

The Great Age of the *Taschenmikroskop*

Part III:

High-End Professional Instruments

(Continued from Issue 190: August 2011)

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Introduction

In the first two parts of this series on "The Great Age of the *Taschenmikroskop*", we surveyed the historical, social and economic background and evolution of the *taschenmikroskop* phenomenon of the 1920s and early 1930s.

In [Part I](#)ⁱ of this series after a discussion of the socio-economic milieu which led to the development of the *taschenmikroskop*, we described and evaluated two examples of relatively basic and inexpensive *taschenmikroskops*: The Spindler and Hoyer 'Junior' and the Hensoldt 'Tami'. In [Part II](#)ⁱⁱ of this series we described some of the more capable and expensive *taschenmikroskops* designed for serious amateurs and professionals: The Kremp 'Klemi', the Goerz 'Lomara', the Leitz 'Minor', and the Hensoldt 'Metami'.

In this Part, we examine two examples of relatively expensive, high-end, *taschenmikroskops*. These elaborate and highly capable portable microscopes were intended for professional travelling scientists. These top of the line instruments had higher magnification options, advanced optics, and functional accessories (e.g., oil immersion objectives, Abbe condensers, iris diaphragms, etc.). They were/are quite versatile, innovative, and functional. These two examples which are, arguably, "the royalty of the *taschenmikroskop* decade": the Hensoldt Protami and the Goerz Ultra-Lomara are discussed in detail below. This includes their pros and cons, the likely perception of these microscopes by their contemporary users, and these instruments as seen in hindsight through our eyes.

The Microscopes

High-range microscopes

Model Designation: "Ultra-Lomara"

Manufacturer: Goerz

Location: Berlin-Friedenau, Germany

Production Year: 1928-34

Figure 1. The Ultra-Lomara with stand, extension tube, two oculars and two objective sets



Despite the similarity of names, the Ultra-Lomara (Fig. 1) is a far cry from the smaller and modest Lomara, also made by Goerz. While the Lomara can be considered a small, albeit premium, pocket microscope for amateurs, the Ultra-Lomara is a highly innovative, multi-purpose microscope and accessory set that can satisfy the needs of professional field scientists. The complete Ultra-Lomara assembly with its accessories and ingenious carrying case undoubtedly brings the *taschenmikroskop* to a high level, though still imperfect in many ways. Despite several deficiencies, its versatility, optical quality, magnification range, materials and ergonomics make the Ultra-Lomara, with its advanced accessories, an extremely capable portable field microscope, even by today's standards.

Dimensions: Weight: 61.25 gr. (pen only), 68.50 gr. (pen with extension tube), 632.55 gr. (stand and pen), 640 gr. (stand and pen with extension tube), complete set with leather case with spare lenses and illuminator in pouch: 1,377.4 gr. Pen length: 13.3 cm, with extension tube: 21.5 cm, complete microscope on stand with extension tube: 29.3 cm.

Performance: Made of the same materials and with the same conceptual underpinnings as the Lomara, the Ultra-Lomara is larger and heavier, and easier to operate for extended periods. Fully extended with provided extension tube, it nearly reaches the size of a standard desk-top microscope of its era. The Ultra-Lomara had a wide field of view for its time of 1750 μ at 100X, high quality optics, and in its more advanced kits a tiltable base stand with detachable substage condenser and fine focusing knob. A contemporaneous advertisement describing one of the advanced Ultra-Lomara configurations noted, "[It has a] well designed stand with fixed stage, two illuminating mirrors and... an effective condenser system". Its "... micro-adjustable stage converts the pocket instrument into a laboratory tool...for a great variety of microscopic observations, [and it] compares favorably with more expensive standard laboratory instruments".ⁱⁱⁱ



Figure 2. Ultra-Lomara as sold in one of its less complex configurations

The Ultra-Lomara was sold in a number of optional configurations. Figure 2 shows the microscope in one of the simpler ones. The kit above includes the (1) Ultra-Lomara microscope - approximate Length - closed: 13.3 cm, extended: 15-1/4 cm. Largest Diameter: 2.28 cm, (2) the extension tube - 8.25 cm long, (3) slides - approximately 6.1 cm x 1.2 cm (2.4" x 0.5"), not shown, (4) and an additional storage compartment. All components are stored in a hard eyeglasses-like case with green felt liner as shown.

An alternate configuration of the Ultra-Lomara is the Mikro-Spion, which came with side mounted illuminator and extension tube, and was sold in a rectangular hard case. The Mikro-Spion configuration and the configuration in Fig. 2 are less functional Ultra-Lomara sets. Both are commonly available, and usually quite inexpensive. As with the Lomara, possibly due to their limited capabilities as well as their subdued appearance, these kits do not appear to be particularly desired by collectors.

Unlike the above, there were kits where the Ultra-Lomara was equipped with a full set of functional accessories, including tilting base stand and illuminator for incident and transmitted light. These accessories add significant functionality and, when present, move the Ultra Lomara into the top tier of *taschenmikroskops*. One of these sets is shown in Fig.3. It included the base stand, three objectives, and three oculars, all stored in a leather binoculars-style case with tab and lock. The small leather case shown at the far lower right of Fig. 3 is for the battery operated electric illuminator for transmitted and reflected light. The illuminator can also be seen outside of its case and in use in Fig. 4.



Figure 3. Ultra-Lomara with full set of accessories.

The four sets of numbered button objectives which can be combined in a variety of configurations to provide various magnifications between 20X and a theoretical 1410X (with immersion oil). These magnification combinations are just visible on the printed card in Fig. 2. Thus, the Ultra-Lomara was not just a microscope but an optical 'system' with many optional accessories that could be bought in a variety of kits, from less capable to more capable and expensive. For those who could afford it, it could be purchased as a full set with three oculars (3X, 5X, 6X), battery operated illumination system for transmitted and incident light (with a second hood for incident light), all set in a convenient leather case with dedicated storage compartments.

The optional illuminator, (Fig. 4) can be connected to a bulb-like flashlight attachment that is screwed into a conventional flashlight bulb socket acting as a battery pack. The illuminator can be inserted into a special rail near the condenser to supply substage transmitted light, or into an alternate objective hood with a slot for the illuminator to supply incident light.

Thus, the microscope can be used for both the examination of thin sections under transmitted light, and the study of opaque (metallographic, entomological, botanical, etc.) samples under reflected light. The catalogue provided with the microscope, in its full configuration, does not show polarizing accessories as available options.

Fig. 4 shows the Ultra-Lomara on the optional tilting stand, seen here with the battery operated illumination unit configured for incident light, and with a special hood with rail holding the illuminator. Fig. 5 provides a close-up of the Ultra-Lomara's stage and substage assembly on the optional stand.



Figure 4. The Ultra Lomara microscope with optional tilting stand and illuminator.



Figure 5. Close-up of stage and substage assembly.

Another option was a pole stand (Fig. 6) with two adjustable arms, one for the microscope tube and the other holding a small clamp. This stand is useful with low magnifying powers for examining small, fine objects. It is often referred to as the "watchmaker's stand".



Figure 6. The Ultra-Lomara on the optional "watchmaker's stand".

The Ultra-Lomara combined with the accessories in its more advanced sets is a versatile and highly functional field microscope. It suffers from the same weakness as the Lomara in requiring changing button objectives^{iv} (Fig. 7) and/or their order to obtain different magnifications. Although this deficiency is partly overcome by the ease of changing the oculars and the extension tube, it is still present. In this, it is inferior to its rival top of the line instrument, the Hensoldt Protami, which comes with triple turret and draw tubes.



Figure 7. Ultra Lomara/Lomara showing button objectives, reproduced from Part II.



Figure 8. Standalone Ultra-Lomara, as hand-held microscope.

The Ultra-Lomara in its "lesser" configurations is less capable. Particularly, if considered in its minimal configuration, without tilting stand (Fig. 8)^v, as a simple hand-held microscope. In these lesser configurations, as noted above, the Ultra-Lomara more properly belongs in the amateur, rather than professional, category.

However, with the optional stand it matches the convenience of the Protami with its optional stand - described below. Like the Protami stand, the Ultra-Lomara's stand has a limb which can be tilted at its inclination joint. With its elegant, compact, and convenient leather travel case with its dedicated storage compartments, and its large set of accessories, the Ultra Lomara and the Protami are, in the authors' opinions, serious competitors for the title of "best overall *taschenmikroskop* at any price".

Model Designation: "Protami "

Manufacturer: Carl Hensoldt & Söhne

Location: Wetzlar, Germany

Production Year: 1925-39

The "Protami" (*professionellen- taschenmikroskop*) (Fig. 9) is the high end model of the Hensoldt "Tami family". The Protami was introduced in 1925, with production continuing until the beginning of World War II. Design improvements occurred between the 1920s and 1930s^{vi}. The examples in our collections, and reviewed here, are of the later improved model, portraying a wider knurled focusing collar than the original, which had a focusing similar to that of the Metami.^{vii}

Like the Metami, the Protami is constructed of brass with chrome and a japanned surface finish. Its saltshaker-like outer case is made of aluminum alloy finished in black-ckinkled enamel.

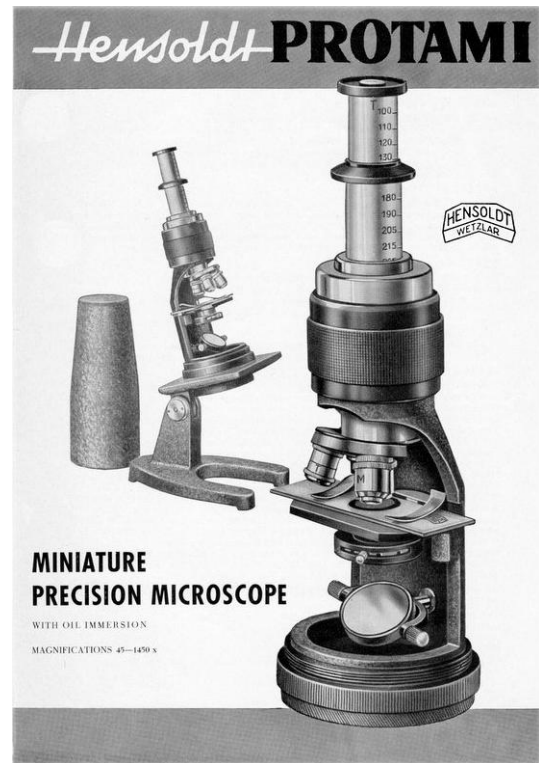


Figure 9. Protami brochure-first page



Figure 10. Protami extended



Protami cover



Protami stored inside its protective cover

Compared to the two smaller Tami models, the Tami and Metami, the Protami is provided with a three objective turret (Figs. 9, 10, and 11-a) which makes changing magnifications an easy and speedy process. Together with the draw tubes, this provides a broad choice of magnifications ranging between 40X and a theoretical 1450X, when used in the oil immersion mode. When the lower achromatic objective "T" (for "Tami") is selected, it provides the magnification sequence of 45-250 times. The "M" ("Metami") marked dry objective provides the magnifications of 340-760X, as indicated by the scale on the tube. The "P" ("Protami") objective is an oil-immersion of 1/12" with numerical aperture of 1.34, yielding the magnification range of 915-1450X. The microscope is equipped with an Abbe condenser with iris diaphragm (Fig. 11-b), flip-up stage clip (Fig. 11-c), substage slide-out canister containing a tube for immersion oil (Figs. 11-d and 13), and flat and concave mirrors on an adjustable arm (Fig. 11-e). Like the Metami, the stage can be flipped out of the optical path (Fig. 12) for easier access for the replacement of the objectives.

The Protami was an expensive microscope for its time. In 1933, its price was 230 RM. As mentioned previously, this was more than twice the price of a standard laboratory-quality bench-top microscope, which averaged around 150-160 RM.

Dimensions: Weight: 1008 gr. (packed), 849 gr. (unpacked). Weight with optional base, but without cover 2,660 gr. Height: 177 mm. (packed), 260 mm. (unpacked, tube fully extended), diameter: 71 mm. (base). Height of microscope on optional base, tube retracted 260 mm, on base and tube fully extended (both extensions) 352 mm.

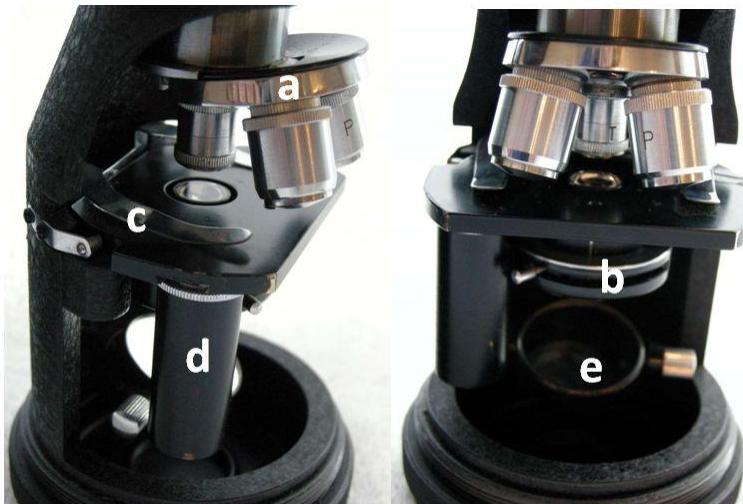


Figure 11. Protami stage and substage

Performance: The Protami is undoubtedly one of the most outstanding field microscopes ever made. With its exceptional optical quality and extremely wide magnification range, it could compete with contemporaneous bench-top microscope. Still, it is completely portable with an overall weight of one kilogram.

It overcomes some of the main disadvantages of the small Tami which was the first model in the family:

(1) It is not too lightweight nor too small, making it more stable in use.



Figure 13. Immersion oil canister

(2) Hensoldt's engineers designed it to have a relatively constant focusing distance, avoiding the need for excessive rotation of the focusing sleeve when changing magnifications, as with the Tami.

(3) The Protami case is a few millimeters taller, avoiding the need to lower the objectives to the stage before packing, an annoying feature of the Tami.



Figure 12. Slide-out stage and canister

This following excerpt from the Hensoldt PROTAMI brochure (Fig. 14) ^{viii} presents the manufacturer's view of the Protami:

ADVANTAGES:

PROTAMI is a miniature precision microscope which in spite of its small size, contains all essential components of conventional laboratory microscope. Its performance is equal to that of standard instruments. The range of magnifications is from 45 to 1450 x. With the metal cover screwed on, it is protected against damage, dust, and moisture. The overall height of the microscope with cover is only 6 2/4" and its weight 2 1/2 lbs.

APPLICATION:

PROTAMI is exceptionally well suited for carrying out laboratory tests in bacteriology, histology, pathology, etc. PROTAMI will prove of equal efficiency in chemical and pharmaceutical, biological, zoological, technological, agricultural, and food-processing laboratories. It is unsurpassed as a **travelling microscope**, as it combines excellent performance with ease of safety in transportation.

DESIGN:

PROTAMI is equipped with a revolving nosepiece carrying 3 objective with generally cover the following range of magnifications"

- 1. Double-Achromat T without front lens 45 x -- 125 x
- Double-Achromat T with front lens, N.A. 0.27 90 x -- 250 x
- 2. Achromat M. N. A. 0.82 375 x -- 760 x
- 3. Achromat Oil Immersion 1P 1/12, N. A. 1.30 900 x -- 1450 x

In addition, it is provided with microscope mirror with plane and concave surfaces, condenser, N.A. 1.20 with iris diaphragm, swing-out object stage and fine adjustment.

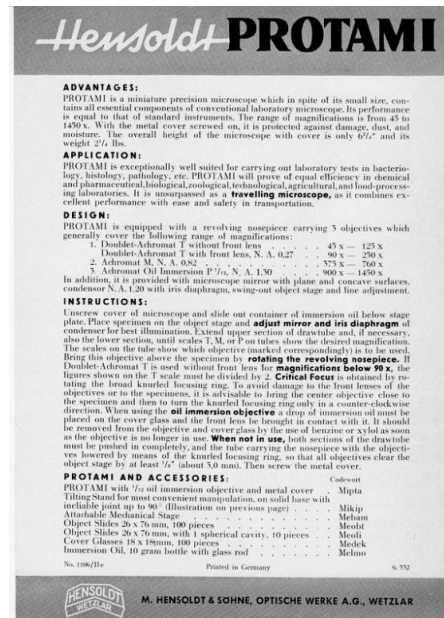


Figure 14. Protami brochure-second Page

The primary weakness of the Protami, apart from its cost, is present only if the optional base is not available. Then, as with the Ultra-Lomara without the tiltable stand, the observer is forced to lean forward and look vertically down into the microscope, making it uncomfortable for prolonged use. Fortunately, the manufacturer was able to overcome this shortcoming by supplying an optional tilting base stand (Figs. 15 and 16).



Figure 15. "Optional" stand and Protami securing thread

The Optional Stand.

The optional stand is optional in name only for professional applications, as it is an essential requirement for serious, prolonged use.



Figure 16. Stand with Protami attached and with the Protami's protective cover in place.

The stand as shown, with microscope unattached, in Fig. 15 is approximately 10 cm tall x 10 cm wide (at its widest) x 14.5 mm deep and weighs 1,760 gr. The microscope attaches to the stand by the screw fitting shown at the left of Fig. 15. This fitting goes under the stage and attaches to the underside of the Protami's base, and is secured to its inside threads. The protective cover screws onto the Protami's outside threads, so it can be placed over the Protami (Fig. 16) even when it's attached to the optional base. A view through the microscope on the optional stand, and at its lowest magnification, is shown in Fig. 23. Although this picture was adjusted to approach the quality of viewing through the Protami, the actual view is much sharper.

Hensoldt Prologue.

Moritz Carl Hensoldt in his later years is shown in Fig. 17. Hensoldt was born in 1821, and was an optical innovator. In March 2002, approximately 99 years after Mr. Hensoldt's death, the company he founded had its 150th anniversary. With Leitz having previously moved outside of Wetzlar, Hensoldt remained as its primary optical firm. The company had been purchased by Carl Zeiss in 1928.

The cursive signature in Fig. 18 was an early Hensoldt trademark. However, as it was somewhat difficult to display on the firm's major products, binoculars and telescope, the trademark there appeared in block letters.



Figure 17 Moritz Hensoldt

In the early 1900s Hensoldt achieved recognition for the quality of their roof prism binoculars, which provided sharp erect images . In response, the company developed a new trademark that fit comfortably on its binoculars. This trademark (Fig. 19) remained in effect until the 1920s, at the start of the "Great Age of the *Taschenmikroskop*".



Figure 18 Hensoldt's early trademark

"Wacht" is German for "Guard" or "Sentry".



Figure 19 Hensoldt trademark from about early 1900s to 1920



Figure 20. Early 1920s version of the Hensoldt trademark

In the 1920s, in a manner similar to that adopted then, and later, by many other optical companies (e.g., Spencer, Leitz, Tiyoda, Chiyoko, etc.) the Hensoldt company developed a new trademark that, as previously, took on the outline of one of its optical components. (Figs. 20 and 21). The white-on-black logo (Fig. 20) is photographed from the top of the protective case of the Protami microscope, discussed above. The earlier version of this trademark has two dots on each side of "WETZLAR" to balance the HENSOLDT name .

Hensoldt also used a black-on-white version of this trademark (Fig. 21). It differs slightly from the white-on-black version shown in Fig 20.

A picture of the Hensoldt, AG Wetzlar factory as it appeared in 1997 is shown in Fig. 22.



Figure 21. Black-on-white logo



Figure 22. Hensoldt Factory Wetzlar Germany 1997

Some initial observations (Full remarks will appear at the end of this series).

In the first two articles of this series, we reviewed the most significant *taschenmikroskop* models made in Germany in the 1920s through the early 1930s. Before we turn to survey the influence of this trend on other microscope makers outside of Germany later this series, we would like to draw some interim conclusions on how these microscopes are seen in the eyes of today's users. Our concluding discussions and remarks will appear in the last Part of this series.

The microscopes presented so far represent different attempts by some of the best optical makers of their time to design field microscopes having performance and functionality suitable for both the serious amateur and professional scientist. The decades between the 19th and the 20th centuries were a transitional period, with significant improvements in microscope design and materials science. The *taschenmikroskop* models presented above and previously reflect these advancements. Some of these designs were rooted in the 19th century, namely the extensive use of brass, sliding tube focusing, single pillar construction, and button objectives. However, some of the better designed models included discoveries and inventions of the early 20th century: e.g., the use of aluminum alloys, chrome and nickel, Bakelite, battery operated electric illumination, and the pioneering use of a three objective turret on a field microscope.

So, a reasonable question follows, who made the best *taschenmikroskop* microscope? There really is no objective answer to this question, because so many variables must be taken into consideration: the weight and size should be small, but too small is inconvenient. The desired magnifications depends on the anticipated application area and use. Of course, price does matter, at least in terms of cost-effectiveness. However, even considering the authors different backgrounds, we easily reached a subjective consensus.

If a small microscope for magnifications not greater than about 250X is desired, the Leitz "Minor" is our first choice for the reasons previously explained. However, the true competition over the "winner's" crown for "best *taschenmikroskop* regardless of price" is, in the opinion of the authors, between the two models discussed above.

This competition between the Hensoldt Protami and the Goerz Ultra-Lomara, is within the same corporate family, because by 1928 both Hensoldt and Goerz were part of Carl Zeiss.

In a perfect world, an Ultra-Lomara equipped with the turret and objectives of the Protami might be the ultimate winner, but then it would not be like any Ultra-Lomara made. So, we need to refer to these instruments as they are. The final test, which is purely subjective, was a theoretical scenario in which we imagined ourselves standing in front of our collections of field microscopes, with backpacks on our shoulders, making final preparations to go into the field. Which microscope should we pick up before we step out? The answer for both of us was: the Protami. It is expensive and not perfectly designed, but it has four P's: panache, performance, protection and the size, weight, and appearance of a truly prestigious scientific instrument. It not only looks great but performs that way as well.

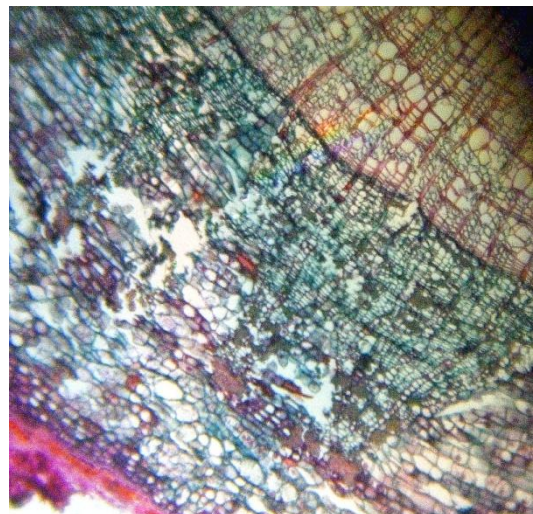


Figure 23. View of older Tilia stem. Protami at lowest power

Evidently, this view is/was not universally shared. In the years that followed during World War II, the world's largest armies equipped their field hospitals with microscopes. The Imperial Japanese Army equipped its troops with the Tiyoda "Mkatera" MKH folding microscope. US military hospitals often used the folding Spencer Model 60, and the Italian Army used the small Fratelli Koristka Regio Esercito - Sanità Militare model. And the German Army, well the Wehrmacht did not use the Protami despite its apparent suitability for the task. Instead, it was a full sized, heavy and robust Ernst Leitz desktop microscope that was used, carried in a heavy wooden box with steel protective corners. Though we may never know the reasons for this decision, possibly it was the performance and versatility of a desktop instrument compared to a field microscope, or the extremely high price of the Protami that dictated this choice. Of course, it might not have been performance or cost, but corporate favoritism of the type we sometimes see from governments today, or perhaps some other reason. It would be interesting to read the papers documenting the choice of microscope used by the German army. If any readers have access to this information, the authors would be pleased to receive it in either German or English.

Perhaps, these governmental decisions combined with the emergence of box-based travel microscopes, the McArthur microscope and its descendents, with their folded optics designs, were some of the reason for the demise of the *taschenmikroskop* after World War II. The future Parts of this paper will discuss not only the responses to the *taschenmikroskop*, but our thoughts on why production of the *taschenmikroskop* models of the 1920s and 1930s continued for only a brief time after their introduction.

Note: This is Part III of a multi-part paper on *the Great Age of the Taschenmikroskop*.

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- ⁱⁱⁱ As advertised in: Tobias, J.C. 1936. *The Student's Manual of Microscopic Technique with Instructions for Photomicrography*, P. 214. London.
- ^{iv} Ibid ii
- ^v Illustration on reverse of magnification table packed with Ultra-Lomara in hard case, as shown in text.
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- ^{vii} For the differences between the two versions, see: Wissner, A. *Antique Brass Microscopes Wanted*, http://www.antique-microscopes.com/photos/protami_microscope_3127.htm (early Protami model), <http://www.antique-microscopes.com/photos/protami.htm> (late Protami model).
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