

Russian pilot slide rules 1916–2014

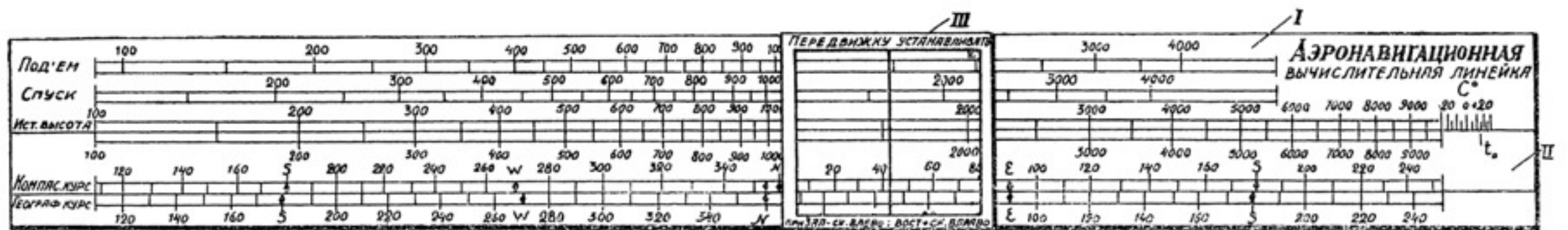
Timo Leipälä

RST 27, Stein bei Nürnberg

21.3.2015

1. Linear pilot slide rules

V. G. Nemchinov (1888–) proposed in 1923 the attached aeronavigation slide rule, but wrote in his navigation device book that that if it cannot be produced in Soviet Union, then Nestler slide rules with some extra markings/scales drawn on them must be used. Evidently Nemchinov’s slide rule was never serially produced.



Фиг. 55. Аэронавигационная вычислительная линейка.

Literature: Немчинов В. Г.: Авиационные приборы, 1926

The first soviet linear pilot slide rule really produced was designed in 1927 by soviet Black Sea air force navigator L.S. Popov according to information presented by V.A. Kormashov. Unfortunately I have not found any description or images of it. Popov has, however, written the small 12 page booklet of size 17 cm x 13 cm

Попов Л.: Описание и инструкция по работе с аэронавигационной счетной линейкой ЛП-2, 1930, 12 с., 1000 copies printed

about the use of LP-2 (Lineika Pilota) pilot slide rule, which evidently is the second version of his design. The booklet does not have any images and presents only a very short description of the device. Most of the space is dedicated to different problems, which can be solved with the slide rule.

Anyway LP-2 has two slides, one on each side.

Literature: Кормашов В. А.: Навигационная счетная линейка НЛ-10. Пособие для летного состава, 1956, 100+3 с.

NL-3 version 1 with 2 slides

NL-3 (Navigatsionnaya Lineika) pilot rule of 1931 is evidently a successor of LP-2. Its first version like LP-2 has two slides, the length is 21 cm and the number of scales is 12.



НИИ. НЛ-3. 1931.

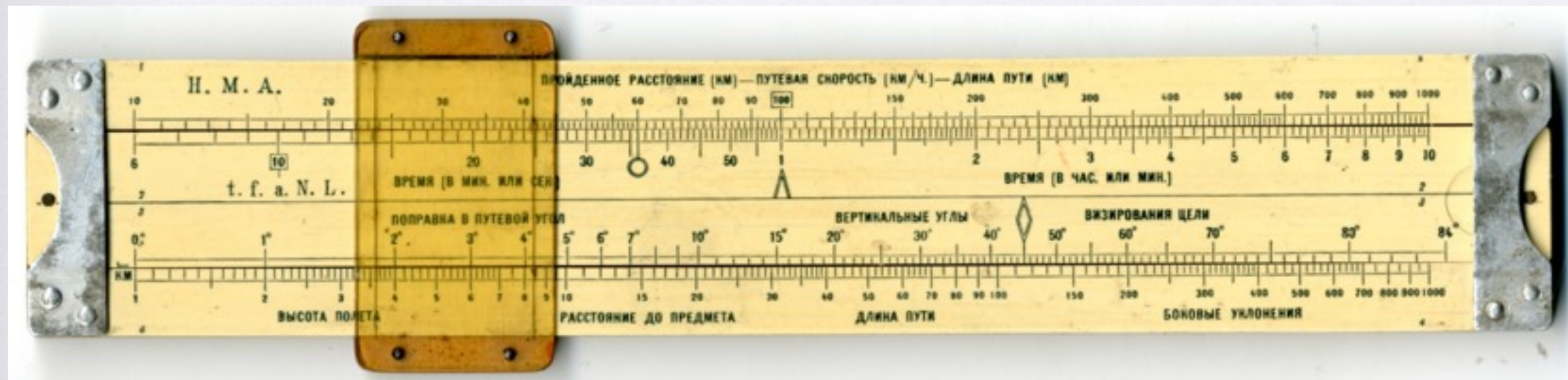
Instructions:

Аэронавигационная счетная линейка НЛ-3, 1932, 16 с.

NL-3 version 2 has identical scales with version 1 but has only one slide. Abbreviation t.f.a.N.L. with latin alphabet on the slide is interesting. Year 1931 here probably means the time of design, not the production year. The earliest source, where I have seen this NL-3 version is Danilin's aeronavigation book printed in 1935.



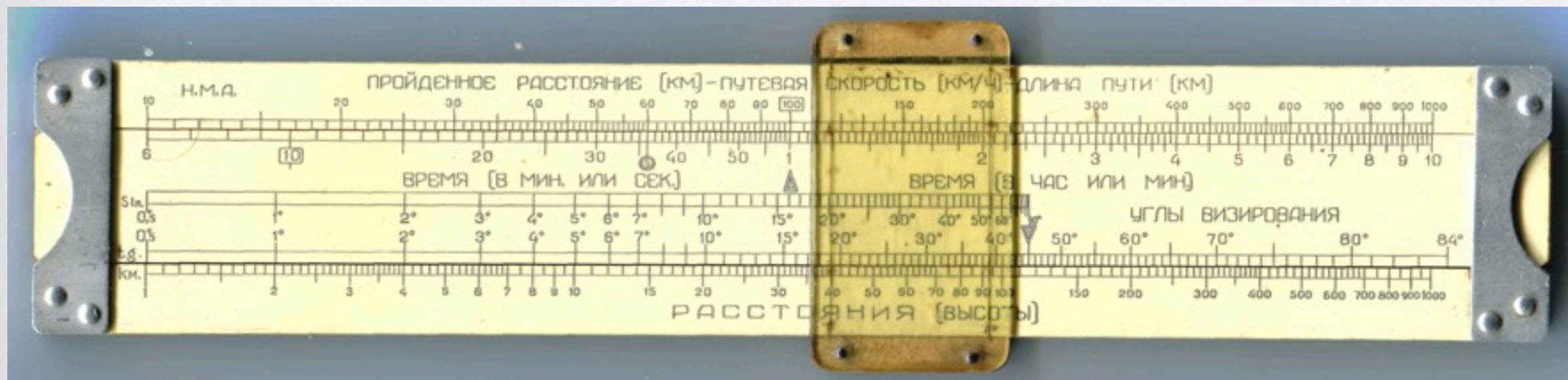
НИИ. НЛ-3. 1931.



Literature: Данилин С.А.: Аэронавигация. Элементарный учебник для пилотов, 1935

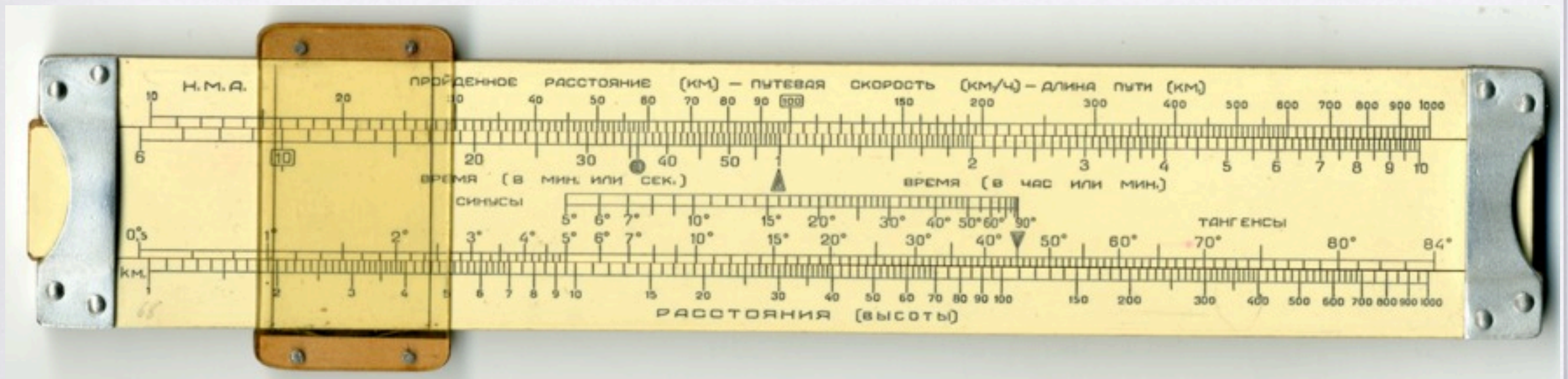
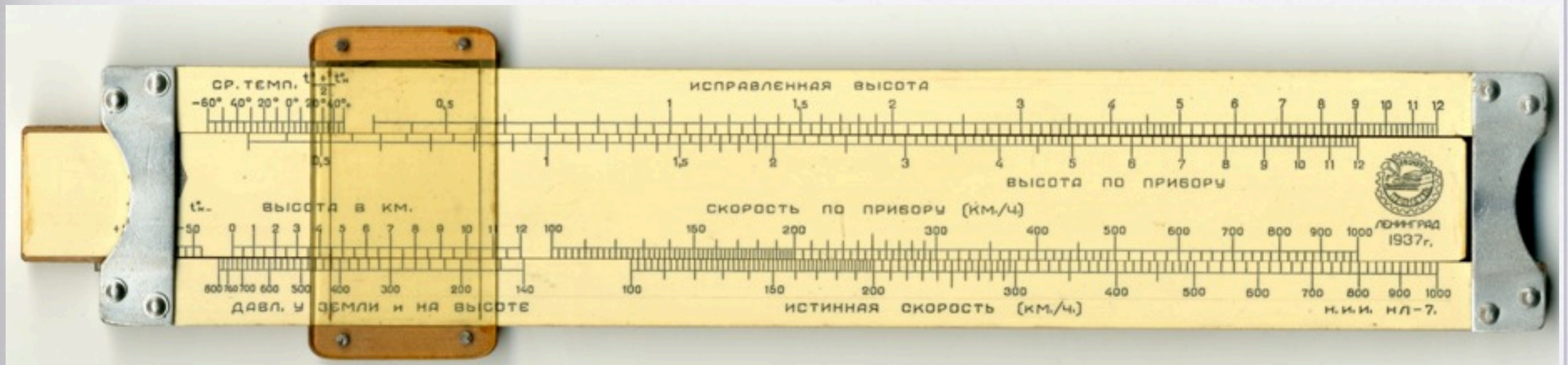
NL-6

I do not know any literature about this model but this rule has been made in 1937 by Prometei factory in Leningrad. Length 21 cm.



NL-7, length 21 cm, 1937-1939

The depicted NL-7 has also been made in 1937 by Prometei in Leningrad, but from 1938 the name of the factory was changed to SPAR (fabrika Schetnykh Priborov i Avtomaticheskikh Ruchk, Calculating device and fountain pen factory)



Handbook: Никольской М. Н. & Блинов В. Я.: Аэронавигационная линейка. Методы и приемы расчетов арифметических, штурманских, бомбардировочных и по аэрофотосъемке, 1939, 88 с., reprint available at Amazon

Arithmetical, navigational, bombing and photogrammetry problems can be solved with the slide rule as can be seen in the subtitle.

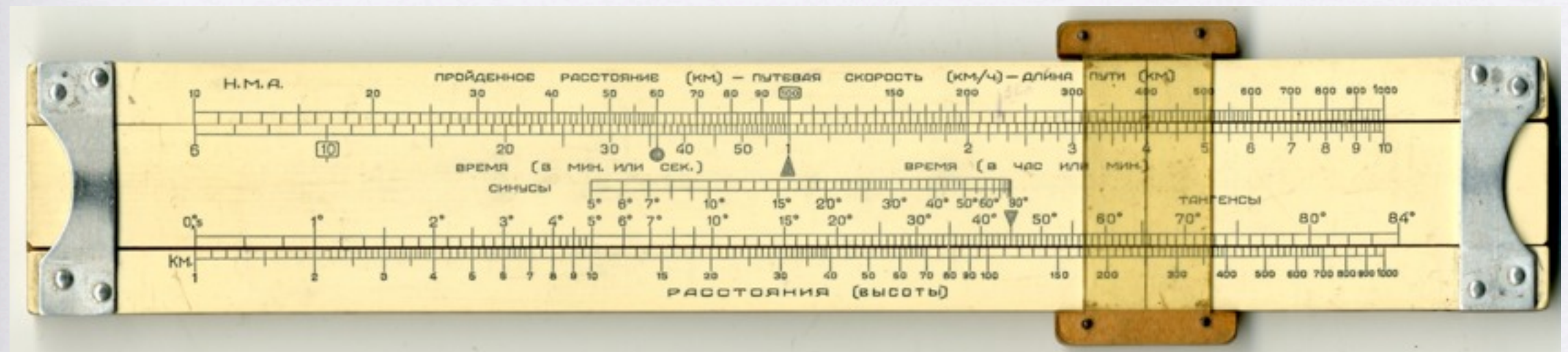


Reprint, 2013

NL-7-II, 1939-1943,
length 23 cm



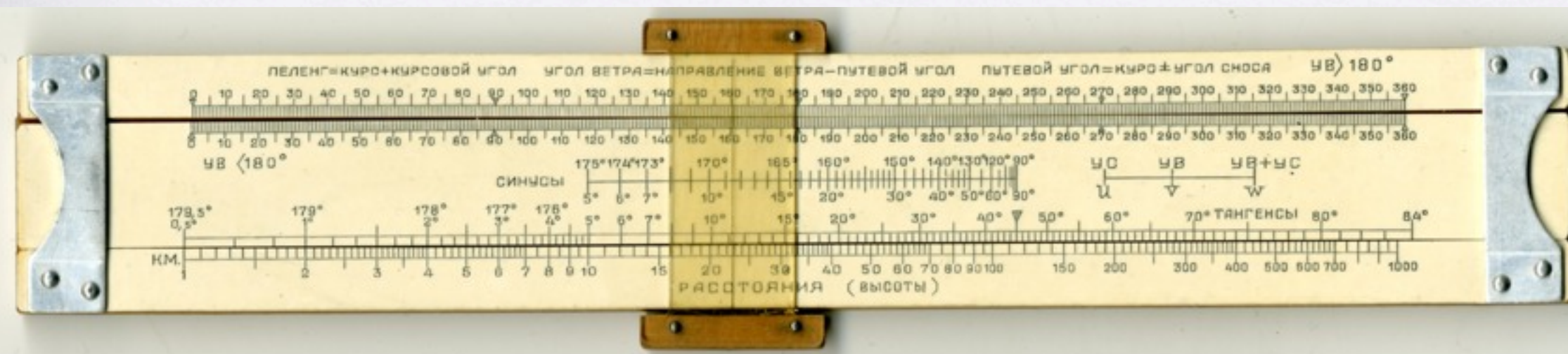
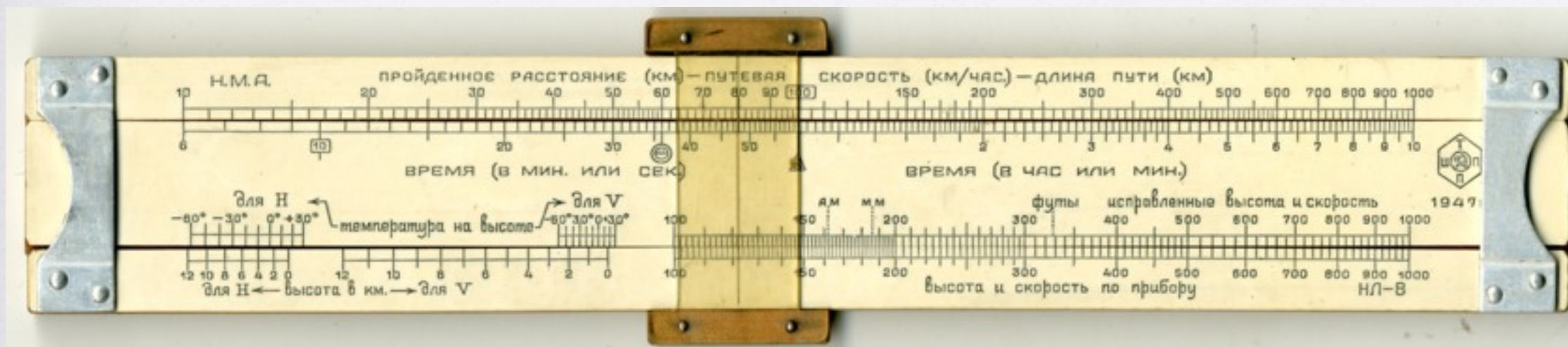
Trest Shkol'nykh Pis'mennykh Prিনadlezhnostei" (Трест Школьных Письменных Принадлежностей, abbreviation ТШПП)



SPAR was evacuated from Leningrad in 1941 and Soyuz company also belonging to TShPP factory group continued its slide rule production during time 1941-1950.

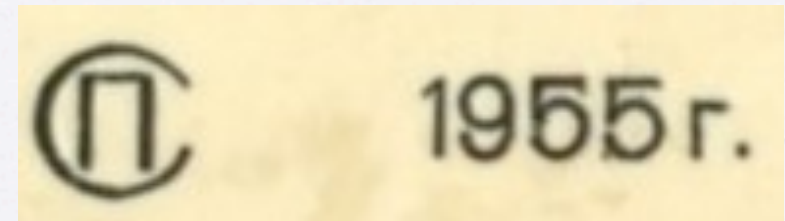
NL-8, 1943-1953

This rule has been made by Soyuz in 1947, but in 1950 SPAR began again slide rule production, now with shorter name SP. The production of slide rules was then transferred from Soyuz to SP. Length 23 cm.

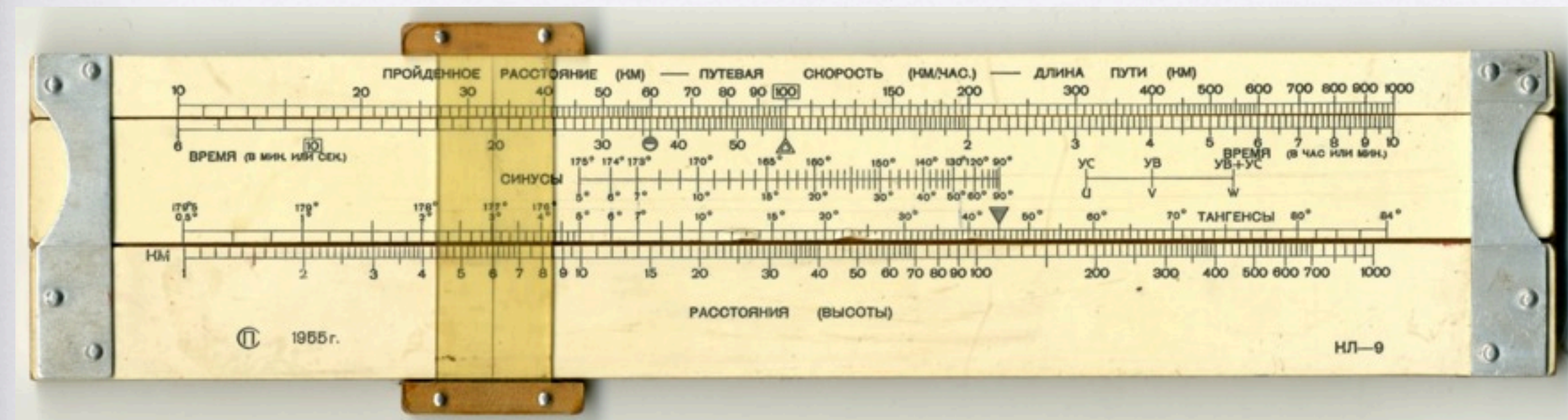
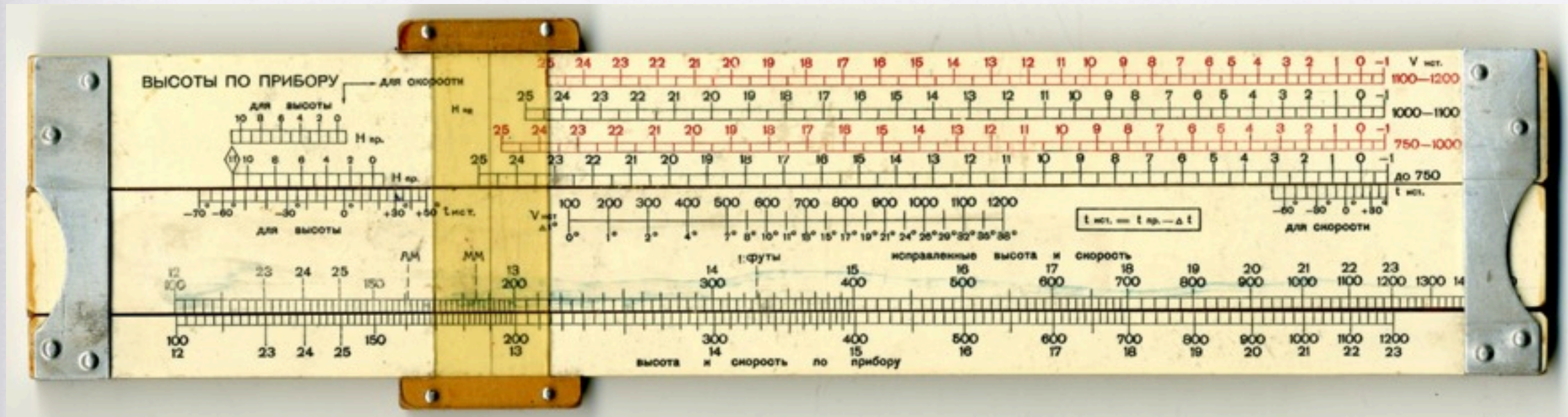


Instructions: Описание и инструкция по пользованию аэронавигационной счётной линейкой НЛ-8, 1943, 30+1 с.

NL-9, 1953-1956, length 23 cm



Made by Fabrika Schetnykh Priborov (SP)
in Leningrad



Literature: Горчаков В.: Расчет высоты и скорости полета при помощи НЛ-9. Вестник воздушного флота, 1953, No 11, с. 79-88

NL-10, 1956-1961

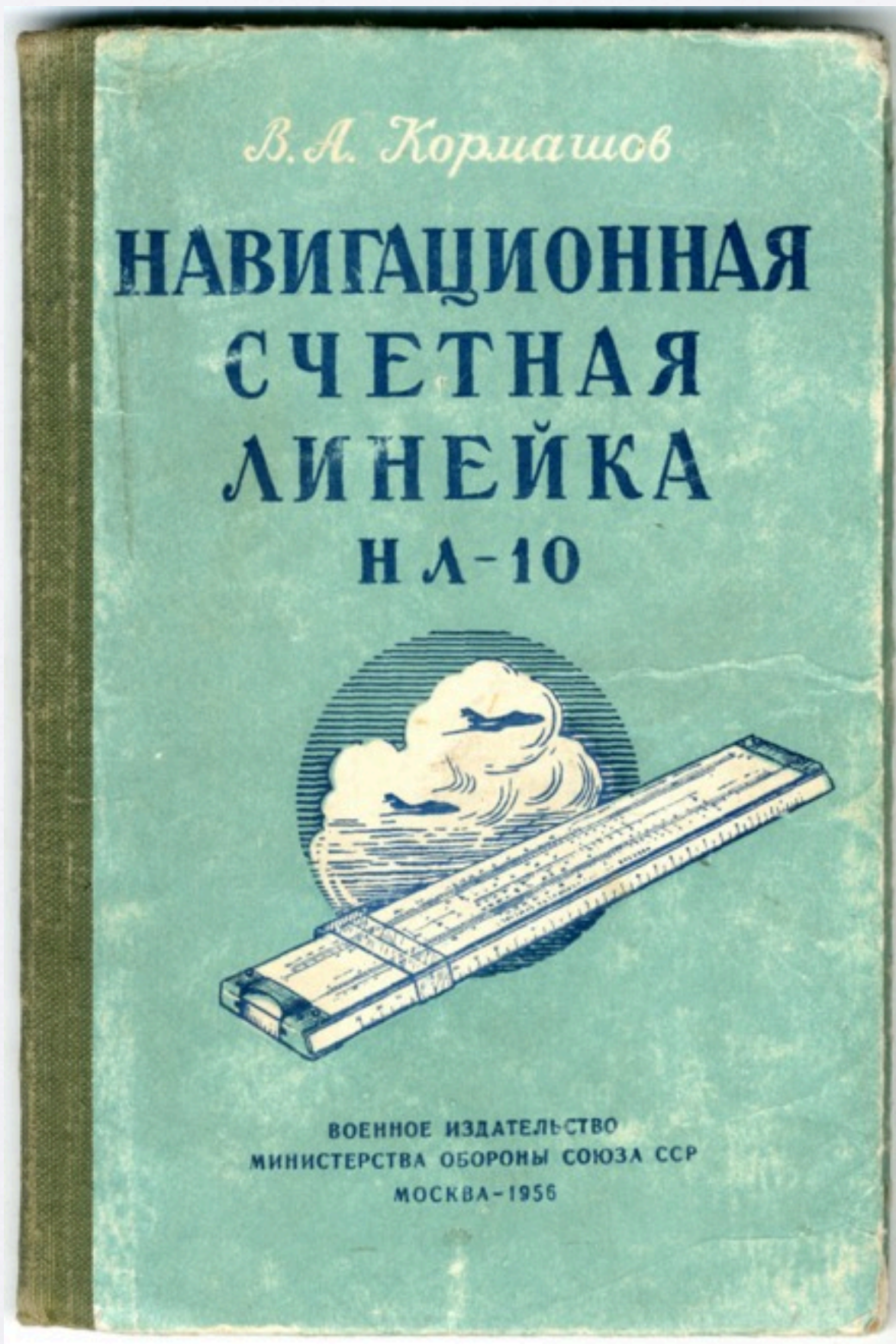
НЛ - 10 П

Made by SP factory, Leningrad.
Length 30 cm.



Handbook: Кормашов В. А.: Навигационная счетная линейка НЛ-10. Пособие для летного состава, 1956, 100+3 с.

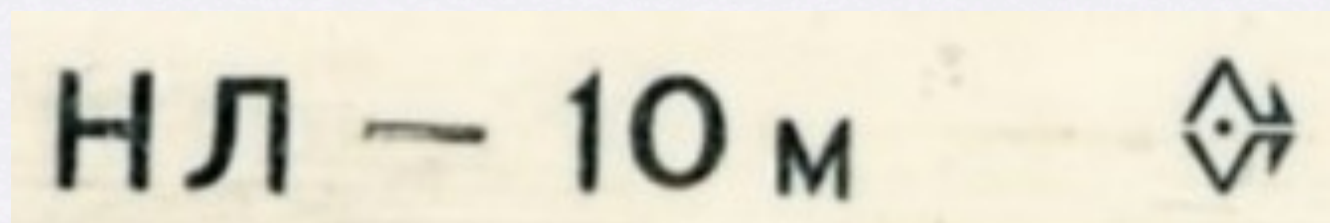
Kormashov, 1956.
Reprint available at Amazon



НЛ-10м (NL-10 modernizirovannaya), length 30 cm, 1961-?



New SP factory logo



Literature:

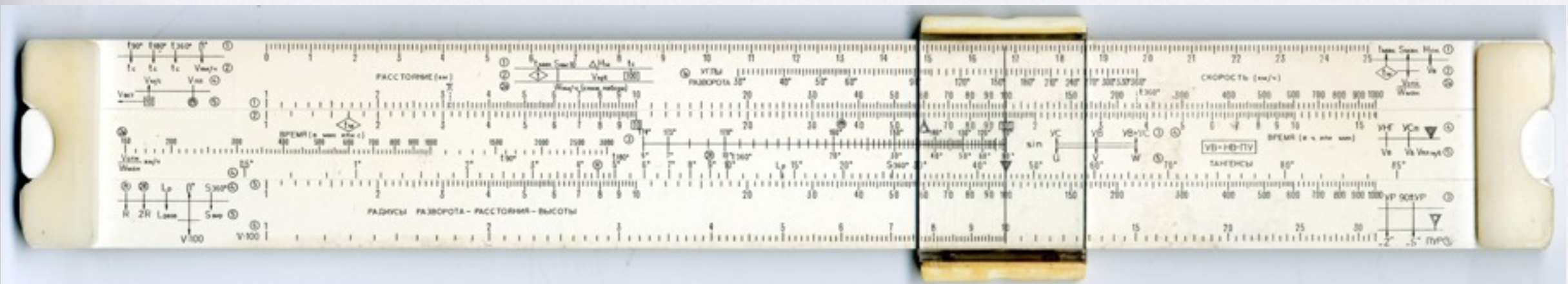
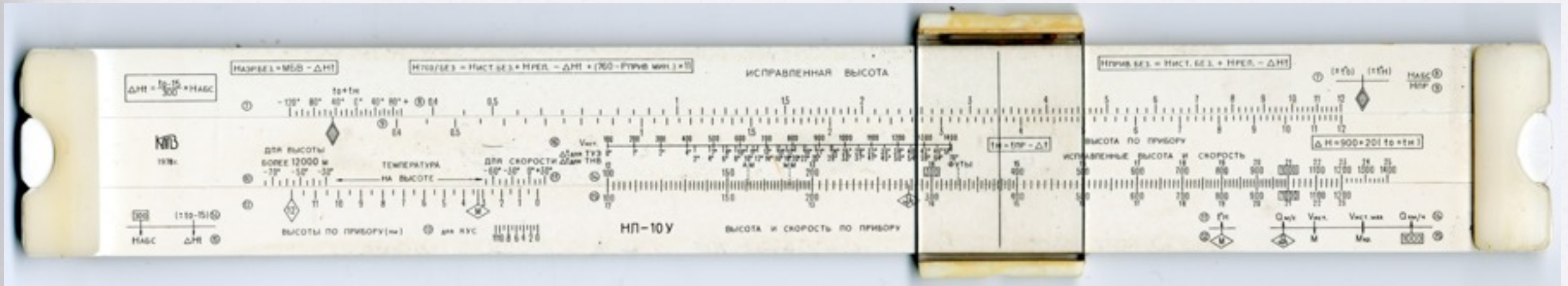
Кормашов В.А.: Навигационная счетная линейка НЛ-10м, 1961, 120+3 с., 16500 copies printed

Саенко А.А.: Навигационная счетная линейка НЛ-10М, 1998, 44 с., 300 copies printed

Designation and device of the navigational slide rule NL-10M,
www.rossiya-virtual.com/tutos/nl10.doc?64c091dc97d4d447b5287bbc1849db6=1c13daf95cd71b9e58aceaadd793f41f



NL-10U, Plastic pilot rule, made in Kiev, Ukraine. Length 35 cm. Only a small amount made (information of Elena Kabanova, Moscow polytechnic museum).

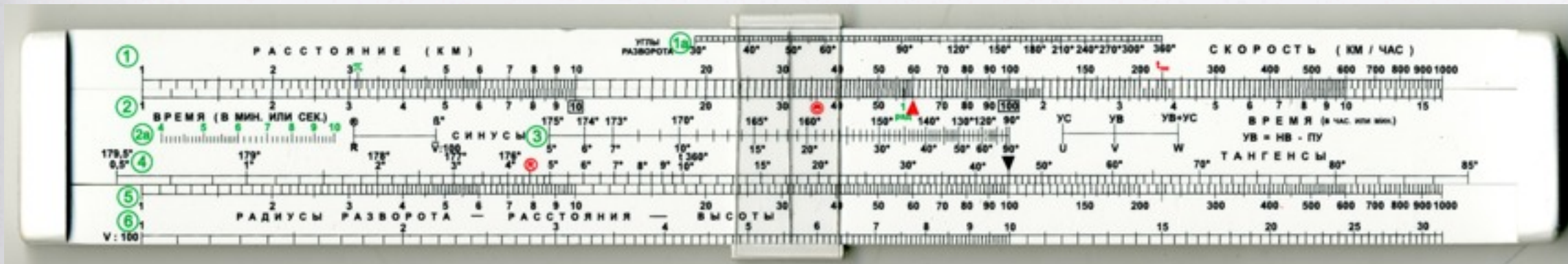


КПБ
1978 г.

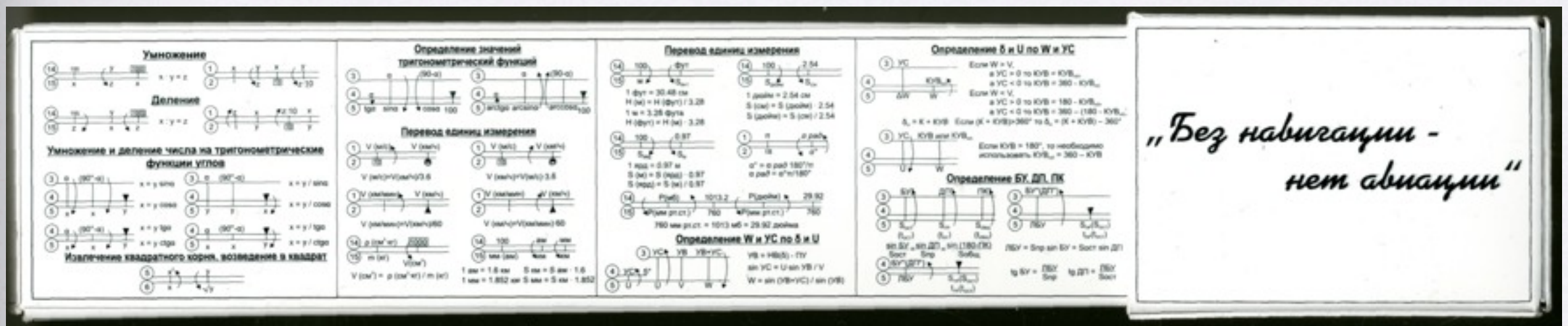
ИП-10У

NL-10mk, plastic rule made in 2014!
 Scale 2a added to NL-10m, length 30 cm.

НЛ - 10мк, Роп 2014г



Nice case with short instructions and text "Without navigation – no aviation".



"Без навигации - нет авиации"

NIISS pilot rule, 1936

Organisation NIISS designed a simple pilot rule, which evidently was not produced serially.

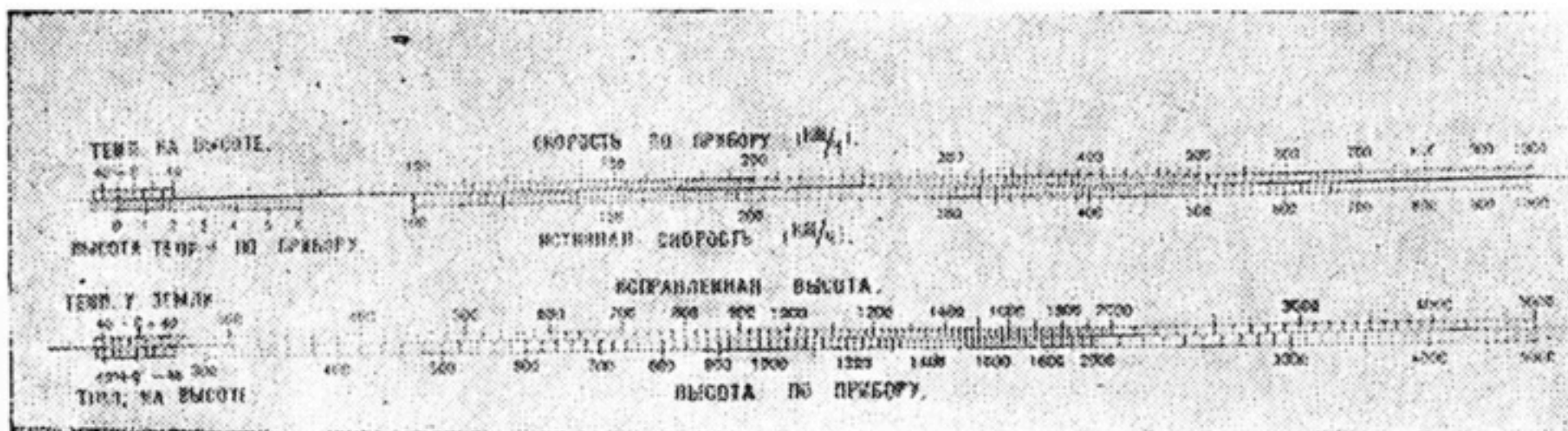


Рис. 1. Счетная аэронавигационная линейка.

Literature: Немчинов В.Г.: Счетная аэронавигационная линейка, с. 5–10, Труды научно-исследовательского института специальных служб. Выпуск 1, 1936

2. Vetrochets (course correctors)

To calculate the effects of wind a course corrector is needed. Russians use the name vetrochet (wind calculator) for these devices.

An early vetrochet was designed by A.N. Zhuravchenko (1884–1964) in 1916. It is a heavy thing weighing 6 kg

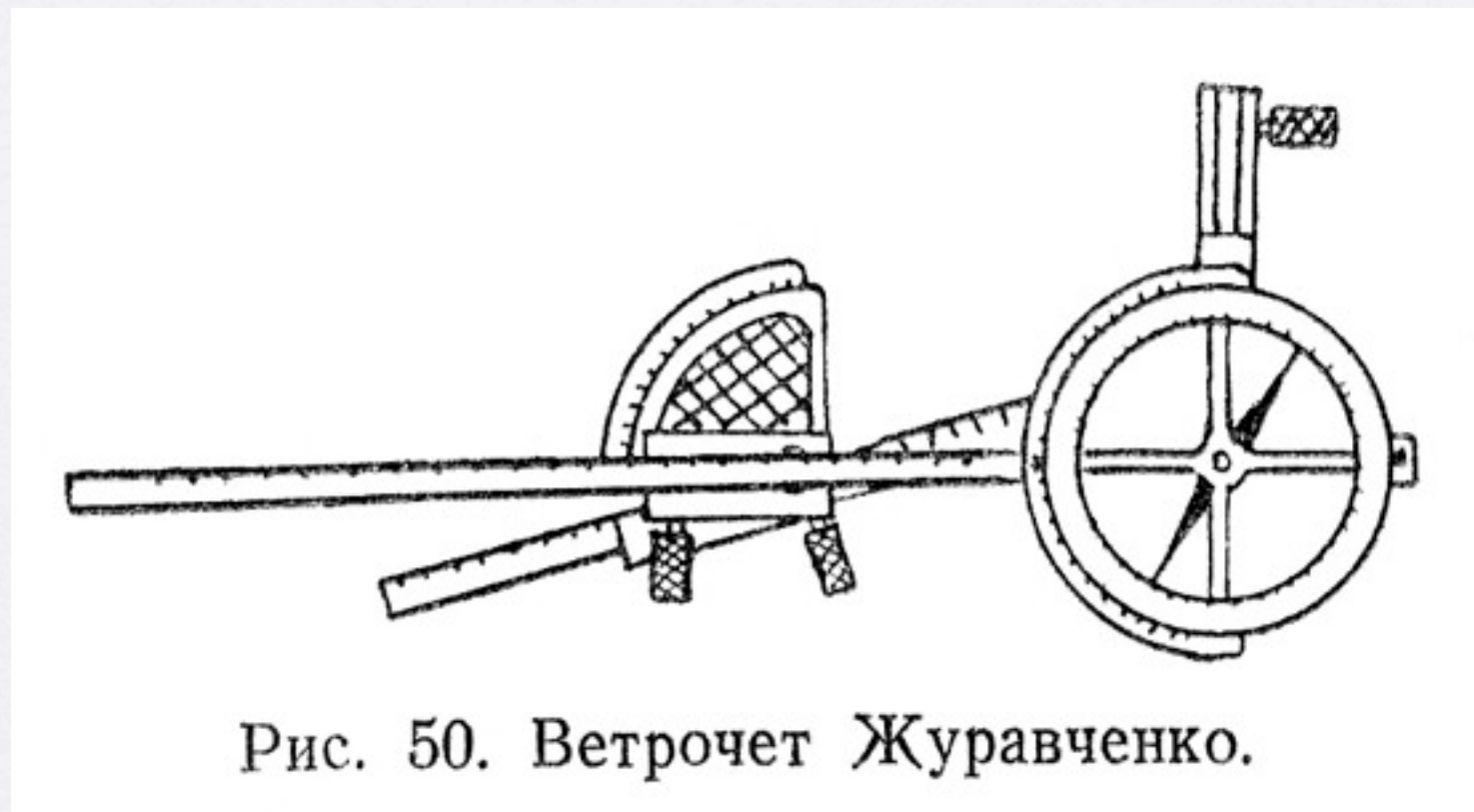


Рис. 50. Ветрочет Журавченко.

Literature:

Ветрочет капитана Журавченко, 1916, 67+1 с.

Кудрявцев Н.Ф.: Навигационные визиры и ветрочеты, 1941, 48 с.

Other designs include 1923 vetrochet of N.F. Kudryavtsev (1894–1989)

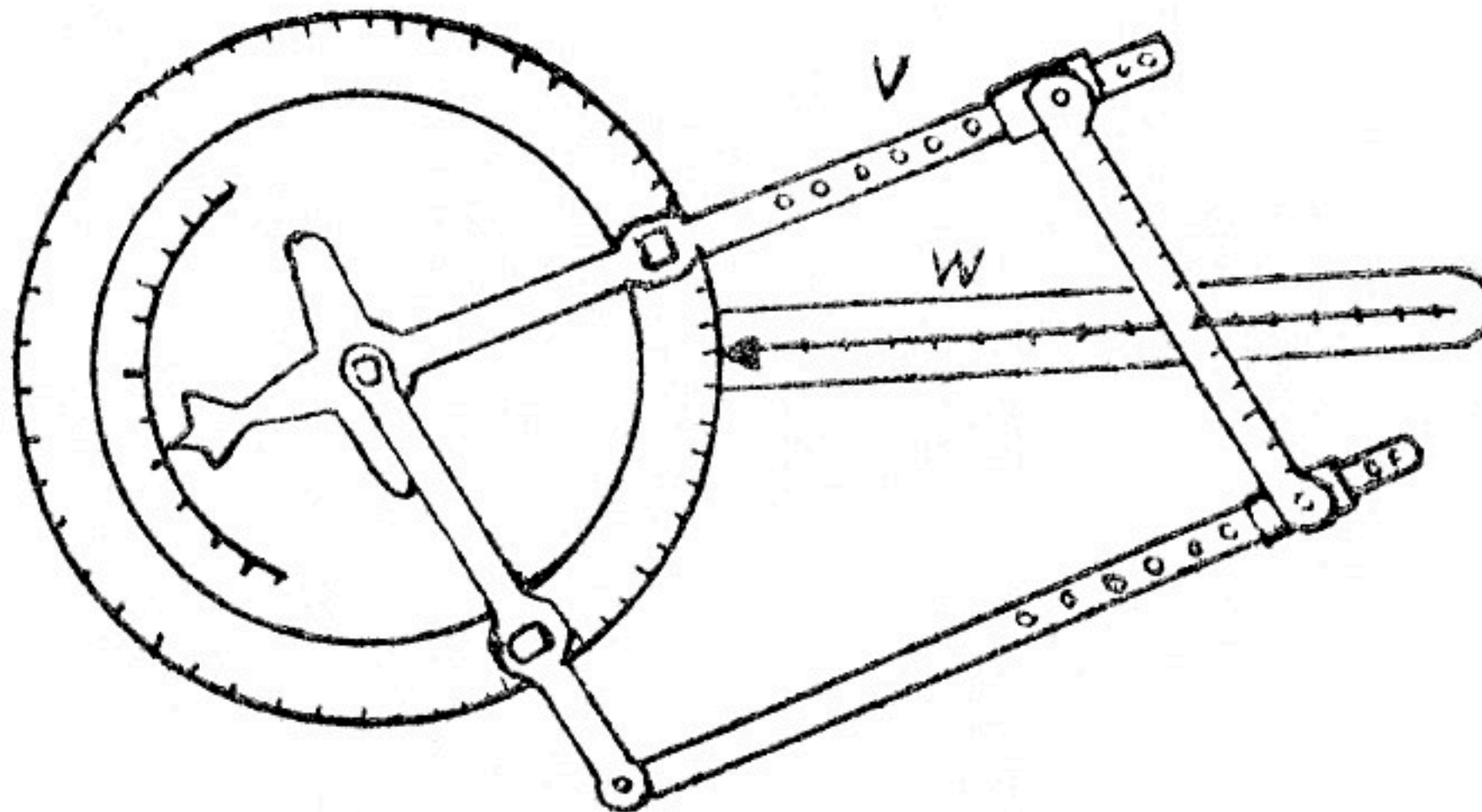


Рис. 56. Ветрочет Кудрявцева.

Instructions: Описание ветрочета Кудрявцева и инструкция для пользования им, 1925, 29 + 2 с.

Another early vetrochet was proposed by P.A. Molchanov (1893–1941), see

Молчанов П.А.: Методы и приборы современной аэронавигационной службы, 1924

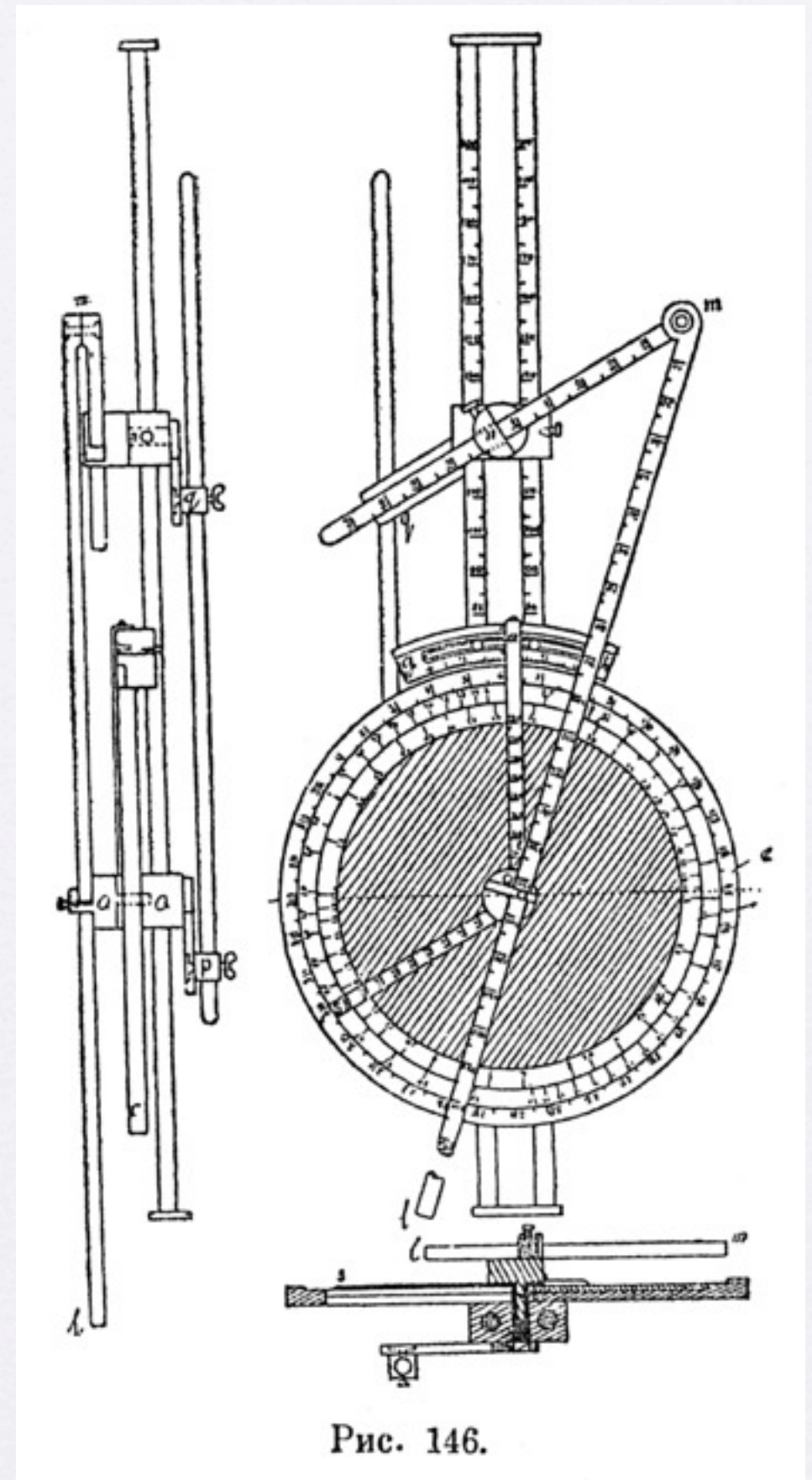


Рис. 146.

Vetrochet A.N.O.

The standard Russian vetrochet is, however, the simple, small and robust vetrochet A.N.O. designed by B.V. Sterligov (1901–1971) in 1927. With slight modifications it was widely used still in the 1970ies.

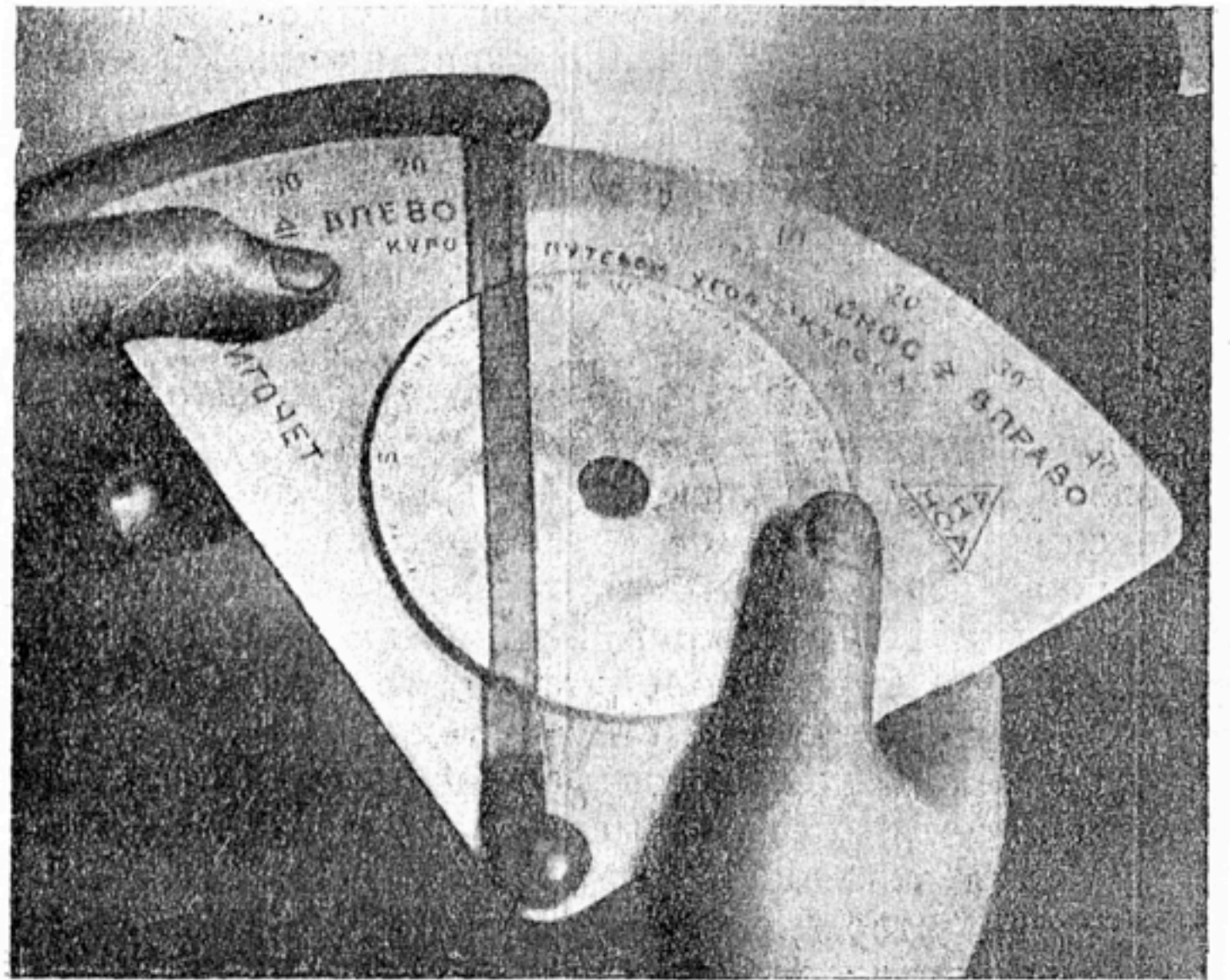


Рис. 5.

Handbook: Описание ветрочета А.Н.О. сист. Стерлигова и наставление к пользованию им, 1927, 67 с., 1000 copies printed.

Vetrochet model 1937, producer Metpribor, height 20 cm, breadth 23.5 cm



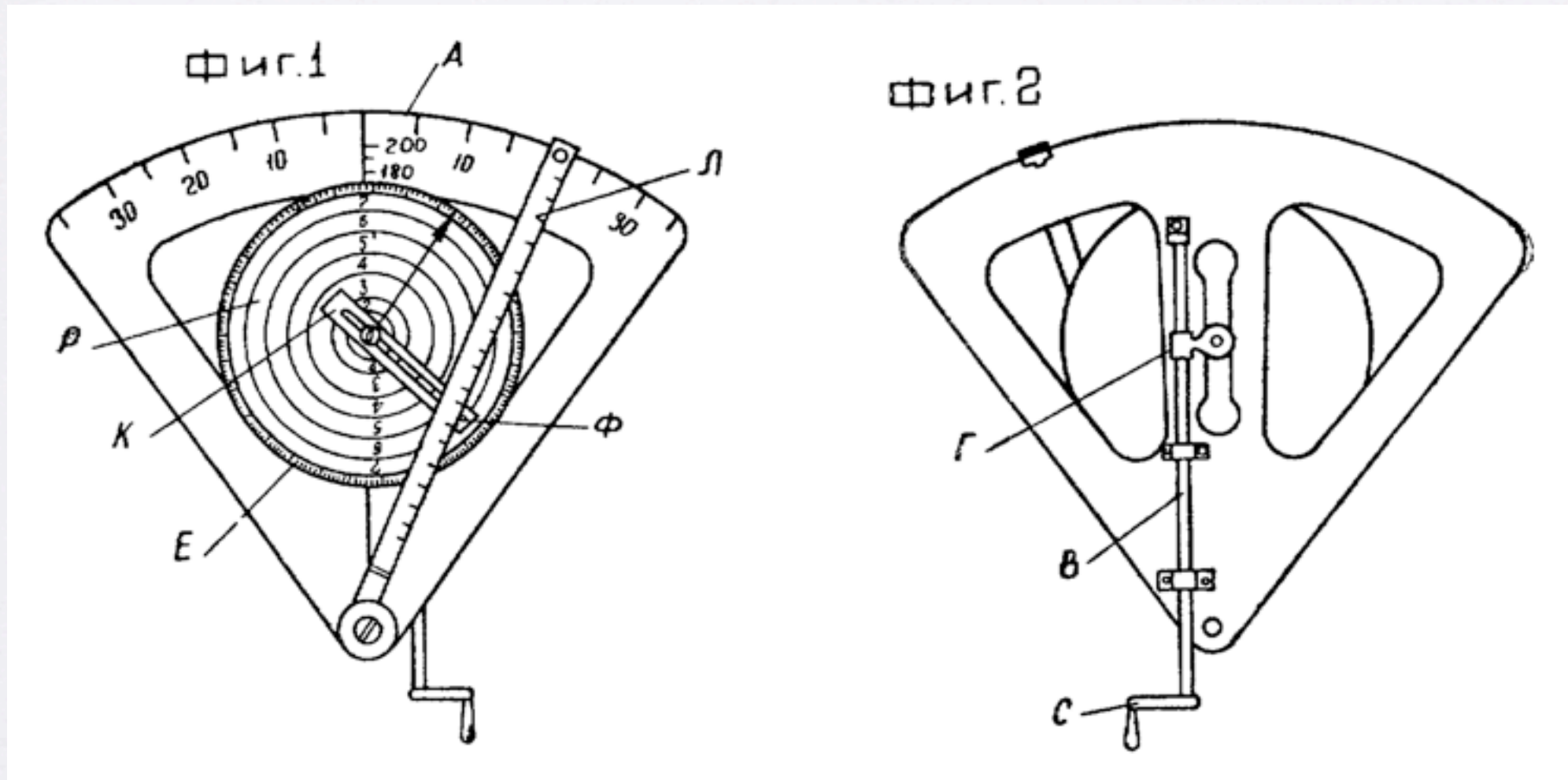
Vetrochet VSh-1 (BШ-1), 1959, dimensions 21 cm x 18.5 cm, made at factory p. ya. № 2 at Voronezh.



Vetrochet 1-90, 20.5 cm x 18 cm



Molchanov's improvement



On 31.7.1940 P.A. Molchanov was granted soviet patent number 57524 for an improved vetrochet ANO. Like most patents it evidently was never used in practice.

See

http://www.findpatent.ru/img_show/3429574.html

http://www.findpatent.ru/img_show/3429575.html#

3. Pilot slide rule and vetrochet combinations

It was not very convenient to have two different calculating devices, so their combination into one instrument was naturally attempted.



Photo from internet

Combined vetrochet KNS,
vetrochet side. On the other side a
circular slide rule of which I do not
have any image. Maybe this a
prototype of the following item

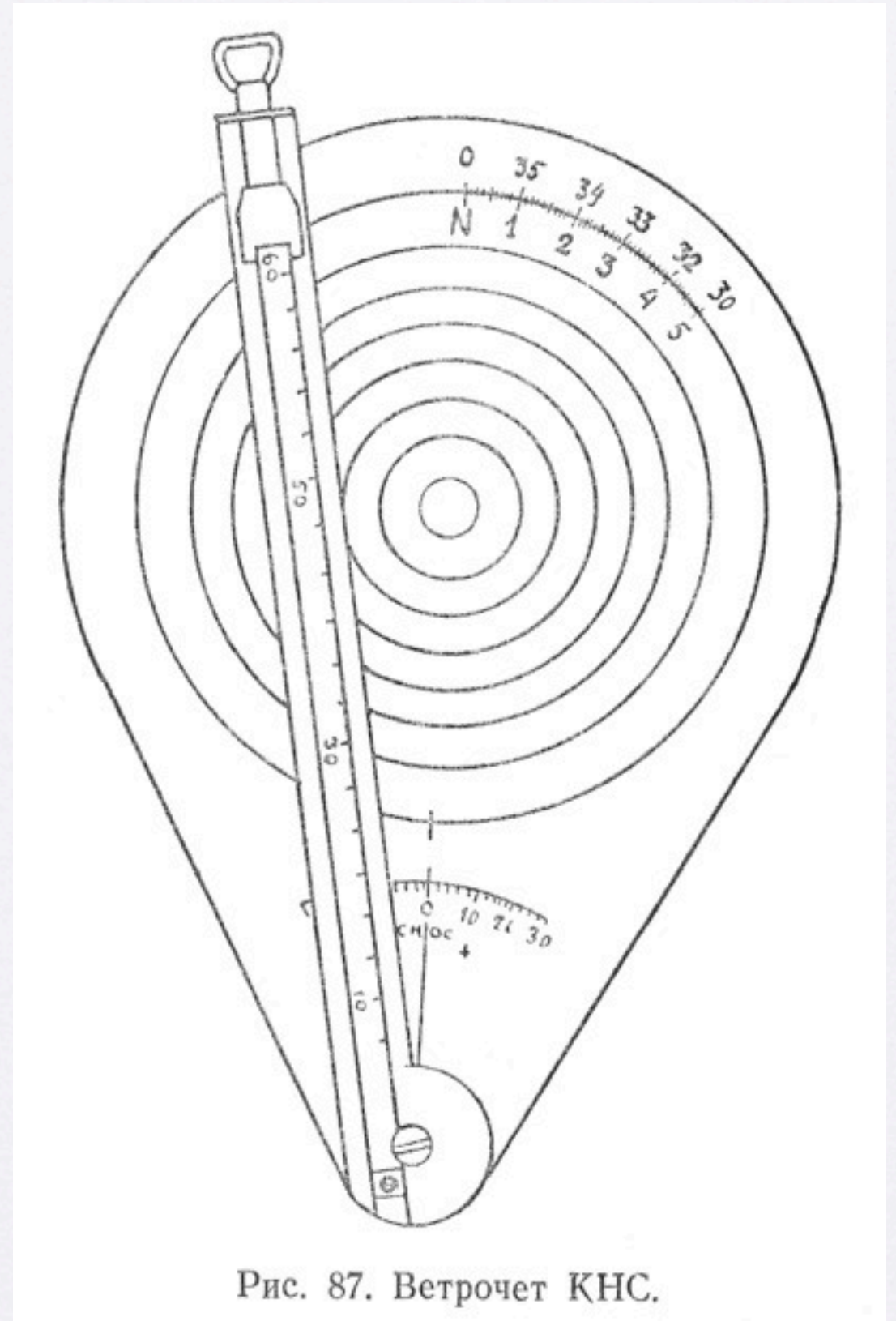


Рис. 87. Ветрочет КНС.

Literature:

Кудрявцев Н.Ф.: Навигационные визирьы и ветрочеты, 1941, 48 с.

Combined vetrochet, vetrochet side

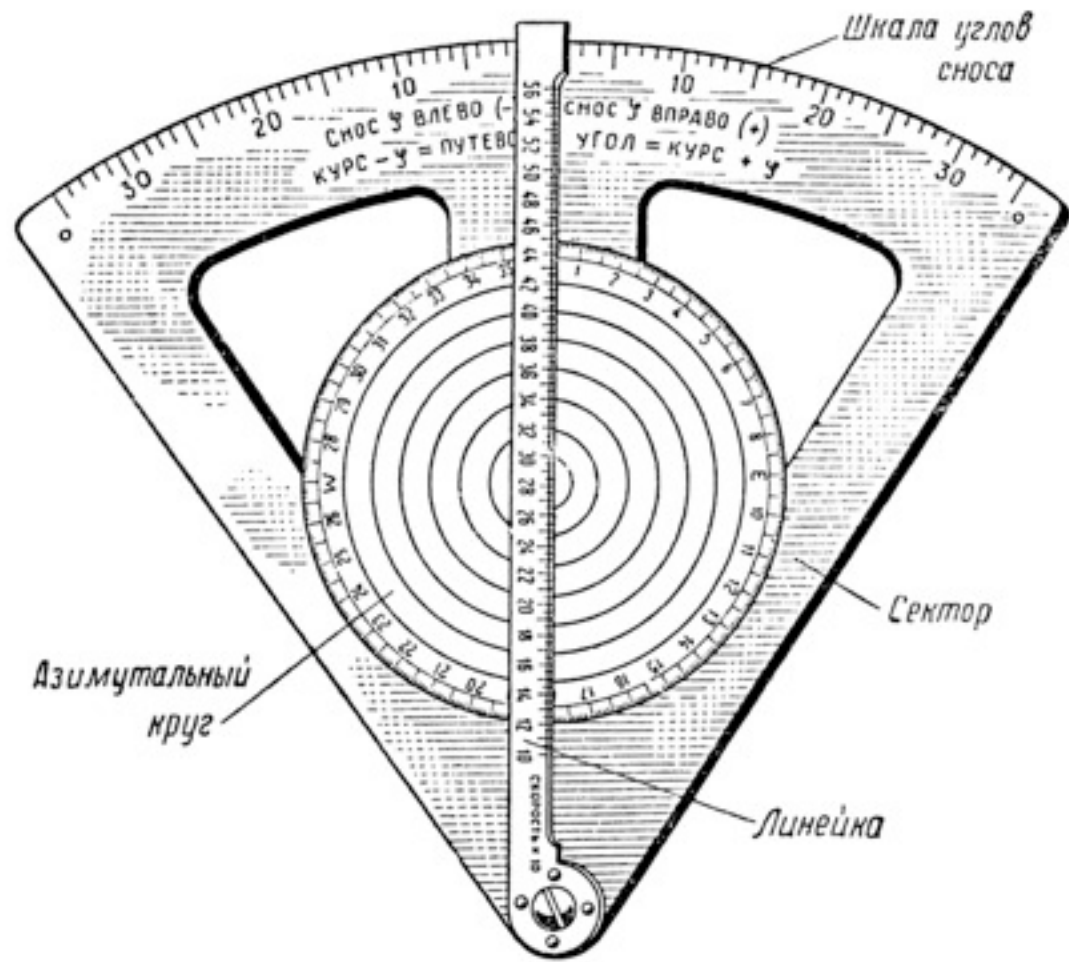


Рис. 2.

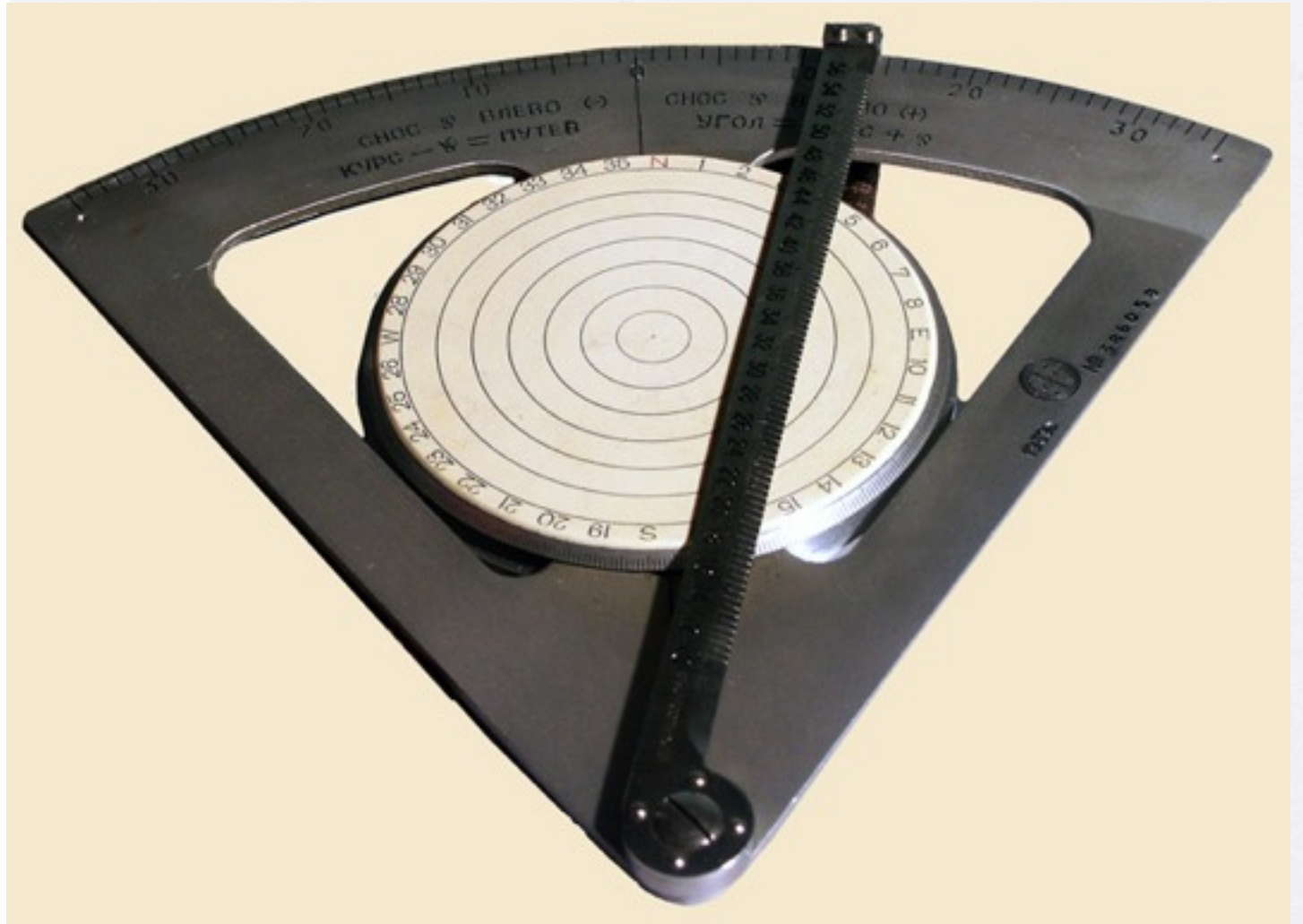


Photo: Polytechnic museum, Moscow

Instructions: Описание комбинированного ветрочета, 1940, 23 с., 7500 copies printed

Combined vetrochet, slide rule side

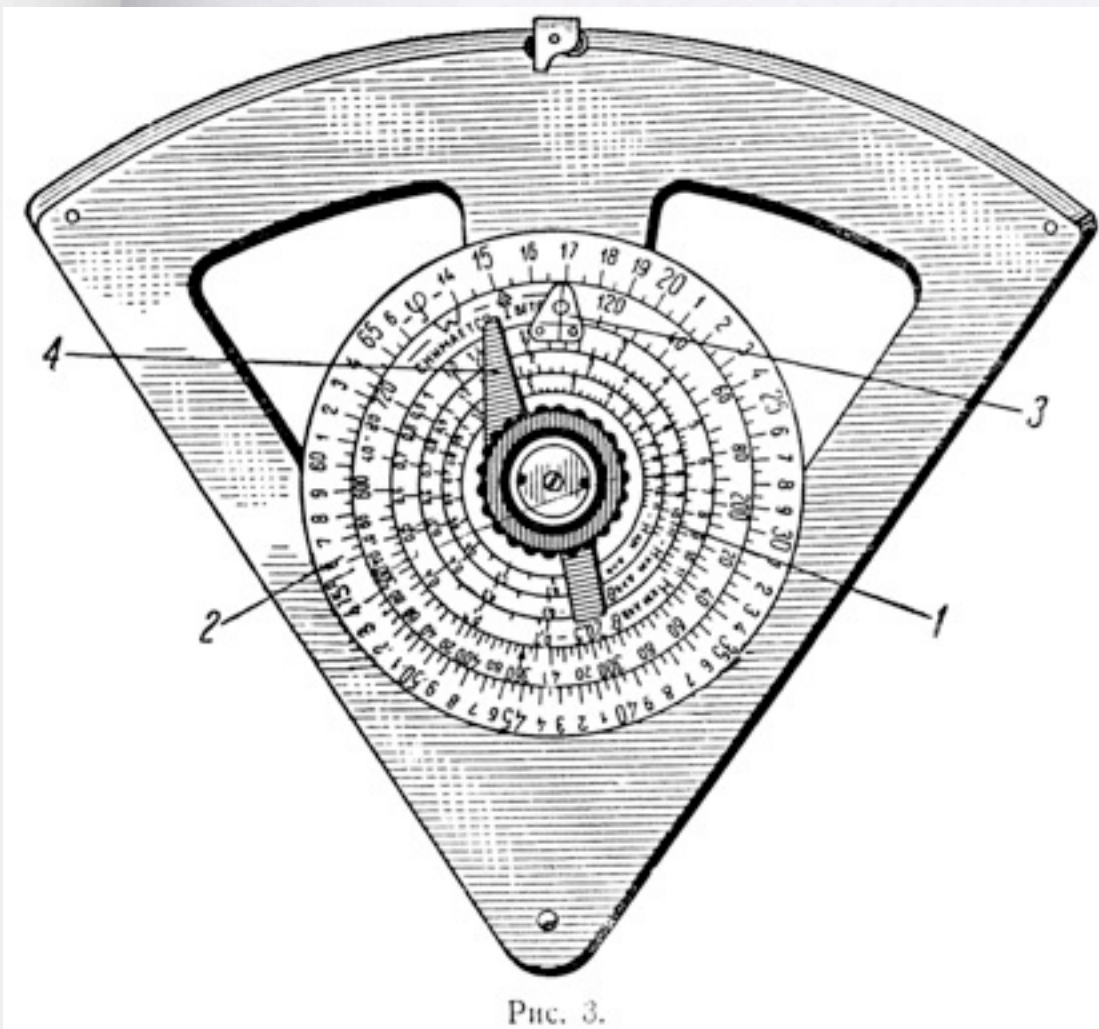


Photo: Polytechnic museum, Moscow

Navigational calculator, 1944

vetrochet side

slide rule side

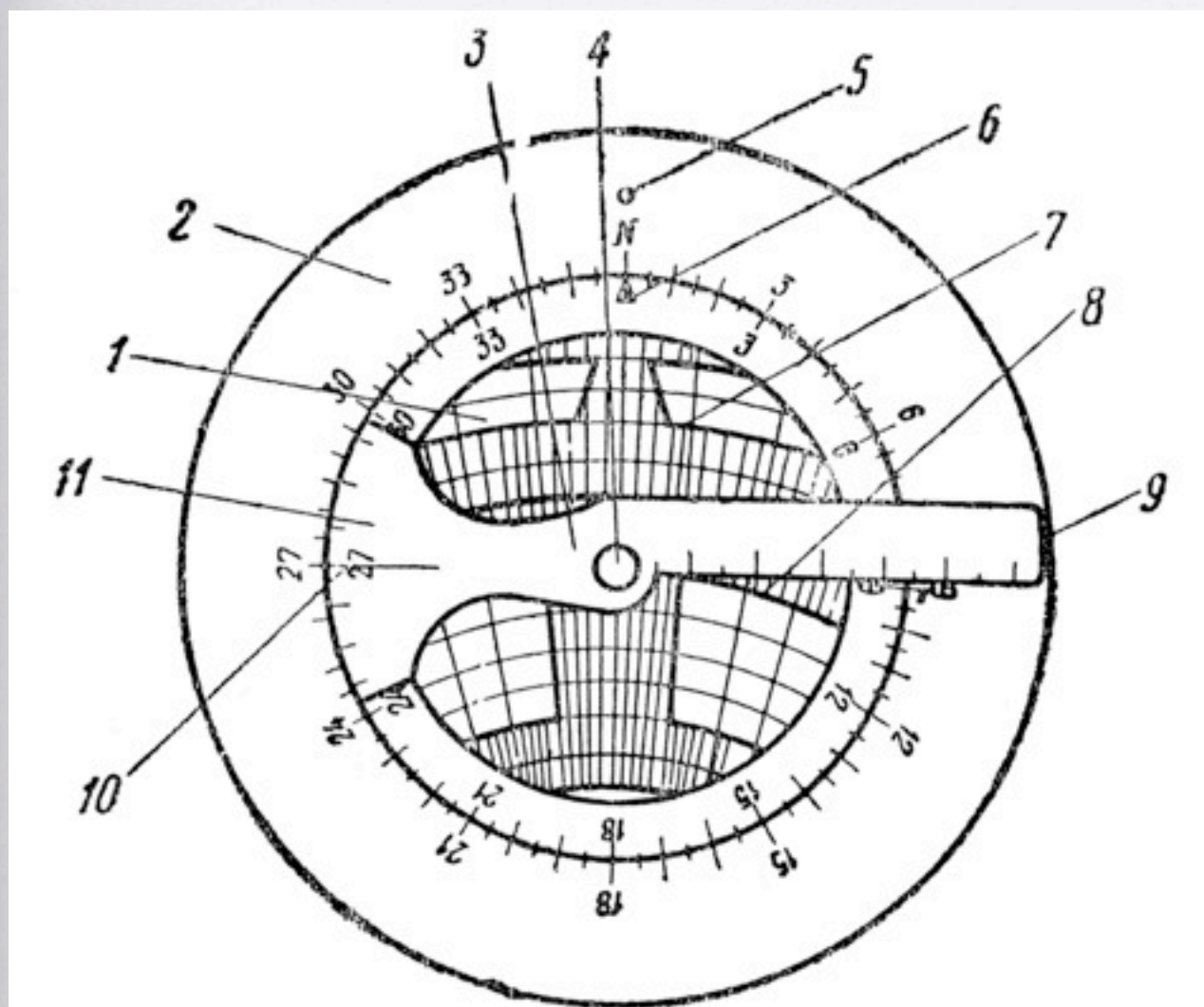


Рис. 1. Навигационный вычислитель
(Вид со стороны ветрочета)

- 1 — диск с сеткой углов сноса и разностей скоростей;
- 2 — кольцо со шкалой курсов и пеленгов; 3 — визирка;
- 4 — ось диска и визирки; 5 — штифт, соединяющий верхний прозрачный диск с кольцом; 6 — курсовая черта;
- 7 — линии сноса; 8 — дуга нулевой разности скоростей;
- 9 — шкала скорости ветра; 10 — индекс визирки; 11 — шкала схождения меридианов.

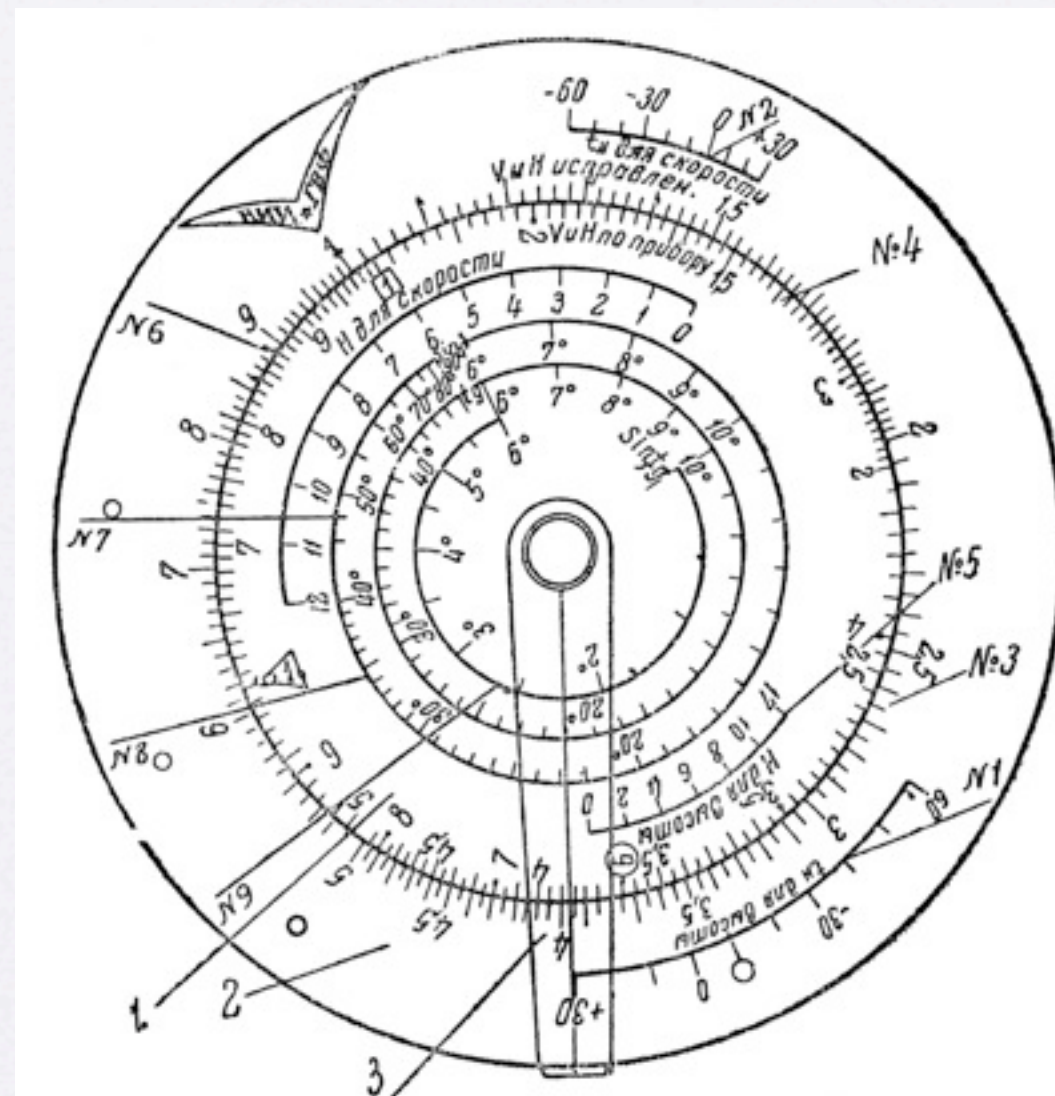


Рис. 2. Навигационный вычислитель
(Вид со стороны счетной линейки)

- 1 — диск; 2 — кольцо; 3 — визирка.

Instructions: Немчинов В.Г.: Навигационный вычислитель НИИ ГВФ, 1944, 31 с., 400 copies printed

Combined navigational calculator KNS-1

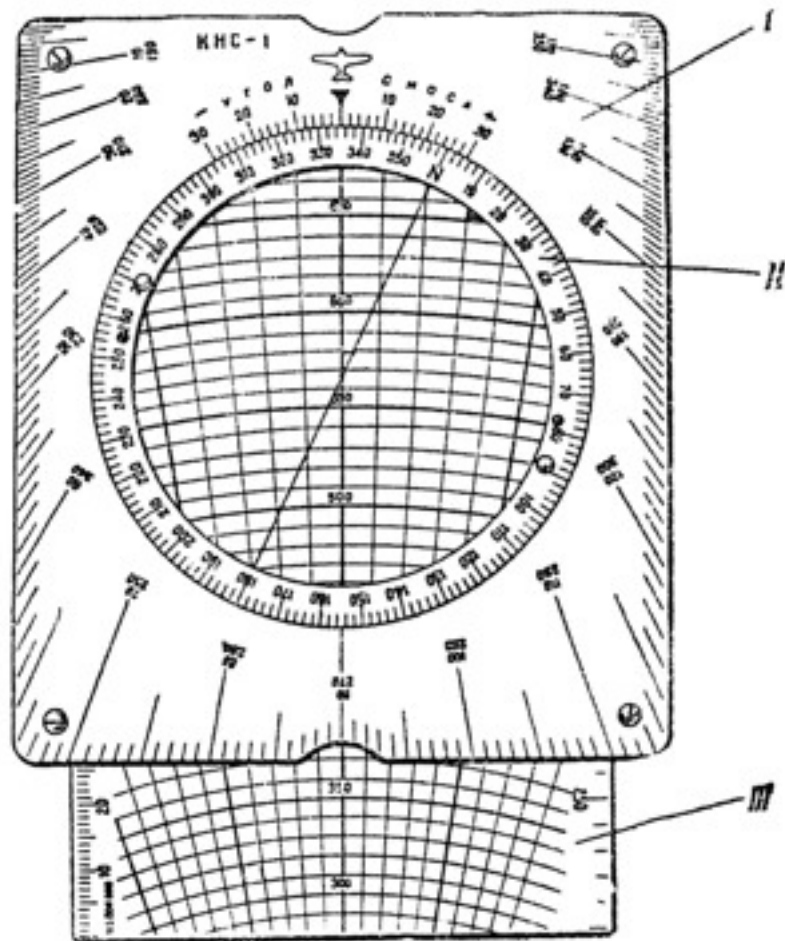


Рис. 128. КНС

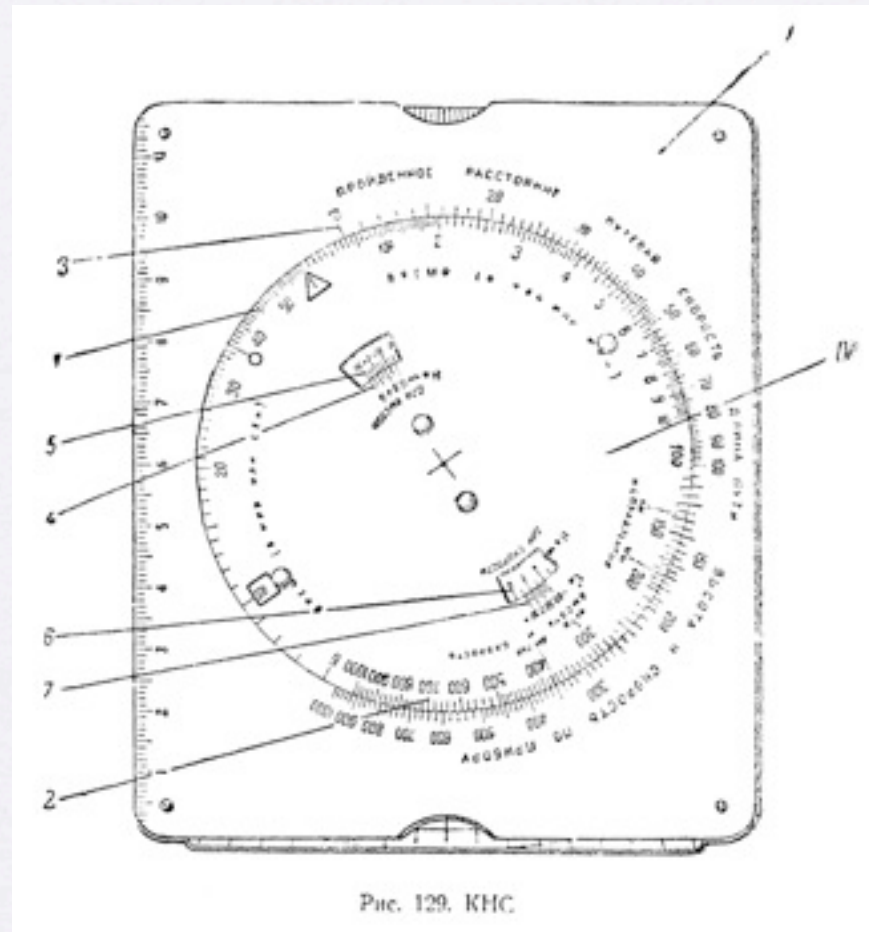


Рис. 129. КНС

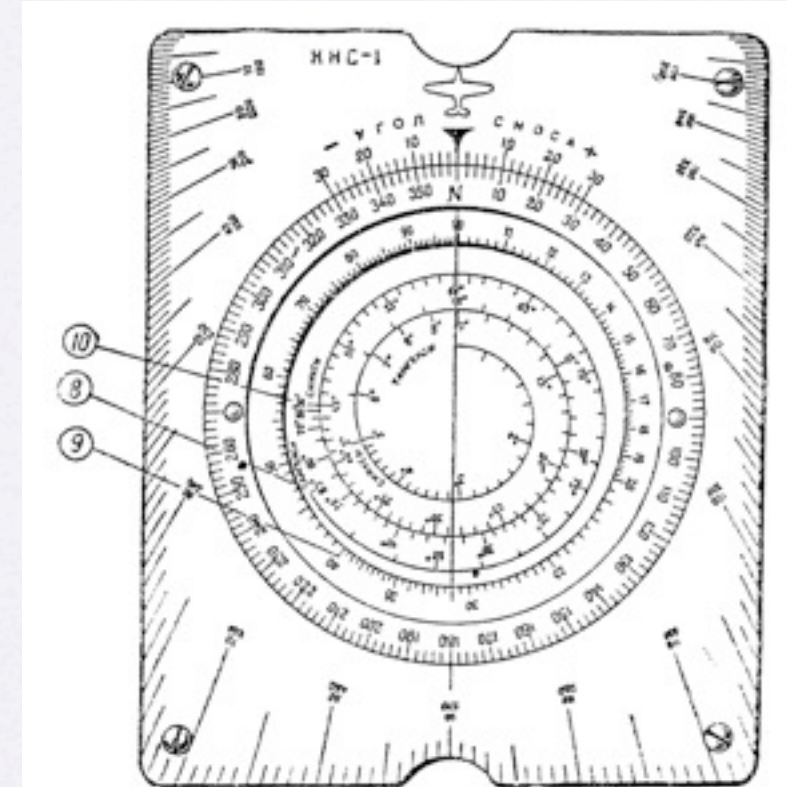
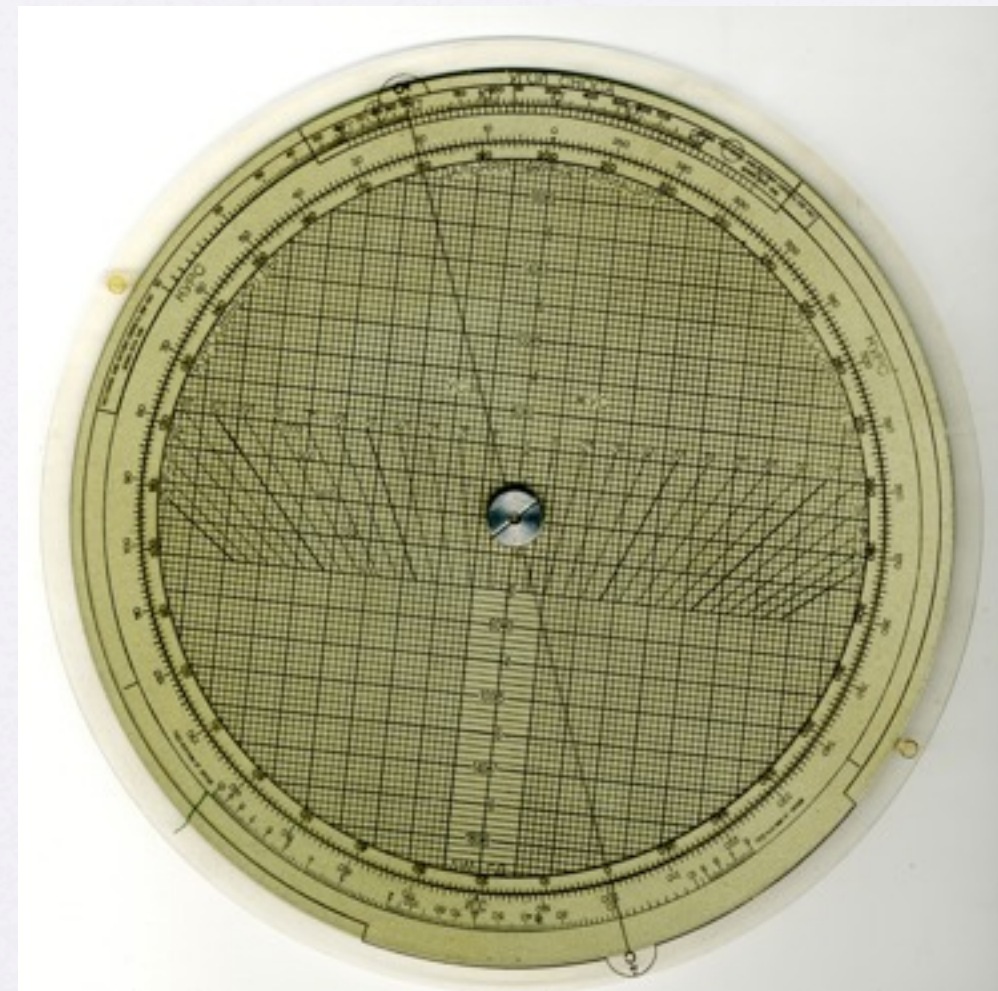
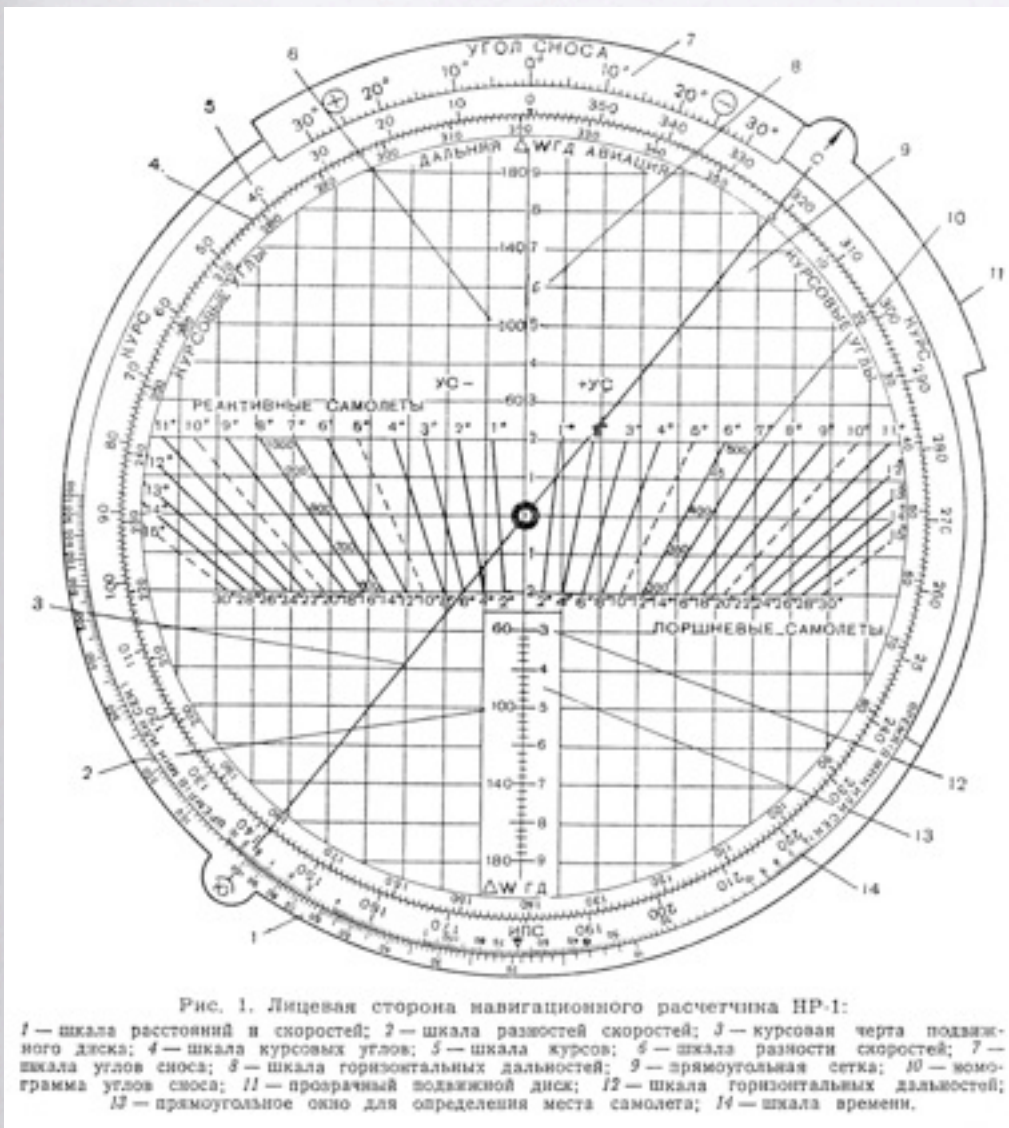


Рис. 130. КНС

Literature: Торгман А.И., Кудрявцев Н.Ф., Сергеев Л.П., Горшков М.Ф.:
Учебник по аэронавигации, изд. 2-е, перераб. и дополн., 1947

NR-1 (navigatsionnyi rachetchik) combined navigation rule, 1959-

NR-1 is a large (diameter 26 cm) round navigation slide rule with a few NL scales on the outer edge. It was made in Riga, Latvia at gidrometpriborov experimental factory (Рижский опытный завод гидрометприборов).



NR-1, made in 1964

Handbook: Кумков, И.М.: Навигационный расчетчик НР-1. Пособие для летного состава, 1959, 44 с.

The window for reading the location of the plane is missing from the real calculator.

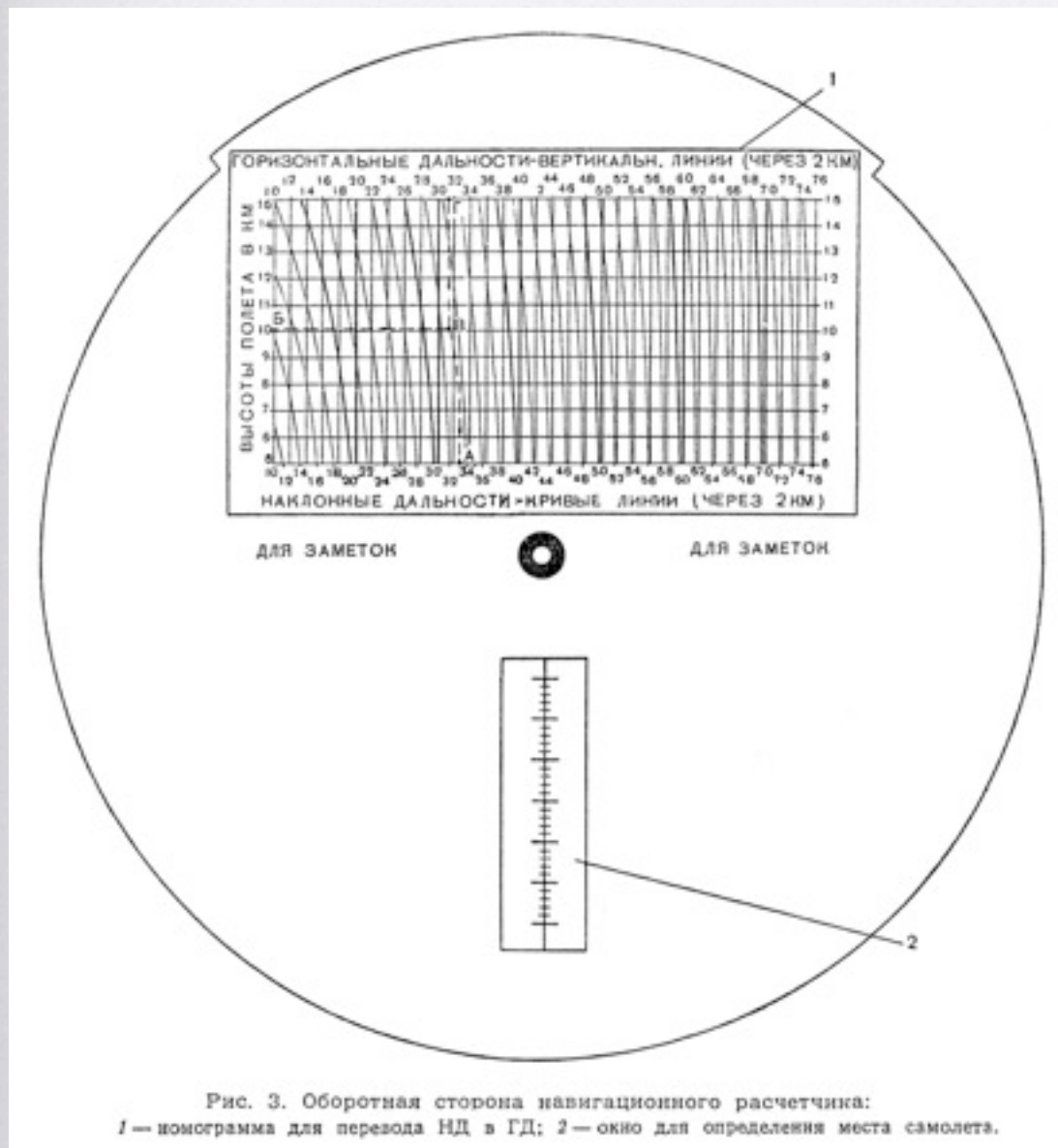
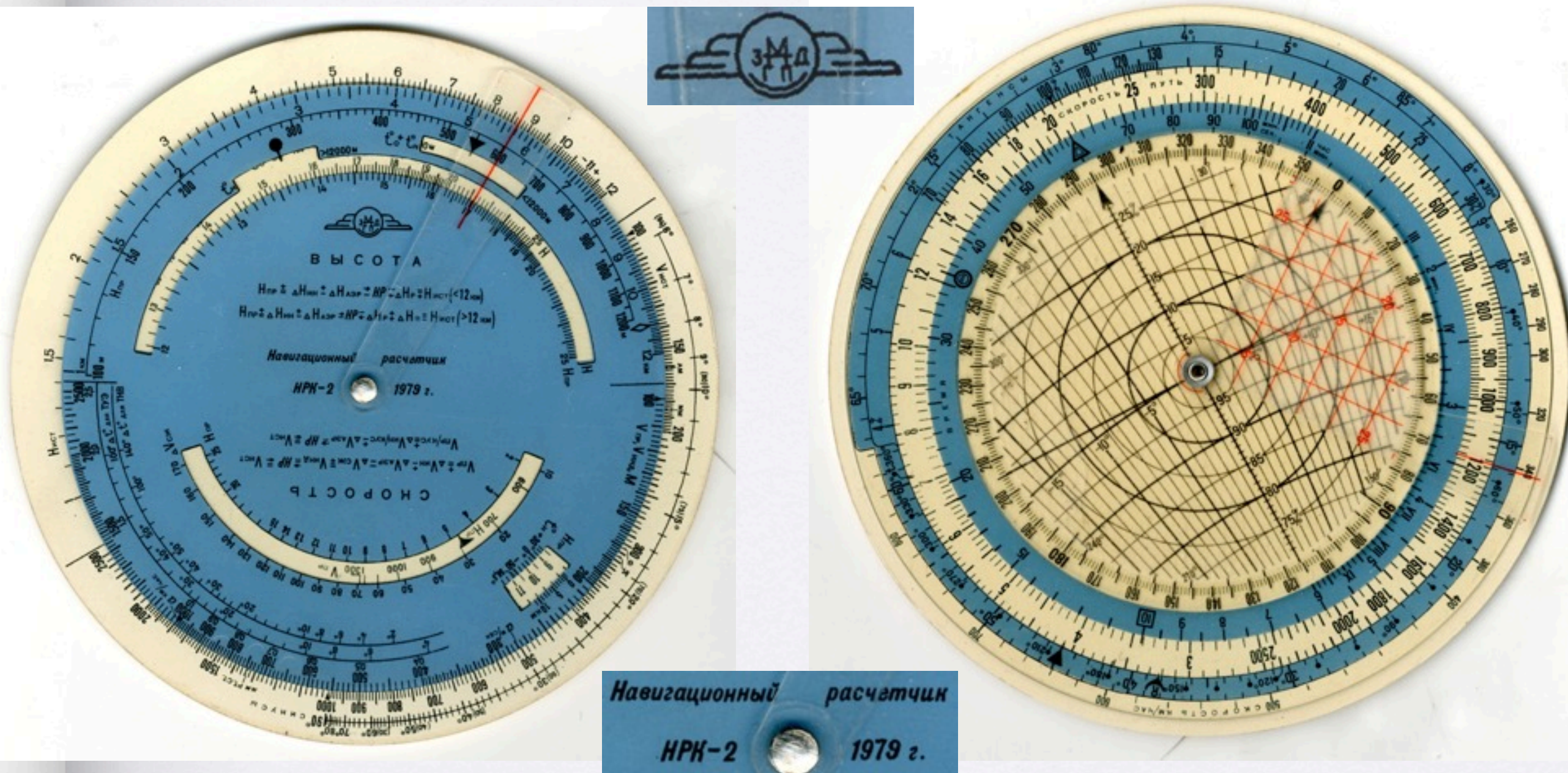


Рис. 3. Обратная сторона навигационного расчетчика:
1 — номограмма для перехода НД в ГД; 2 — окно для определения места самолета.

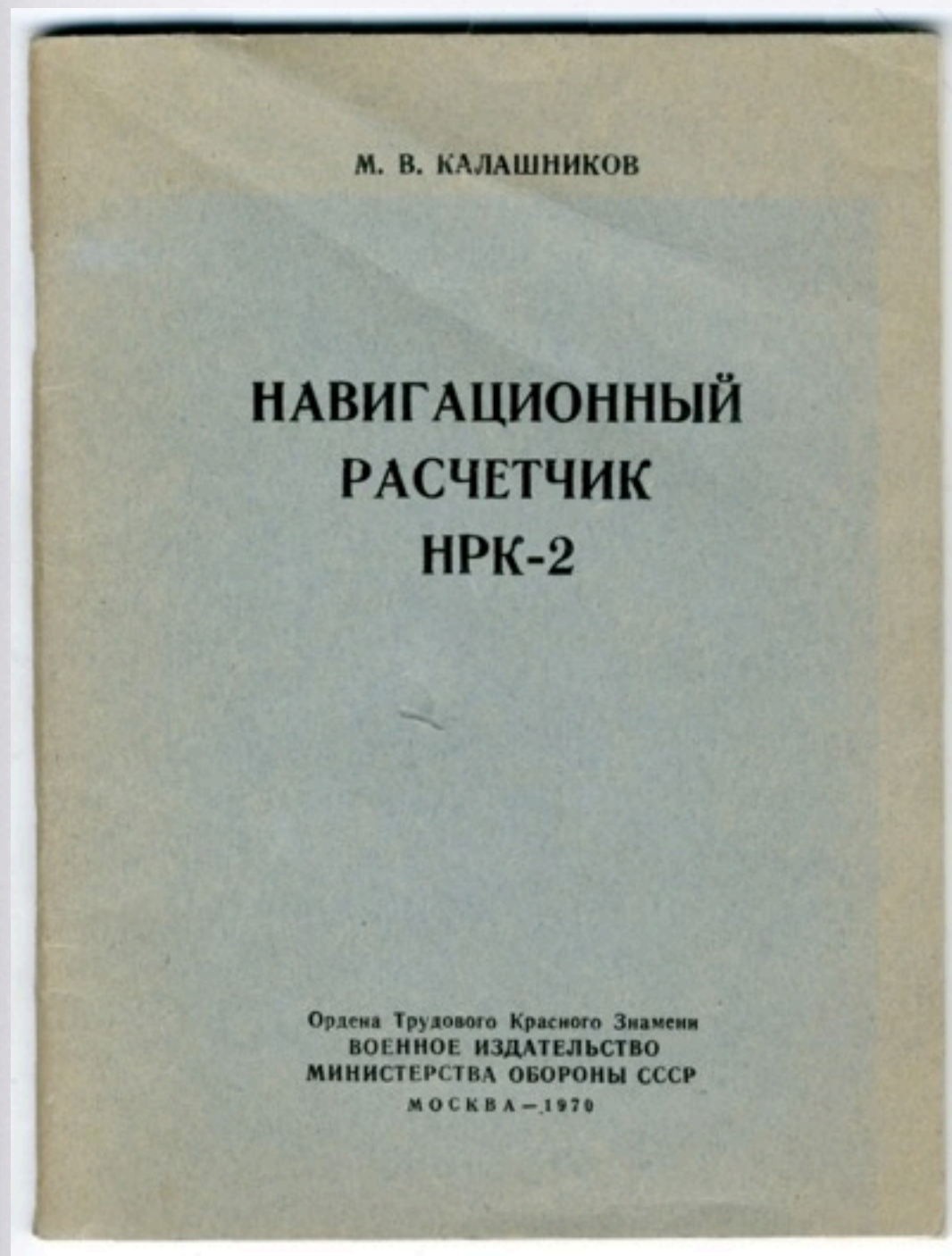


NRK-2 (navigatsionnyi rachetchik kombinirovannyi) combined slide rule, 1970-

NRK-2 of diameter 15.5 cm contains almost all NL-10m scales. It has the same logo as NR-1, so it has probably also been made in Riga.



According to information from Elena Kabanova NL rules were used much more than NRK-2. Maybe NRK-2 is too complicated?

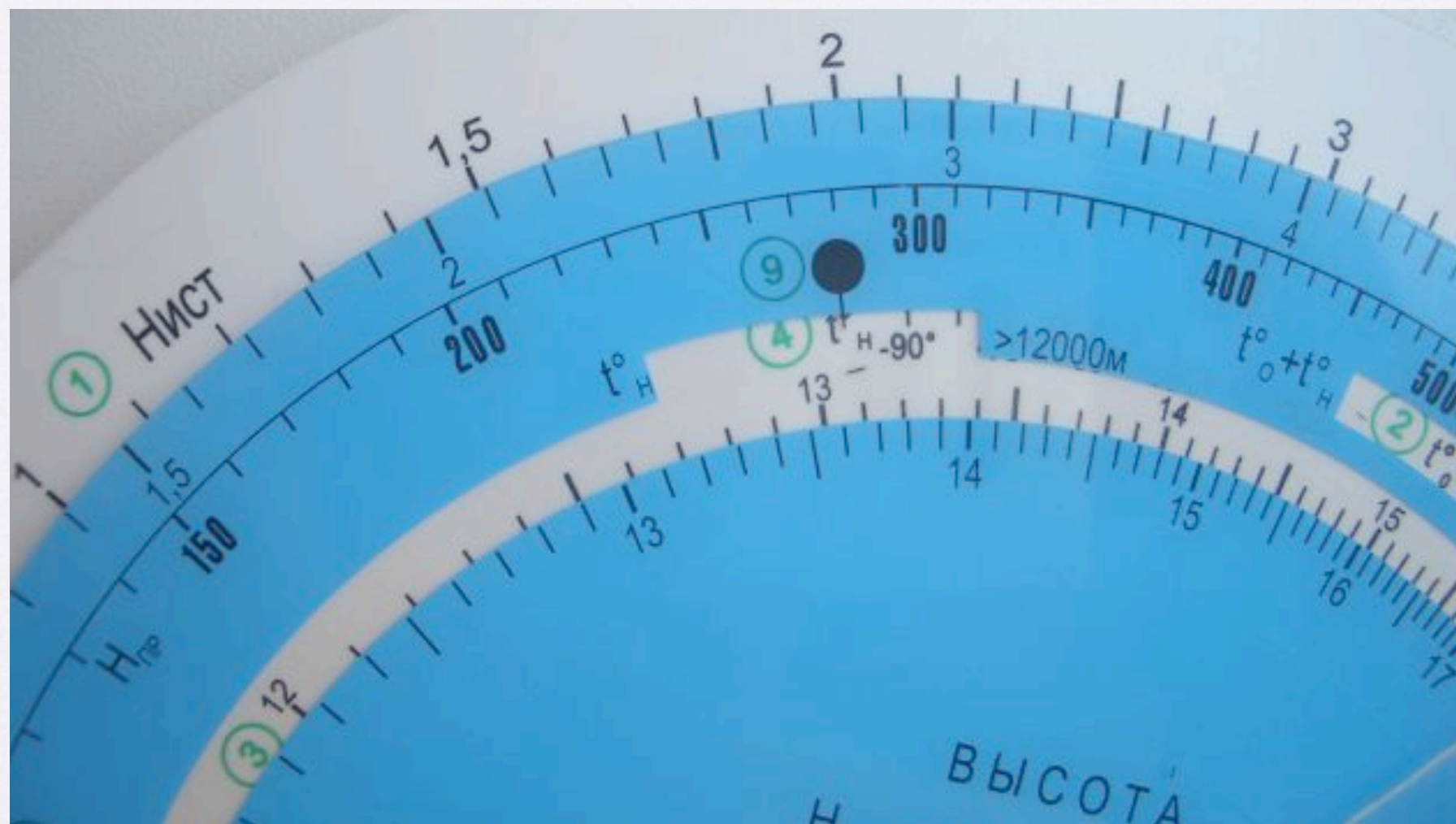


Literature: Калашников М.В.: Навигационный расчетчик НРК-2, 1970, 80 с., 12500 copies

Барановский И.М.: Навигационный расчетчик НРК-2, 1971, 116 с., 15000 copies

Малуша Л.М.: Навигационный расчетчик НРК-2 и его применение, 1971, 49 с., 300 copies

NRK-2k is a recent NRK-2 modification made at Chelyabinsk. It should be otherwise identical with NRK-2, but numbering of scales has been added.



NRK-2k images from internet

4. Other calculating devices for pilots

NPL, (НПЛ, Nakolennnyi Planshet Pilota) Pilot's knee tablet.

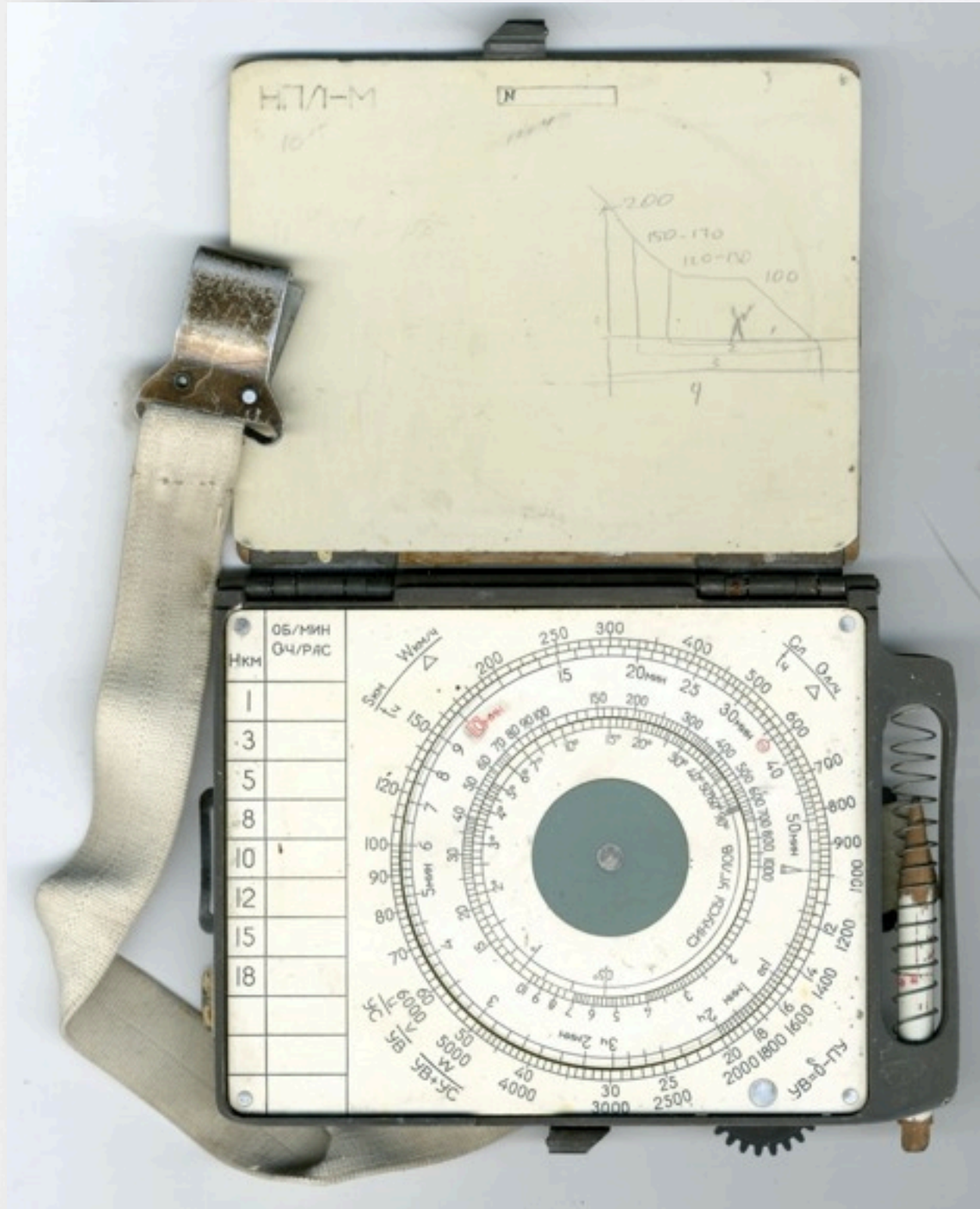
The knee tablet is fastened by the knee. It consists of a circular slide rule and celluloid pages, where notations can be made with a pencil. In the photo the pilot has a smartphone on his left knee and a knee tablet on his right knee.



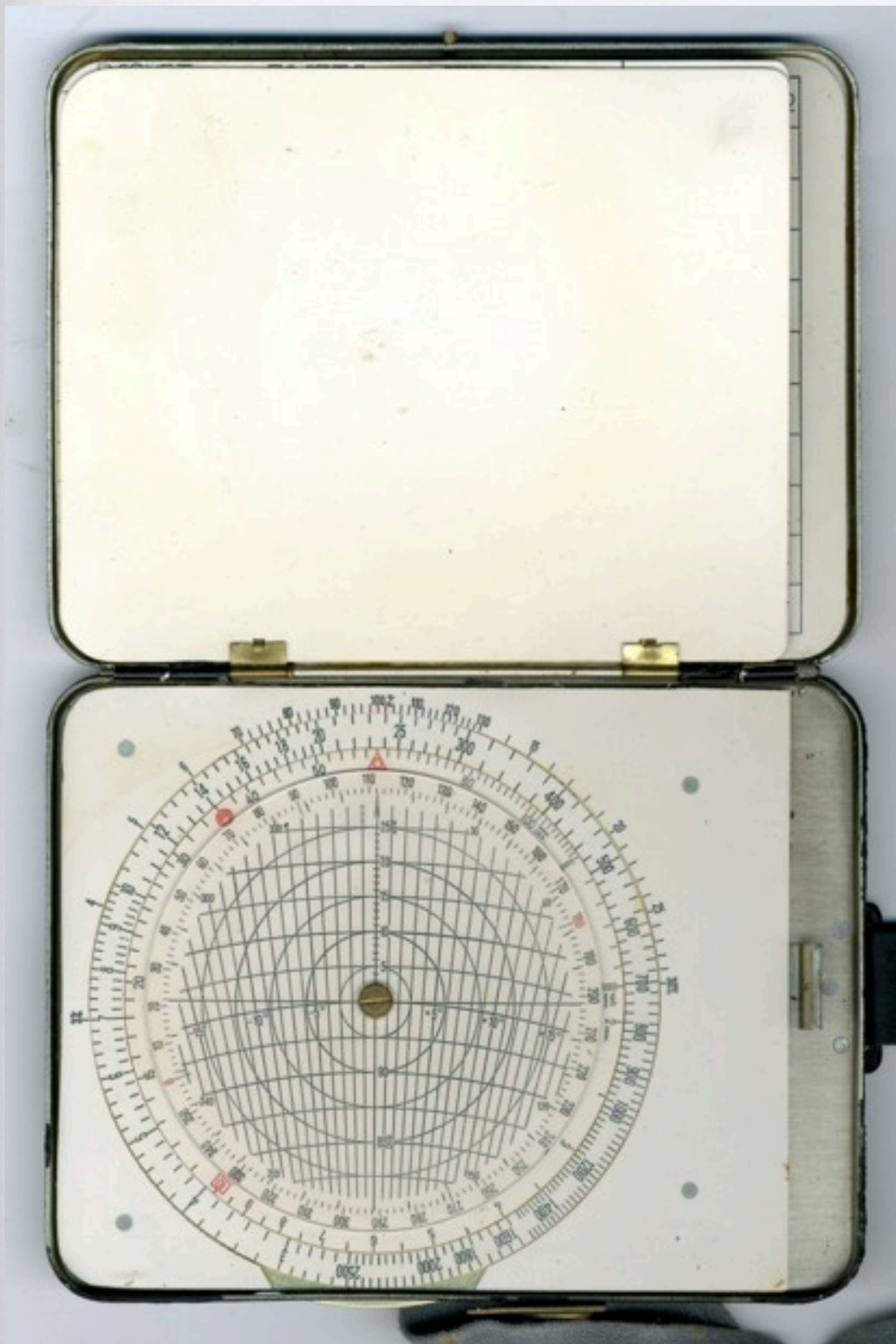
Photo from internet

Literature

Носов Н.А.: Вождение одноместного самолета, 1956



Newer NPL-M version, 1966-



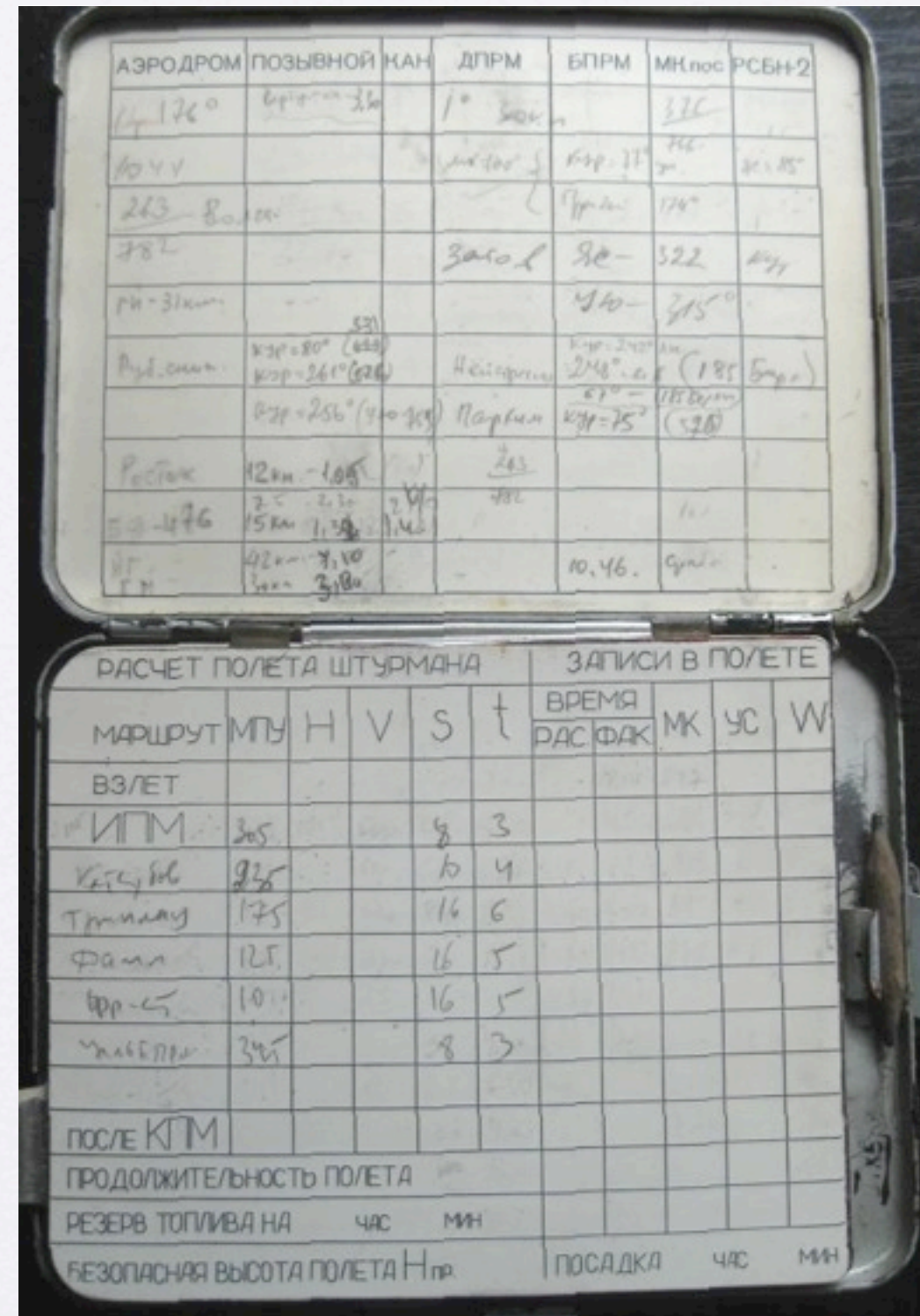
АЭРОДРОМ	ПОЗЫВНОЙ	КАН	ДПРМ	БПРМ	МК _{нос}	РСБН-2

РАСЧЕТ ПОЛЕТА ЛЕТЧИКА				ОСТАТ. ТОПЛ.	ДРУГИЕ ДАННЫЕ
МАРШРУТ	МПУ	S	t		
ДО ИГМ					
ИГМ					
ПОСЛЕ КГМ					
ПРОДОЛЖИТ. ПОЛЕТА					
РЕЗЕРВ ТОПЛИВА НА		ЧАС		МИН	
БЕЗОПАСН. ВЫСОТА ПОЛЕТА		Нпр			

For navigators there were slightly different NPSH (НПШ, Navigatsionnyi Planshet Shturmana) tablets. The slide rule is the same, but more information can be written on the tablet.



NPL-M



NPSH-M, source internet

РАСЧЕТ		ПОЛЕТА		ЛЕТЧИКА		ДРУГИЕ ДАННЫЕ
МАРШРУТ	МПУ	S	t	ОСТАТ. ТОПЛ.		
ДО ИГМ						
ИГМ						
ПОСЛЕ КГМ						
ПРОДОЛЖИТ. ПОЛЕТА						
РЕЗЕРВ ТОПЛИВА НА		ЧАС	МИН			
БЕЗОПАСН. ВЫСОТА ПОЛЕТА		H _{пр}				

NPL-M

РАСЧЕТ ПОЛЕТА ШТУРМАНА						ЗАПИСИ В ПОЛЕТЕ				
МАРШРУТ	МПУ	H	V	S	t	ВРЕМЯ		МК	УС	W
						РАС	ФАК			
ВЗЛЕТ						15.35	247			
ИГМ	247	200				16.46				
Фазов	352	200						243	+3	1.0
Кривизн	85	200				16.46	16.46	79	+8	1.0
Дифференц	185	200				16.46	16.46	185	+10	1.0
Пассаж	247	200				16.46	16.46	243		
и др.										
ПОСЛЕ КГМ										
ПРОДОЛЖИТЕЛЬНОСТЬ ПОЛЕТА										
РЕЗЕРВ ТОПЛИВА НА		ЧАС	МИН							
БЕЗОПАСНАЯ ВЫСОТА ПОЛЕТА H _{пр}						ПОСАДКА		ЧАС	МИН	

Позади 247
 1. Различия 19, 181 передачу разго
 241 970 508 208 287
 321 391 414 728 738
 134 197 308 760 110 110
 Большой малый
 кривизн кривизн
 - Непрерывно контролировать высоту, скорость, H, t_{пол} и др.
 - Сохранять ориентировку в полете
 - Если возможно полета, или в
 700 900 700 700 700 700
 - Своевременное использование запасов
 с-т от 120

NPSH-M

Circular slide rule system Vachanov for motorless gliders. Side a: glide, side b: drift

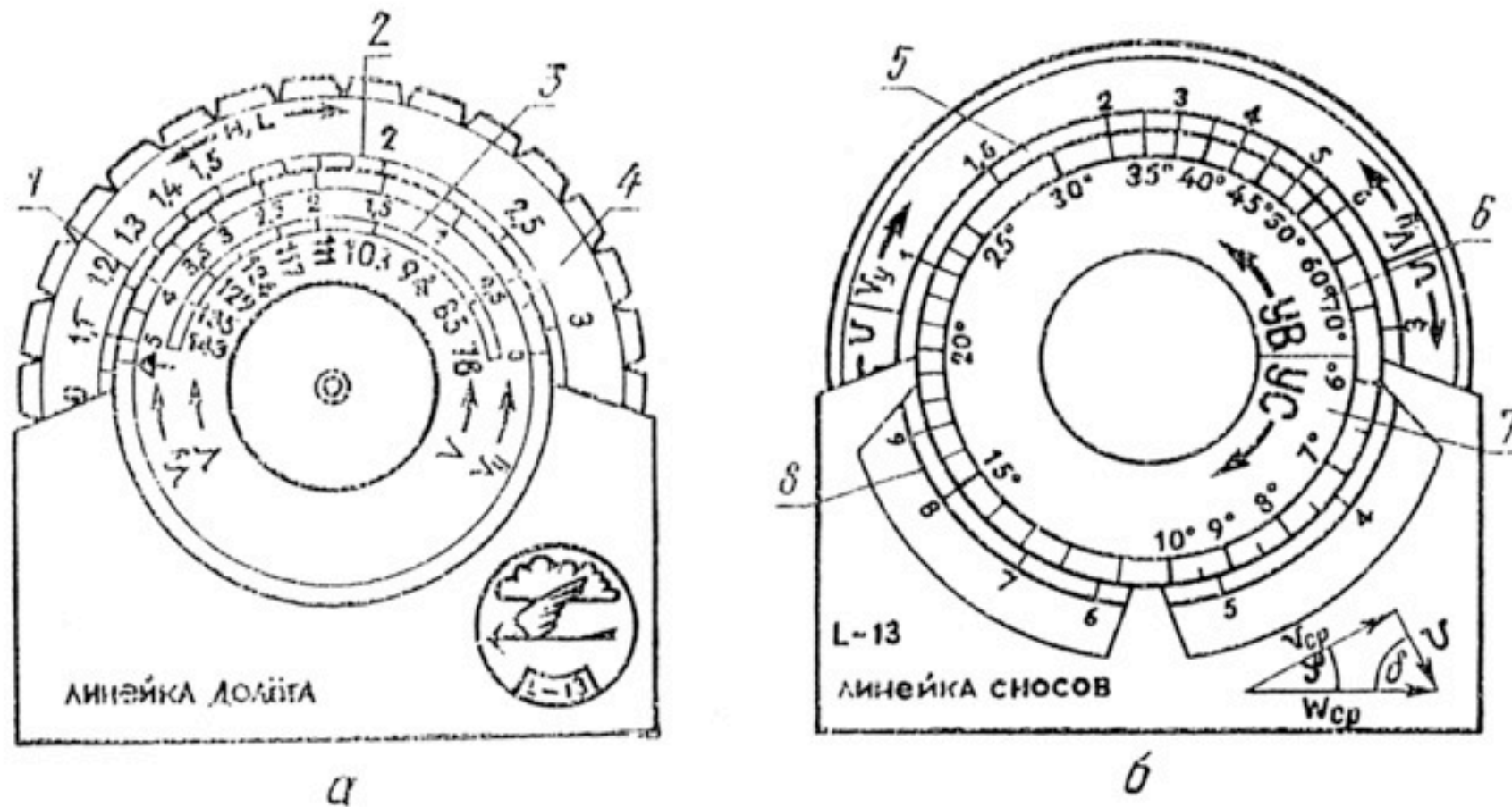


Рис. 41. Кольцевая линейка Е. Вачасова:

a — линейка долета; *б* — линейка сносов; 1 — шкала высот;
 2 — шкала расстояний; 3 — шкала скорости долета (перехода);
 4, 5 — шкала скороподъемности; 6 — шкала углов ветра; 7 —
 шкала углов сноса; 8 — шкала скорости ветра

Literature: Шмелев В.Ф.: Планеровождение, 1977

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