Slonimsky's Multiplying Device:
Cylinder Developments and Calculation Methods

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Introduction

Selig Slonimsky's multiplying device, invented in Russia in 1844, is described in [1–5]. It was an oblong, low box measuring 40 × 33 × 5 cm (fig. 1).

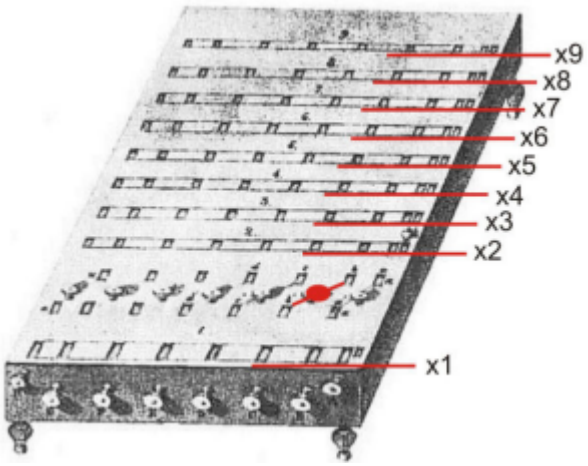

Fig. 1 [2]

Inside the box were 8 cylinders (Slonimsky in [5] designated them from right to left: A, B, C, D, E, F, G, H). All the cylinders had rows of digits and letters on them. The cylinders could be rotated by handles on the front wall of the device, and cylinders B, C, D, E, F, G, in addition, – moved along their axis by handles located between rows 1 and 2. One of the last cylinders is shown in fig. 2.

Fig. 2 [1]

The holes in the closest row displayed the multiplicand, and the eight farthest rows displayed the digits of its product by 2, 3, …, 9.
Between rows 1 and 2, the holes were located diagonally.
This article describes the developments of cylinders and a detailed calculation methods on this device.

Developments of cylinders

The developments of all eight cylinders (from left to right) – H, G, F, E, D, C, B, A) can be divided into three parts (fig. 3):
1) part with digits;
2) row 1;
3) pointer part (the digits and letters of this part were displayed in diagonally located holes between the "main" rows 1 and 2; the rows of the pointer part will be referred to hereinafter as "pointer row 1" and "pointer row 2").

Fig. 3

Cylinder A development (enlarged)

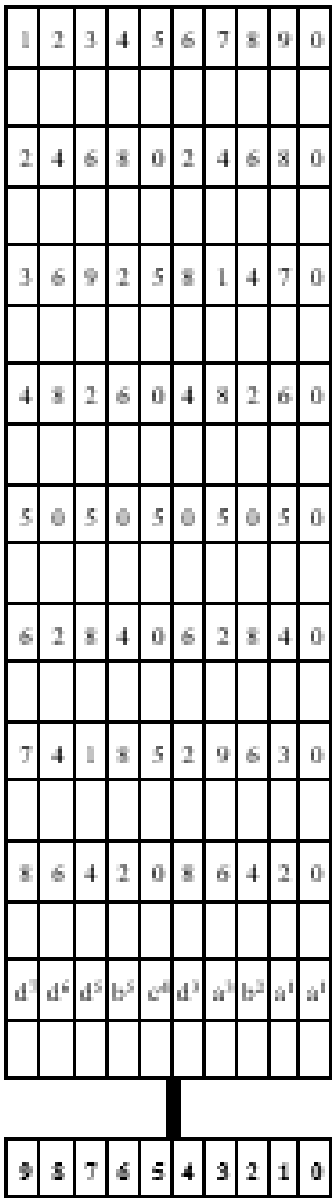

Fig. 4

Cylinder B, C, D, E, F, G development

- part with digits (fragments):

Fig. 5 (56 rows, 40 columns)

- pointer part (enlarged):

Fig. 6 (14 rows, 40 columns)

- row 1 (enlarged):

Fig. 7

In total, only on each cylinder B, C, D, E, F, G there are 2840 digits and 600 letters.

Cylinder H development (enlarged)

Fig. 8

Calculation methods

Let's look at an example of multiplying the number 9785.
By rotating the front handle of cylinder A, it was turned to a position in which the last digit of the multiplicand 5 was displayed in the hole of row 1. At the same time, the "code" c^4 was displayed in the hole of the pointer row 1 (see fig. 6 and fig. 9)[1].

Pointer row 1							c^4
Pointer row 2							
Row 1							5
Cylinder	H	G	F	E	D	C	A

Fig. 9

This code, like other codes that were displayed in other holes of the pointer row 1, "spoke" about what actions should be performed in the place on the left. These actions are as follows.
Cylinder B (tens place) was rotated by means of the front handle to a position where $\frac{c}{8}$ was displayed in the hole in row 1 (8 is the penultimate digit of the multiplicand, c is the letter from the code on the right) – see fig. 10.

Pointer row 1								c^4
Pointer row 2								
Row 1							$\frac{c}{8}$	5
Cylinder	H	G	F	E	D	C	B	A

Fig. 10

After this, the extreme right upper handle of the pointer part of the device was rotated (clockwise or counterclockwise) until the same code c^4 was displayed in the hole of pointer row 2 (shaded in fig. 10). In this case, cylinder B was shifted along the axis forward or backward to a position in which the tens digits of the sought products were displayed in rows 2, 3, …, 9 (see fig. 11[2]).

[1] Other holes in the pointer rows displayed some values remaining after previous calculations.
[2] Fig. 11 shows the right part of the development with digits.

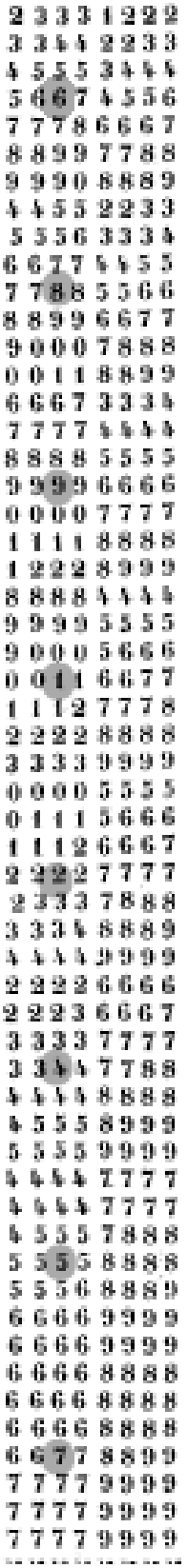

Fig. 11

At the same time (!) the code a^7 for the next hundreds place was displayed in the hole of pointer row 1 (see fig. 12).

Pointer row 1							a^7	c^4
Pointer row 2							c^4	
Row 1							$\frac{c}{8}$	5
Cylinder	H	G	F	E	D	C	B	A

Fig. 12

This automation was ensured by the fact that:
1) digits in the tens place and others on the development are arranged every 7 lines; it is at this distance from each other that the holes for displaying the result are located on the upper part of the device body in rows 2, 3, …, 9;

2) the values a^7 and c^4 in the development in fig. 5 in the column corresponding to $\frac{c}{8}$, are 7 lines apart from each other (see fig. 12) and the same distance between the holes of the pointer rows 1 and 2.

Fig. 13

The cylinders C, D and E were set in the required positions in a similar manner[3], and cylinders F, G and H were set to the position where row 1 indicated $\frac{a}{0}$ and pointer row 2 – a1.
After all the actions, the situation was as in fig. 14.

[3] The calculations ended when the value a1 appeared in the pointer row 1.

Pointer row 1		a^1	a^1	a^1	d^7	c^6	a^7	c^4
Pointer row 2		a^1	a^1	d^7	c^6	a^7	c^4	
Row 1	$\frac{a}{0}$	$\frac{a}{0}$	$\frac{a}{0}$	$\frac{d}{0}$	$\frac{c}{9}$	$\frac{a}{7}$	$\frac{c}{8}$	5
Cylinder	H	G	F	E	D	C	B	A

Fig. 14

Calculation results on the device are shown in fig. 15:

0	0	0	8	8	0	6	5
0	0	0	7	8	2	8	0
0	0	0	6	8	4	9	5
0	0	0	5	8	7	1	0
0	0	0	4	8	9	2	5
0	0	0	3	9	1	4	0
0	0	0	2	9	3	5	5
0	0	0	1	9	5	7	0
	a^1	a^1	a^1	d^7	c^6	a^7	c^4
	a^1	a^1	d^7	c^6	a^7	c^4	
$\frac{a}{0}$	$\frac{a}{0}$	$\frac{a}{0}$	$\frac{d}{0}$	$\frac{c}{9}$	$\frac{a}{7}$	$\frac{c}{8}$	5

Fig. 15

In conclusion, we note that Slonimsky's device made it possible to determine the products of numbers no greater than 1,666,666.

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It admire the fact that Selig Slonimsky, having placed several thousand numbers and letters on cylinders, created a device in which the products of a number by 2, 3, …, 9 are determined so quickly and easily.

References

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