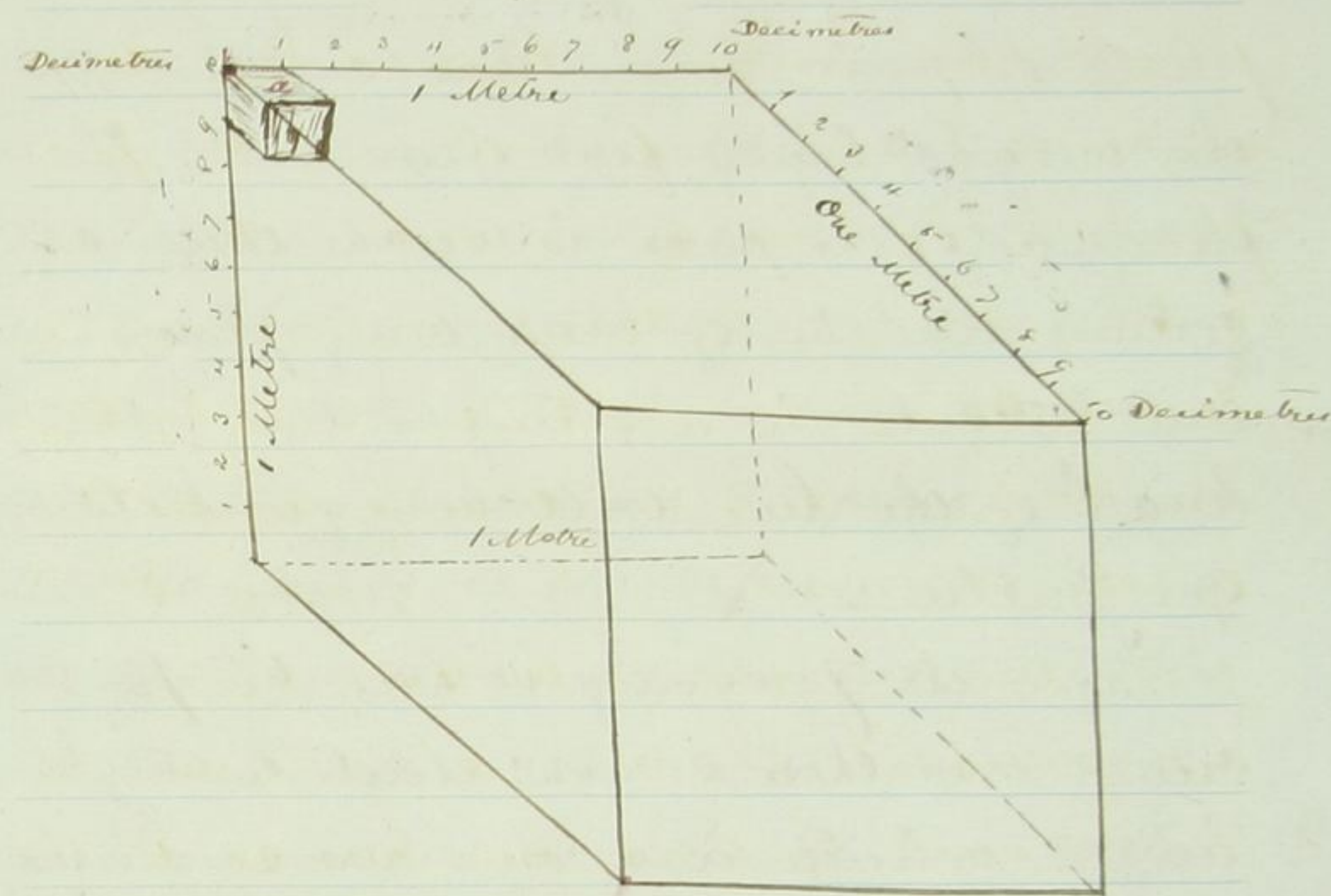


Figure B.

a represents, on a small scale, one "litre" measure, contained in a larger measure of one thousand litres capacity.

The unit of weight is a "gramme", and is the weight of a volume of water which has attained its maximum of density (that is, being at a temperature of four degrees, forty four hundredths Fahrenheit) that can be contained in a small cube, one side of which would equal the hundredth part of a metre. Now the "litre" contains one thousand of these small cubes, (see a, Figure B), and therefore the weight of a litre of water is equal to one thousand grammes.

The unit of money is the "franc" which is made of an alloy of nine parts of pure silver, and one of copper, the weight being five grammes. The diameter of the piece is such that a certain number of them being placed side by side in a straight line, the length of the line will be equal to one metre.

From the foregoing it will be perceived that these various units of weight, length, volume and coins, are so devised that if all of them be lost excepting one, even though that one be but a single coin, they can readily be ascertained again by means of a very simple mental calculation which can be made under almost any circumstances, and made use of for all practical purposes.

II.

In 1867, among the interesting contributions sent to the public exhibition at Paris, was a complete collection of all the various systems of weight and measurement in use throughout the civilized world; and the inconvenience

attending the exchange between different nations of observations concerning agriculture, industry, commerce, military art, etc. made by each, and in which each country would use its own system of weights and measures, became so apparent that, with a view of getting rid of this diversity, a special committee, composed of the representatives of all the countries represented at the Exhibition, expressed an unanimous opinion in favor of the metric system being substituted for those in use in their respective countries.

This recommendation was considered so opportune that the subject was at once taken up by the various governments, and another committee composed of representatives of several countries, specially appointed for the purpose of considering the advisability of making such a change, was ordered to assemble at Paris. At the last sitting of this Commission on the 24th of September last, the expediency of manufacturing samples of the various metric measures for the use of governments adopting

the metric system was considered; and it was decided that this should be done at Paris, under the supervision of the members of the Commission, and the first sample of weight was cast with great solemnity, in presence of M. Thiers, the president of the French Republic, and of his Cabinet. These measures are manufactures of a material that will be the least affected by changes of temperature; or other causes. The samples are intended to serve exclusively as models for the use of the authorities both in France, and in such other countries as have adopted the metric system, or are about to adopt it; and the object of the governments of these countries in acquiring them, is to use them in testing the correctness of the weights and measures employed by merchants in their transactions with the mass of the people, and thus protecting the latter against frauds arising from the use of false weights and measures by the dealers.

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Inasmuch as these samples are made according to certain processes, and of an alloy that necessarily contains a large proportion of rare and precious metals, they are rather expensive, and therefore very few will be cast in excess of the number made for the use of those governments represented in the Commission, or that may have already applied for them; and these few are now being rapidly disposed of.

The French Government wishing to extend to Japan the same facilities for ascertaining the advantages of the metric system that have been given to other countries, has directed its Minister at the Court of Tokio to inquire whether it is the desire of His Imperial Japanese Majesty's Government either to procure any of the models of weights and measures now being manufactured, or to ascertain both how to make them, and how to use them for the purpose they are intended for. Should His Imperial Majesty's Government con-

clude to appoint some one to go to Paris for this purpose, Mr. Berthemy states in his despatch that he will be received with much pleasure by the Commission.

One of the pamphlets accompanying the despatch of His Excellency, the Comoy for France, is a history of the framing, introduction, and development of the metric system, not only in France, but also in other European countries and in America. It shows that, at this date, the system is in use among twenty eight states, having a joint population of five hundred millions of inhabitants, out of the ~~seven~~^{thirteen} hundred and fifty millions on the face of the globe.

The second volume gives the account of the sittings of the Commission at Paris up to 1872 inclusive, and the results of the discussions held by it in connection with the adoption of the new system in various countries, the manufacture of models, etc. etc. The countries represented in this Commission are

Germany,
England,
Argentine Republic,
Austrian Hungary,
Bavaria,
Belgium,
Chili,
Colombia,
Denmark,
Spain,
United States,
Ecuador,
France,
Greece,
Hayti,
Italy,
Nicaragua,
Netherlands,
Peru,
Portugal,
Russia
San Salvador,
The Pope,
Sweden & Norway,
Switzerland,
Turkey,
Uruguay.

Venezuela,
Württemberg,

III

It is very evident that if, as His Excellency, the Envoy for France says, the whole civilized world is about to adopt the metric system of measures and weights, the Government of His Imperial Japanese Majesty has made a mistake in giving up its own system for that of England, which, no more than the old French system, offers no intrinsic merits superior to that of Japan. In my opinion, it would be advisable to rescind at once the law, or, at least, suspend the passing into effect of the Imperial decree prescribing the change; and, without delay, appoint an officer to sit with the international Commission at Paris, and report upon the advisability of issuing another decree substituting the metric system for

the old one of Japan, so that not only the weights and measures, but also the coins of the latter country, would conform with those of the countries that have adopted the metric system. Unless the Government of His Imperial Majesty will follow this plan, it will risk the troublesome experiment of making in its present system, a change that, from all appearances, must soon be followed by another; that is to say, if the alteration in the system of measures and weights, which is at present contemplated, is made with a view to assimilate them to those of other countries, and thus facilitate the happy relations that have lately been inaugurated between Japan and foreign powers. Therefore, an appeal for the serious consideration of this subject, is, to say the least of it, timely.

From pamphlet No 2, it appears that the Argentine Republic, Greece, Peru, San Salvador, and Uruguay are represented in the Commission

by their own ministers in Paris. Japan, with a view to save expense, might follow this example. But should it be judged advisable to send a special delegate, the appointment of a man of science would be preferable. This latter course has been followed by Russia, France, the United States and England. But as all the necessary scientific researches on the subject must, by this time, have all been made, it would be almost useless for Japan to go to the expense of sending a special deputy to Paris, as His Imperial Majesty's representative in France, whether he be a scientific man or not, would, in my opinion, be fully qualified to accomplish the object in view. Should it be decided by His Imperial Majesty's Government, to adopt this course, it will be necessary to assign M. Berkeny to that effect,

in the body of the despatch sent in reply to his communication to Mr. Soyesima of the 19th of September last. It would also be necessary to concert with Mr. Berkeny as to what instructions should be sent to the Japanese minister in Paris, and the sort of communication that it will be necessary to address the French Government on the subject.

Respectfully submitted

C. W. ...

H. E. Zamoni Soyesima,
Minister for Foreign Affairs

etc etc etc

Edo, 14 October 1873

Tables for the Reduction of English Weights and Measures into Metric Measures.

N.B. As to the equivalents for English coins in francs, given in these tables, it must be remembered that the same vary according to time, place, and the rate of exchange.

Measures of Length.

Inch ($\frac{1}{36}$ of a yard)	= 2, 539 954 Centimetres.
Foot ($\frac{1}{3}$ of a yard)	= 3, 047 944 9 Decimetres.
Imperial Yard	= 914 583 48 Metres.
Fathom (2 yards)	= 1, 828 766 96 Metres.
Pole ($\frac{5}{8}$ of a yard)	= 5, 029 11 Metres.
Furlong (220 yards)	= 201, 164 37 Metres.
Mile (1760 yards)	= 1609, 314 9 Metres.
.03037 inches	= One Millimetre.
.393708 inches	= One Centimetre.
3, 937079 inches	= One Decimetre.
39, 37079 inches	} One Metre.
3, 280 8992 feet	
1, 093 633 yards	
6, 2138 Miles	= One Myriametre (1000 metres.)

Measures of Area.

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x x x x
x x x x

Measures of Capacity.

Pint (1/8 of a gallon) = .567932 litres.
 Quart (1/4 of a gallon) = 1.135864 litres.
 Imperial Gallon = 4.54348797 litres.
 Peck (2 gallons) = 9.0869759 litres.
 Bushel (8 gallons) = 36.347664 litres.
 Sack (3 bushels) = 1.09043 hectolitres.
 Quarter (8 bushels) = 2.907813 hectolitres.
 Chaldron (12 sacks) = 13.08516 hectolitres.
 1.760773 pints } = One litre.
 .2200967 gallons }
 2.2009668 gallons = One Decalitre.
 22.009668 gallons = One Hectolitre.

Measures of Weight.

Troy { Grain (1/4 of a penny weight) = .065 grammes.
 Penny weight (1/20 of an ounce) = 1.555 grammes.
 Ounce (1/2 of a pound) = 31.091 grammes.
 Pound Imperial = 373.096 Kilogrammes.
 Avoirdupois { Ounce (1/16 of an ounce) = 1.771 grammes.
 Ounce (1/16 of a pound) = 28.338 grammes.

Avoirdupois { Pound = .4534 Kilogrammes.
 Hundred weight (112 pounds) = 50.78 Kilogrammes.
 Ton (20 hundred weight) = 1015.65 Kilogrammes.
 15.438 grains Troy }
 .643 penny weight } = One Gramme.
 .0322 pound Troy }
 2.6803 pounds Troy }
 2.2055 pounds Avoirdupois } = One Kilogramme.

Gold Coins.

Guinea of 21 shillings = 29.47 Francs.
 Sovereign of 20 shillings = 25.21 Francs.
 Pound Sterling = 25.21 Francs.

Silver Coins.

Crown = 5.81 Francs.
 Shilling = 1.16 Francs.
 Dollar (George III.) = 5.32 Francs.

李氏第拾八号覽書
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