

On Old Russian Cylindrical and Circular Slide Rules

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Introduction

This paper is an extended version of my talk at the German slide rule meeting on April the 17th 2010 at Trier. The purpose is to study Russian/Soviet cylindrical and circular slide rules made before 1940. As these are quite rare, this is a literature study. Personally I have seen none of the slide rules described below.

The transliteration standard of US Library of Congress for Cyrillic characters is used throughout in the text. The references are written in Cyrillic to assist in finding the original sources.

1. The cylindrical slide rule of Aleksandr Shchukarev

About the only old Russian cylindrical or circular slide rule mentioned in western literature is the cylindrical slide rule of Aleksandr Shchukarev (Александр Щукарев). E. Chamberlain gives in his article [2] the Internet address of a photo of the cylinder and a time date around 1910, but no other information. One easily finds using the Internet some information about Shchukarev in English and much more if one also looks for the Russian pages. Article [3] of G. N. Povarov (Г. Н. Поваров) contains a good description, written in English, of his life and works; however, without mentioning his cylindrical slide rule. Povarov has also written a very good paper [18] in Russian describing the history of Shchukarev's cylindrical slide rule and this paper is the primary source for the following information. The photo referred to by Chamberlain has been scanned from this article.

Aleksandr Shchukarev (1864-1936) was a chemist, but he also spent much time on logic, methodology, and mathematical methods of science. He graduated from Moscow University and received his doctorate of science in 1909. He worked as a privatdocent in Moscow and from 1911 as a professor of physical chemistry at Kharkov University, Ukraine. In 1931 Shchukarev retired, but continued his work as a scientific consultant for several institutes.



Figure 1. Photo of Aleksandr Shchukarev

While a chemist, Shchukarev was able to build himself the cylindrical slide rule in 1909, for which he obtained the Russian patent on July the 5th, 1910. For some reason the patent was never officially registered. Evidently Shchukarev lost interest in the cylindrical slide rule after moving to Kharkov, receiving a regular salary, and developing further the logic machine of Pavel Khrushchov (Павел Хрущов). Only one rule was made, which now belongs to the collections of Polytechnical Museum in Moscow. The museum has the patent documents and a printed instruction manual for the slide rule. Unfortunately, I do not have any bibliographic information of the original brochure, but somewhat abbreviated instructions can be found in [18]. From this source we can also learn the following characteristics of the cylinder: the length of the inner cylinder is 17 cm, diameter 3.5 cm, with a logarithmic spiral scale of length 10 m. On this cylinder there is a freely moving transparent celluloid tube and on this celluloid tube there are 3 (only 1 existing now) movable “cursors” in the form of a ring.

The rule is somewhat damaged and the damaged outer cylinder (tube) is not present in Figure 2. Figure 3 is a scan of the photo in [18] with a cursor.

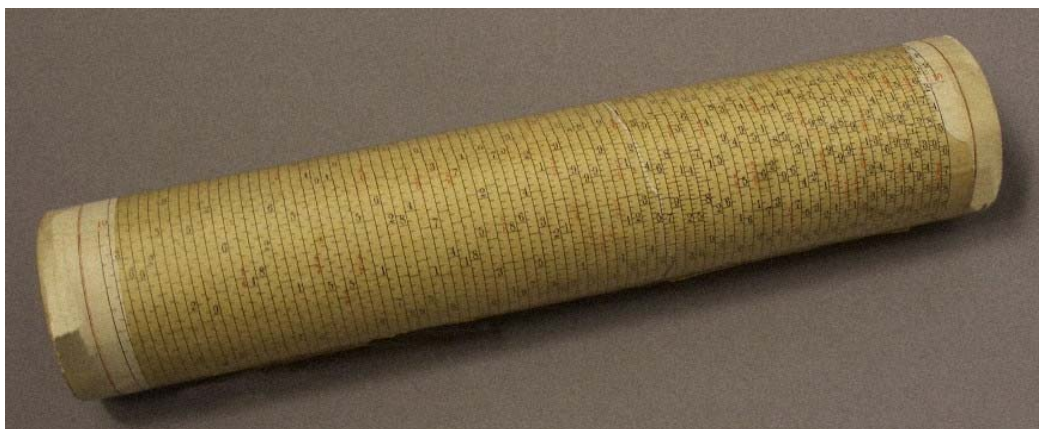


Figure 2. Shchukarev's cylindrical slide rule
Photo ©Polytechnical Museum, Moscow

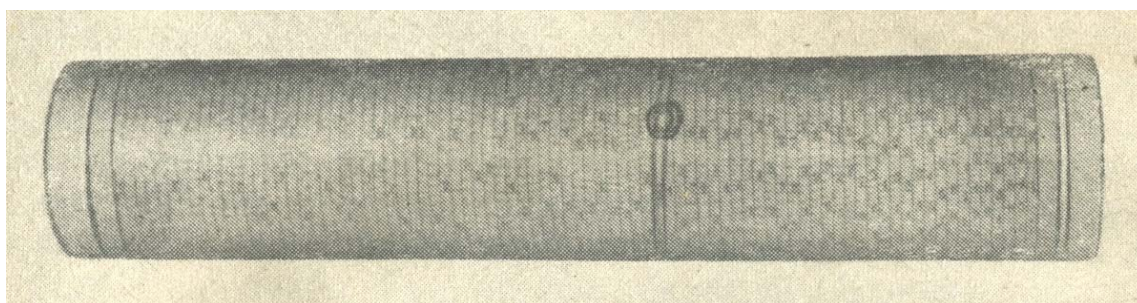


Figure 3. Shchukarev's cylindrical slide rule in [18] with a cursor

2. The cylindrical slide rule of Mikhail Podtiagin

Professor Mikhail Podtiagin (Михаил Подтягин, 1889-?) was a mathematician and economist, but practically no information about him exists on the Internet. He wrote books about mathematics and Soviet economy, and also compiled multiplication tables for products of two digit and four digit numbers. His cylindrical slide rule was patented in Soviet Union (No. 9921), France (No. 639371) and England (No. 314371, 1928). The English patent can be studied at

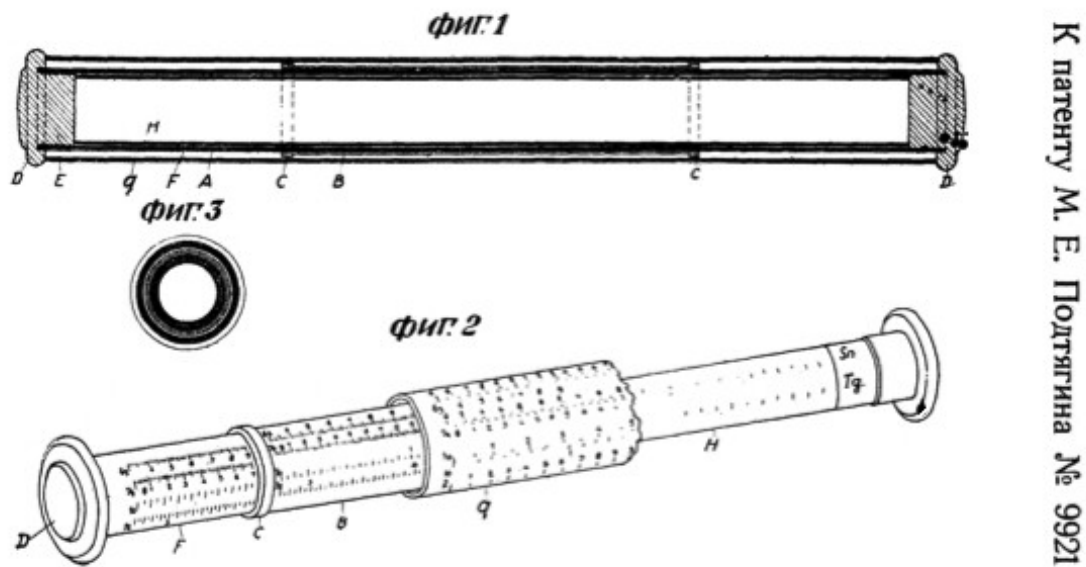


Figure 4. Podtiagin's Russian patent drawing
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The quantity production of Podtiagin's cylinder was performed by the chemical company [МОСКХИМ (МОСХИМ)] in Moscow. The official instruction manual [12] that came with the device was published in 1931 and 3000 copies were printed. Thus, the number of Podtiagin cylinders made was probably at most 3000. The manual contains no pictures, but the book [21] describing the use of precise slide rules with divided scales, has pictures of Podtiagin's cylinder, see Figures 5 and 6.

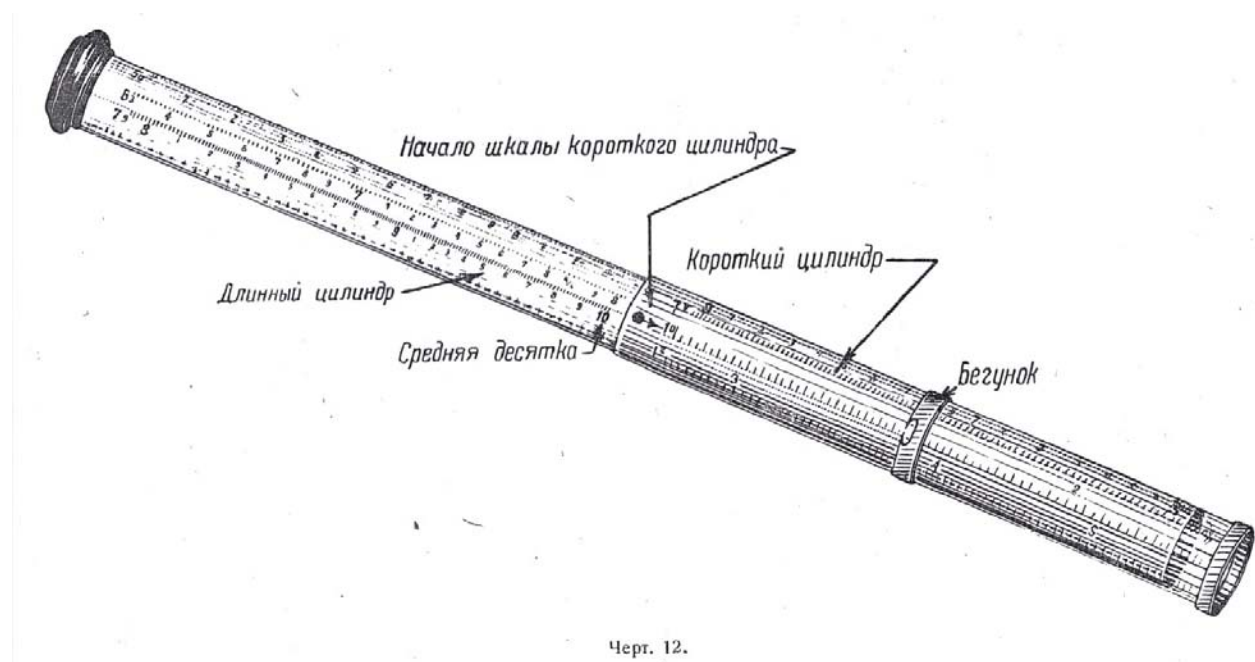


Figure 5. Actual form of Podtiagin's cylindrical slide rule in [21],
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This actual production version of Podtiagin's cylinder is much smaller than the device in the English patent description. The length of the scale on the inner surface of the transparent freely moving outer cylinder (tube) is 106 cm divided in 10 parts of 10.6 cm scales (according to the patent, 760 cm divided in 20 parts). The scales are black and the numbers appear above the scales. The cursor moves freely on the outer cylinder. On the inner cylinder each of the 10 blue scales with numbers below them is 21.2 cm in length, providing 100% redundancy.

The transparent tube-formed case of the cylinder can also be used in calculations. On the inner surface there are 2 logarithmic scales in 10 parts, printed in blue with numbers below the scales. On the outer surface at exactly the same places there is a cubic scale on the left side and a quadratic scale on the right side, both printed in black and with numbers above the scales. The manual [12] suggests the possibility to produce in future different cases with logarithmic and trigonometric scales and already has some examples for their use. As seen at the right part of the perspective drawing of Figure 4, the Russian patent included a fourth cylinder containing sine (sin) and tangent (tg) scales. This would fit inside the inner cylinder, but was not included in the final version.

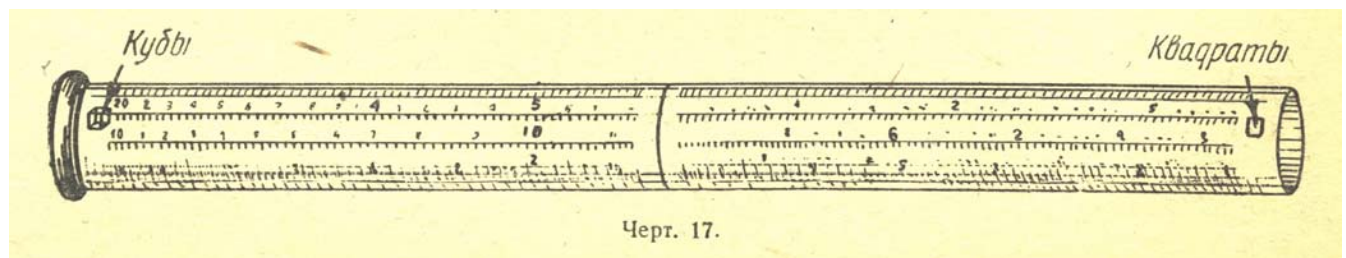


Figure 6. The case of Podtiagin's cylinder in [21]
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Evidently Podtiagin's cylinder was not a commercial success. One reason might be that Nestler's cylindrical slide rule was available simultaneously in Soviet Union [11]. All three Nestler models were more precise and perhaps not much more expensive. According to the advertisement seen in Figure 7, Nestler was the best and cheapest cylindrical slide rule.

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» 45	»	»	»	12,50 метров

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Требуйте цены и каталоги.

Наравне с пишущей машинкой необходим в
каждом бюро.

Figure 7. Russian ca. 1929 advertisement of Nestler's cylindrical slide rules in [11]

The large Russian technical encyclopedia (Техническая Энциклопедия) has in both of the two editions [16, 17] a figure of a Nestler cylinder. The Fuller calculator is also mentioned in the text parts, but there is no information about Podtiagin's cylinder. However, in 1960, N. C. Belen'kii (Н. С. Беленький) in his book [6] concerning economic calculations shows a picture of Podtiagin's cylinder together with Fuller and Thacher calculators. Belen'kii started his publishing career by 1924 and probably had personally used Podtiagin's cylinder. The Polytechnical Museum in Moscow owns a cylinder of Podtiagin¹, but I do not have a photo of it.

3. Circular slide rule of A. Kun

In 1875 A. Kun (А. Кун) in St. Petersburg produced a circular slide rule and published the instruction manual. His name does not seem to be Russian; perhaps Kun was from Germany like so many other Russian engineers, craftsmen, and other technologists. of that era. If he really was a German, the original form of his surname could have been Kuhn, Kuehn, or even Kühn.

The rule is made of cardboard and the National Library of Russia in St. Petersburg has one example with an instruction booklet [13]. In addition to normal multiplication and division

instructions the manual contains some examples of commercial calculations that can be performed with the disc as well as tables for calculation of volumes and weights. The diameters of the scales are 23.9 and 20.3 cm, scale lengths being approximately 75.0 cm and 63.6 cm. The scales² are from outside in a strange order: L, S, C, D. The rule was made at the lithographic workshop of A. Il'in (А. Ильин) in St. Petersburg and was approved for printing by the censors on October the 25th 1875. The quantity of rules produced was evidently not large. Professor Mikhail Cherepashinskii (Михаил Черепашинский) did not know this slide rule, when he told Florian Cajori [1] about Russian slide rules. This ignorance is understandable, because Cherepashinskii was born in Austria, graduated from the Technical University of Vienna, worked at Austrian railways, and did not move to Russia until 1878 at the age of 33. Moreover, he lived in Moscow and not in St. Petersburg.

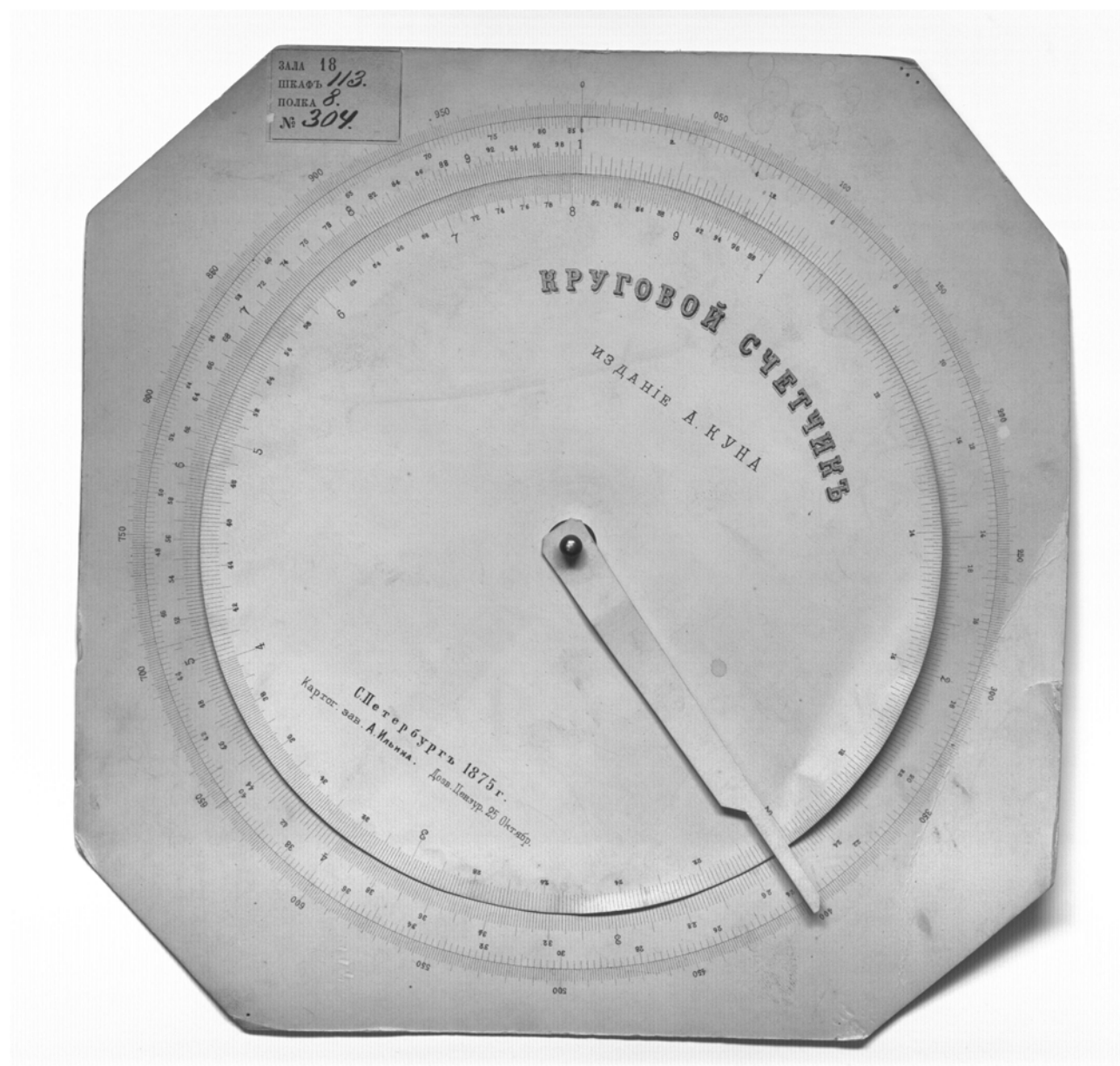


Figure 8. Circular slide rule of A. Kun
Scan ©The National Library of Russia

4. Circular slide rule system Kozhevnikov

The Schuitema collection, which was donated to The Arithmeum in Bonn, has a nice circular system Kozhevnikov (Кожевников) slide rule. The diameter is 10.3 cm having D, L, A, S, T, K scales³ with similar graphic square and cube symbols for A and K scales as seen in Figure 6 on the case of the cylindrical slide rule of Podtiagin. Even though the initials of Kozhevnikov do not appear on the rule, he must be P. L. Kozhevnikov who obtained during the time 1924-1931 three patents for circular slide rules. The short abstracts [8], [9] and [10] of the patent descriptions have been printed in the journal of the Soviet patent office and the first of these seems to resemble best the actual rule. Thus the rule in the Schuitema collection has evidently been made around 1925-1935. I have not found any other literature regarding this rule, meaning the rule, even if produced in quantity, is rare.

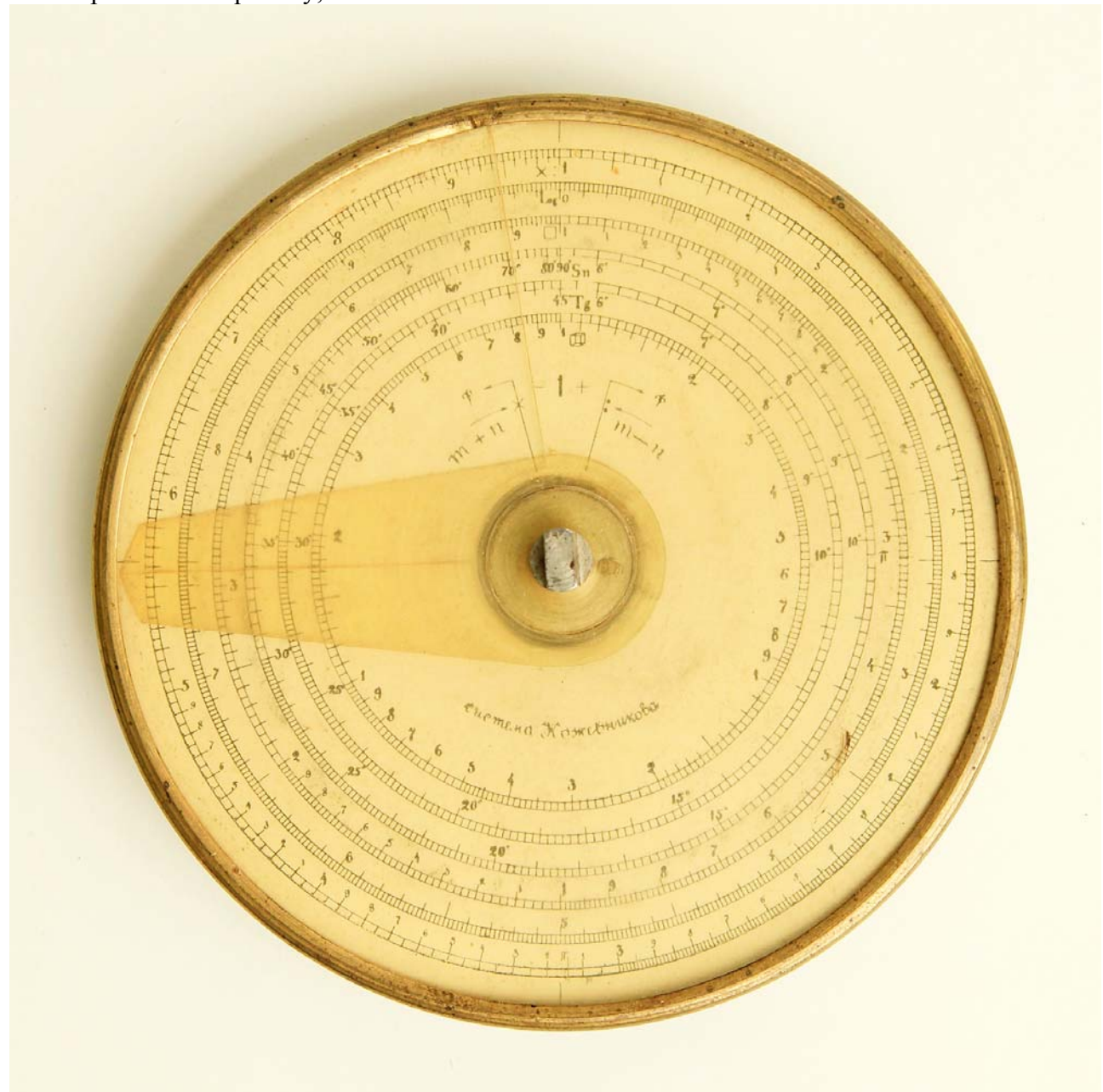


Figure 9. System Kozhevnikov circular slide rule
Scan ©Arithmeum, Bonn

5. Other circular slide rules

Some other circular slide rules have been made or at least planned in Russia/The Soviet Union before 1940, but information about them is slight. For example N. D. Bepamiatnykh (Н. Д. Беспамятных) writes in his slide rule history article [7] that engineer Ia. A. Gubianskii (Я. А. Губянский) constructed a circular slide rule, the instructions of which were printed in 1906. The main advantage should have been increased precision from the lengthened scales. A little later in 1909, the first Russian slide rule patent № 15064 obtained by a Russian citizen was granted to student B. Furer (Б. Фурер) of Technical Institute of Kiev for his circular slide rule [18]. The design used divided scales for better accuracy, but evidently the rule was not produced in quantity.

In 1935 I. I. Kupchinov (И. И. Купчинов) published an article [15] where he stated that the normal 25 cm slide rule is not sufficiently accurate for geodetic calculations and presented his own circular slide rule. The slide rule was made of plywood and is 30 cm in diameter. At the end of the article the author writes that if the disc were produced in quantity, it would obtain a monopoly in calculations of land surveyors. I do not know if this dream became true.

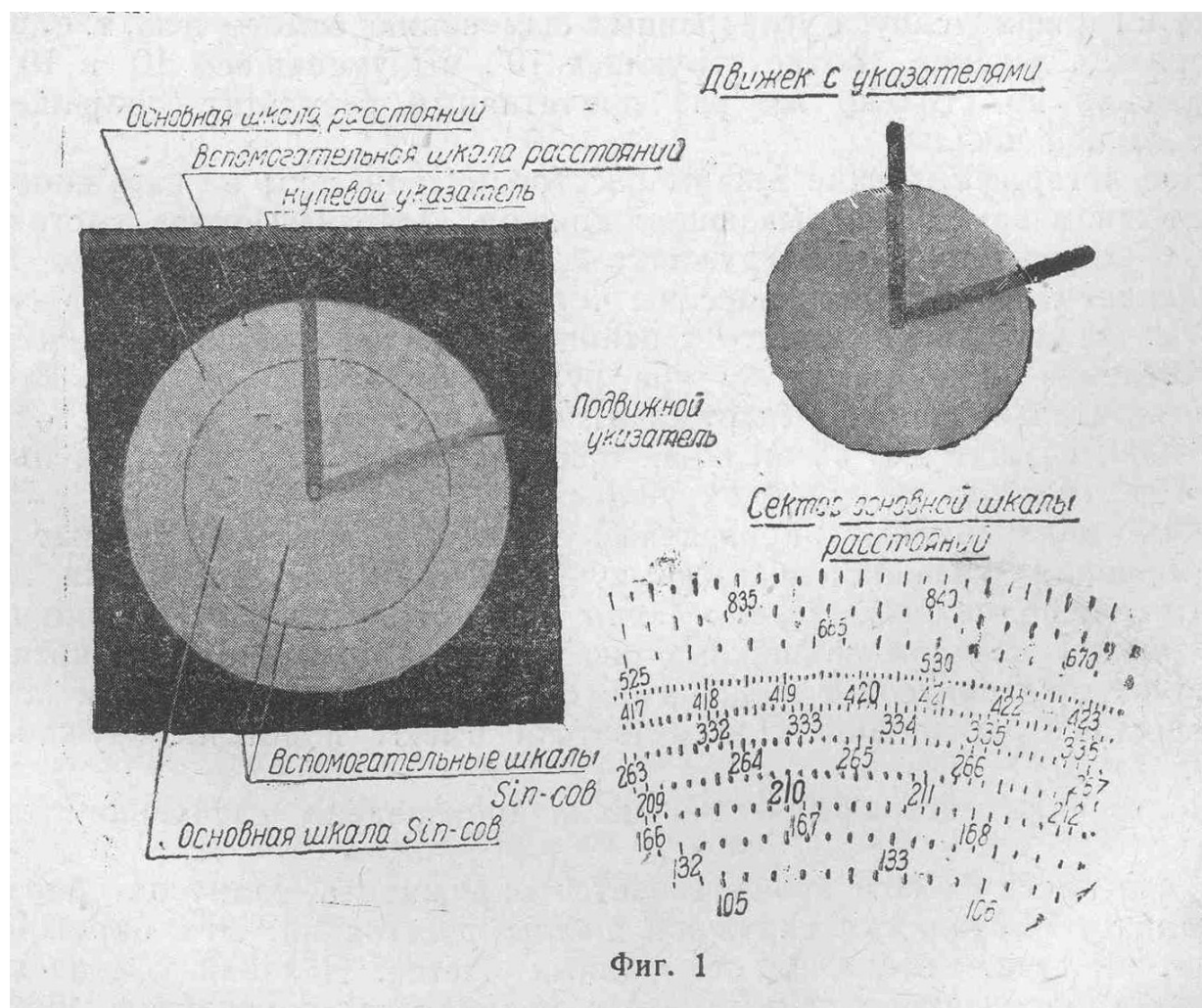


Figure 10. Circular slide rule of Kupchinov
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6. Newer circular slide rules

For the sake of completeness I list some additional literature references to newer circular slide rules. The ubiquitous small KL-1 watch produced by Second Watch Factory in Moscow was introduced in 1965 [14]. The circular slide rule Sputnik made by Kalibr factory in Moscow was released ca. 1967 and described in [22]. Not so common as these is the calculating disc of A. Ia. Aleksandrov (А. Я. Александров), which was designed for high precision calculations. Only 500 copies of the instruction booklet [4] were printed. For military use there existed, for example, a combined pilot disc NRK-2 [5] replacing NL-10m pilot slide rule and Vetrochet course calculator, radiation disc RL [19] and topographic artillery disc STM [20] that came with RT and RT-2 theodolites.

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Notes

1. Personal communication from Ol'ga Anan'eva.
2. Personal communication from Ol'ga Gurbanova.
3. Personal communication from Nina Senger-Mertens.

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