A Very Early Lenoir Slide Rule

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In this article I would like to present a slide rule made by Lenoir (before Gravet) which seems to be one of the first models of slide rules built in France in the beginning of 19th Century (around 1825). I will explain the reasons that make me believe this.

FIGURE 1.
Etienne Lenoir (1744-1832).
For elements of biography, see [11]

Origin

I bought this rule on eBay.de in 2006. The seller told me that she found it some years earlier in an auction in Strasbourg (east of France). The rule was described as an "old wooden French slide rule", with a picture of fair quality. The detail which caught my attention was a signature in the middle of the upper edge, which looked the same as the Lenoir signature on an ivory slide rule of the museum of the *Conservatoire National des Arts et Métiers* (CNAM) in Paris, which is pictured in the website of the museum.[1] The signature was not very readable in the photo on eBay, but when I received the rule, it appeared I had been right : this rule had actually been made by Lenoir and is a very early one. I was lucky ! Note that the same signature can be found on the *mètre-étalon* (one of the platinum pieces officially defining the meter) made by Lenoir in the 1790's, exhibited in the CNAM museum.

FIGURE 3.
The Lenoir signature on the rule

Material

The rule is made of wood (boxwood or fruitwood). The rule itself is of one piece, as is the slide. Apart from the Lenoir signature, there is no other inscription (address, date, number etc.). The right end of the slide is fitted with a copper knob.

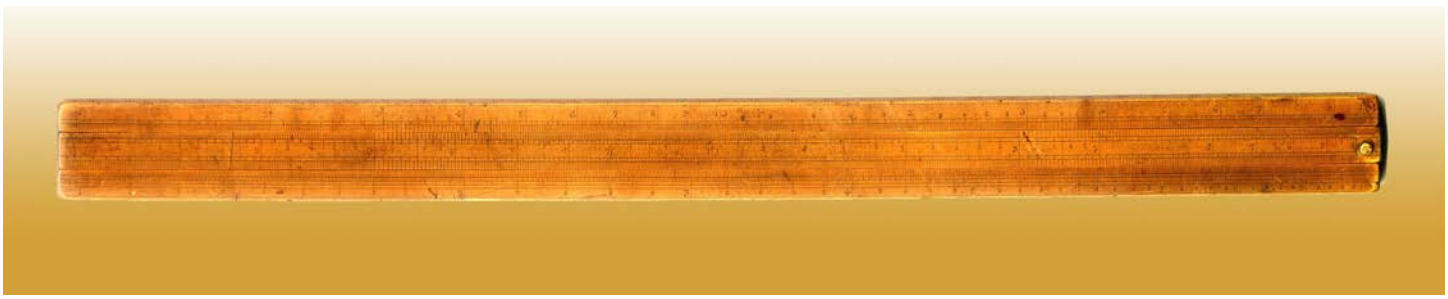

FIGURE 2.
The Lenoir rule

Condition

The rule is in used condition, with some stains, lines, but no scratches. The scales remain very readable. It appears that this rule was machine-divided, because the graduations are exactly of the same length and thickness. The digits were engraved by hand. We know that around 1820 Lenoir had built a dividing machine for slide rules, capable of engraving eight rules in one operation. Unfortunately, the slide of this rule has been broken, and the glue repair, though carefully made, caused a shift of 0.2 or 0.3 mm in the scales. This repair seems to be quite old. Nonetheless, this slide rule is of great interest.

Technical characteristics

- Size : length : 36cm ; width : 2.7 cm ; thickness : 0.8 cm ; weight : 60 grams.
- Scales : It s a SOHO system rule, with the ordinary scales, and sinus, tangents and logarithms under the slide. It has no cursor, of course.

Dating this rule

The most important fact for dating is obviously the Lenoir signature. It shows that the rule was made by the Lenoir father and (or) son. Another very interesting particularity concerns the measuring rulers on the slide rule : the upper one is graduated in cm and mm from 0 to 36 cm, and the lower one is graduated in "pouces de Paris" and "lignes", from 0 to 13 pouces 3 lignes.[2] These two rulers continue under the slide to 72 cm and 26 pouces 6 lignes. The coexistence of these two systems is a first indication for dating the rule, because it suggests that it was made when French people were not yet familiar with the new metric system, which was introduced during the French Revolution at the end of the 18th Century and became the legal system in France July 4, 1837.

The third indication for dating this rule is the length of the rule : 36 cm. A communication of Francœur in the *Bulletin de la Société d'Encouragement pour l'industrie nationale* from 1821 (see [4]) states that the first rules made by Lenoir were 36 cm long, under the indications of Jomard.[3] The first prototype was produced at the end of 1820, and was made of copper, and the regular wooden model was introduced for sale in the beginning of 1821. The public price was 10 francs. At the same time, Lenoir made cheaper 20 cm long rules, price 5 francs, with Collardeau. So I can date this rule between 1820 and 1830.

Particularity

The back of this rule is perhaps the most interesting part : it is completely covered by an engraved table of 7 rows by 47 columns, that is 329 entries ! This table is almost entirely readable, with only some digits worn away at the two ends.

The first two columns show equivalents between length, surface and weight units from the new metric system to the old French one, and between French and English units. The other columns give divisors used to calculate weight, volume, etc., of various items according to their shape (parallelepipedic, cylindrical or spherical), the material of wich

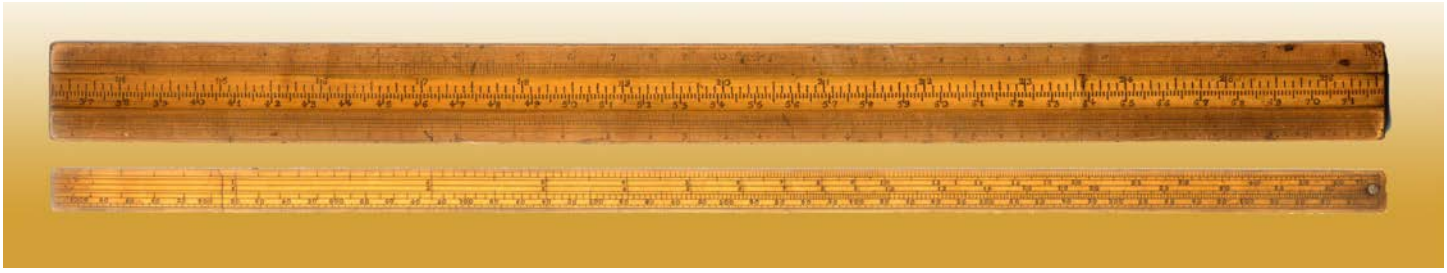

FIGURE 4.
The rule and the slide : notice the two rulers, the lower in centimeters, and the upper in pouces and lignes of Paris.

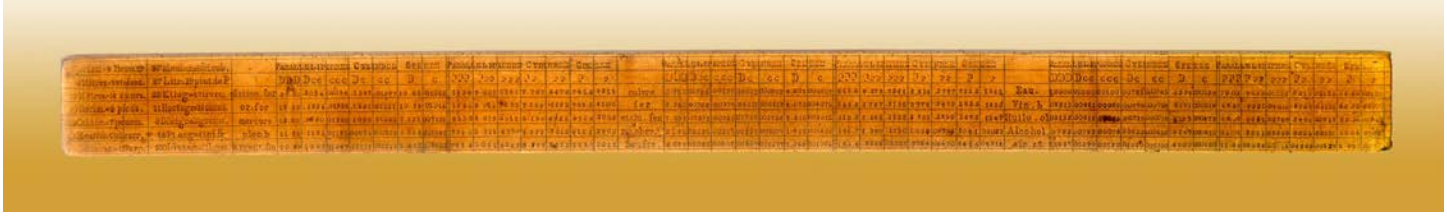

FIGURE 5.
The table engraved on the back of the rule

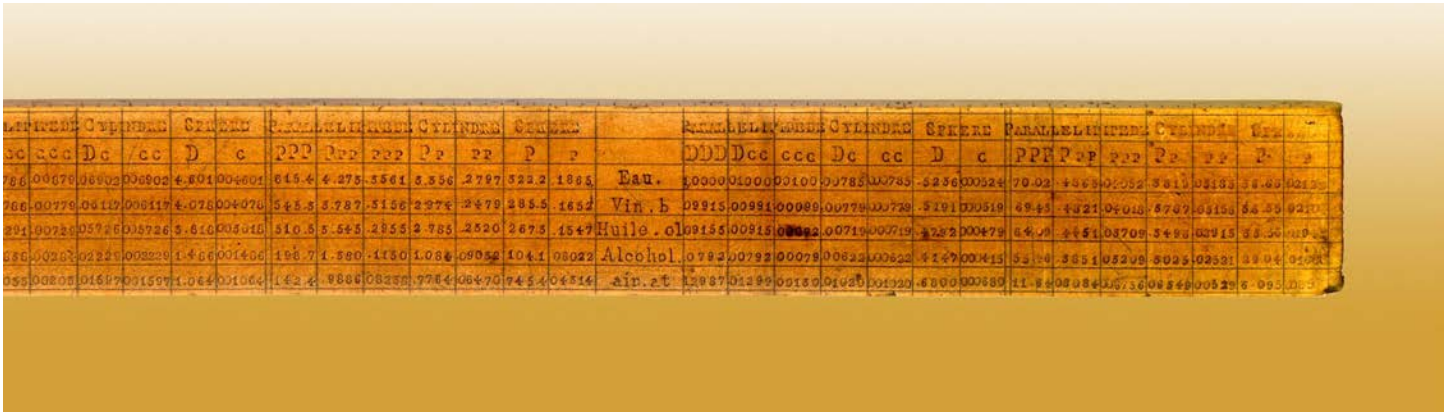

FIGURE 6.
Detail of the table on the back of the Lenoir slide rule.

they are made (15 different materials being listed, from platinum, gold, silver, water, alcohol, olive oil, wine etc.), and the units (meter, decimeter, feet, inches (of Paris)). So this table presents a considerable quantity of numerical data, sometimes very difficult to use because of the smallness of the characters and the decimal point's being invisible or covered by the digits or the lines of the table. It was engraved by hand!

Conclusion

In 2008 I had the opportunity to visit the slide rules collection in the reserves of the CNAM museum; it is an amazing experience! I could see that this rule is exactly the same model as the ivory one in the museum, including table on the back: the CNAM dates it between 1820 and 1827.

They have some wonderful pieces. Unfortunately, they haven't the whole production of early French slide rules, but only some models. This can be linked with the lack of consideration for slide rules in France, and maybe in other countries; in most of books concerning scientific instruments, the slide rule doesn't exist, or there are only three or four lines under the title "logarithmic instruments". I don't understand why.

Here is a complete description of the table on the back. For commodity reasons, I present it in 4 parts, which are contiguous.

First part: correspondence between some units:

? Myriam.=9 lieues.25	37 M. cubes=5 toi.cub.
76 Mètres.=39toises.	27 Litr.=29 pint.de P.
19 Mètres.=16 aunes.	23 Kilog.=47 livres.
13 Décim.=4 pieds.	11Hectogr.=36 onces.
19 Centim.=7 pouces.	8 Decigr.= 16 grains.
? M.carrés.=5 toi.carr.	16 Pi. Ang.=15 pi.fr.
? Hectares.=117 arp.	100 Liv.ang.=91 L.pm.

1 myriam[etre] = 10 km ; Lieues, toises, aunes are old French length units.

Pied = foot, pouce = inch. arp = arpent, old surface unit.

Livre = pound, once = ounce, grain weight units

Pinte = pint, capacity unit.

All these old units had very different values according to the country, and even the province. These the values are from Paris.

The three other parts are designed on the same model and provide divisors for computing volumes and weight, according to the material and the shape of the object.

TABLE 1.
Platine = platinium, or = gold, mercure = quicksilver, plomb = lead, argent = silver

	Parallelipipede			Cylindre		Sphere		Parallelipipede			Cylindre		Sphere	
	DDD	Dcc	ccc	Dc	cc	D	c	PPP	Ppp	ppp	Pp	pp	P	p
platine. for	20.35	.2034	.02034	.1597	.01597	10.65	.01065	1424	9.889	.8241	7.767	.6472	745.6	.4315
or. for	19.36	.1936	.01936	.1521	.01521	10.14	.01014	1356	9.414	.7485	7.394	.6162	709 ;8	.4108
mercure	13.60	.1360	.01360	.1068	.01068	7.121	.007121	952.3	6.613	.5511	5.194	.4328	493.6	.2886
plomb	11.35	.1135	.01135	.08914	.003914	5.943	.005943	794.8	5.519	.4599	4.335	.3612	416.1	.2403
argent.fin	10.47	.1047	.01047	.08223	.008223	5.482	.005482	733.2	5.091	.4243	3.999	.3332	383.9	.2222

TABLE 2.
Cuivre = copper, fer = iron, marbre = marble, soufre = sulfur

	Parallelipipede			Cylindre		Sphere		Parallelipipede			Cylindre		Sphere	
	DDD	Dcc	ccc	Dc	cc	D	c	PPP	Ppp	ppp	Pp	pp	P	p
cuivre	8.788	.08788	.00879	.06903	006902	4.601	004601	615.4	4.273	.3561	3.356	.2797	322.2	.1865
fer	7.788	07788	.00779	.06117	.006117	4.078	004078	545.3	3.787	.3156	2.974	.2479	285.5	.1652
etain. fon	7.291	.07291	.00729	.05726	005726	3.818	003818	510.5	3.545	.2955	2.785	.2320	267.3	.1547
marbre.	2.838	02838	.00284	.02229	.002229	1.486	001486	198.7	1.380	.1150	1.084	.09032	104.1	06022
soufre.	2.033	02033	.00203	.01597	.001597	1.064	001064	142.4	.9886	.08238	.7764	06470	745.4	.04314

TABLE 3.
Eau = water, vin = wine, huile. ol = olive oil

	Parallelipipede			Cylindre		Sphere		Parallelipipede			Cylindre		Sphere	
	DDD	Dcc	ccc	Dc	cc	D	c	PPP	Ppp	ppp	Pp	pp	P	p
Eau	1.0000	.01000	00100	.00785	000785	.5236	000524	70.02	.4863	.04052	.3819	.03185	36.66	illis.
Vin. b	0.9915	.00991	00099	.00779	000779	.5191	000519	69.43	.4321	.04018	.3787	.03156	36.35	illis.
huile. ol	0.9155	.00915	00092	.00719	000719	.4792	000479	64.09	.4451	.03709	.3496	.02913	33.56	illis.
Alcohol	0.792	.00792	00079	.00622	000622	.4147	000415	55.46	.3851	.03209	.3025	.02521	29.04	illis.
Air. at	12987	.01299	00130	.01020	001020	.6800	000680	11.54	08084	006736	06349	00529	6.095	illis.

The unreadable (illis.) digits are due to the age and wear of this rule. They are perfectly readable on the rule in the CNAM museum.

Explanations

All these numbers are divisors. They allow, as we said, the user to compute weights or volumes according to material and shape of the object. The D, c, P, p are length units. You have to read : D = decimeter, c = centimeter, P = foot, p= inch (of Paris).

So, for a parallelepipedic object : DDD means that the three dimensions are in decimeters, Dcc, one in decimeters, and two in centimeters and so on.

For the cylinder, Dc : diameter in dm, height in cm, etc.

For a sphere, the number given is the diameter.

So we can see that, in the metric system, columns correspond to each other dividing by 10, 100, 1000.

One foot = 12 inches, so the other columns correspond dividing by 12, $12^2 = 144$ and even $123 = 1728$, in the case of the sphere.

It is evident that the use of such a table, which is much smaller on the slide rule, is very tedious !

However, it is a wonderful example of the Lenoirs' work.

Footnotes

1. Search in the CNAM museum site for: *designation: regle a calcul and auteur: lenoir*. There are some pictures.
2. "pouces de Paris" (not the English inches) and "lignes"are length units used in France before the adoption of the metric system (1 pouce = 2.7 cm and is divided into 12 lignes).
3. It is interesting to notice that Jomard, Lenoir son, Francœur and many people of the *Société d'Encouragement* took part at the *Expédition d'Egypte* with Bonaparte in 1799-1801, together with many French scientists. There is no doubt that this military and scientific "adventure" created links between young French scientists which continued during the 19th Century.

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