day. Realizing correctly that iridescent glass would come into fashion, one started iridizing mostly seed beads and a few jewelry articles (the bijouterie-wares producer Josef Ullmann in Morchenstern was the first to try iridescence on jewelry and buttons). Paul Weiskopf supplied the necessary chemicals or got them from somewhere else....

> Other metallic-reflection effects such as luster were used for decoration. The results of fortunate coincidences were exploited and led to specialization in the business and so this branch of work has lasted up to the present. The equipment, the iridizing drum or muffle, is fairly simple to use; a kiln was also needed for the rest of the procedure... (Meissner 1954:22).

The company Zimmermann & Weiskopf in Morchenstern, which was registered in 1876 after the death of Hartwig Weiskopf, printed business cards listing numerous "chemical products for decorating glass, porcelain and ceramic wares: vitrifiable and luster colors; chemicals for gilding, silver coating, platinizing and etching; enamel colors, aniline dyes, aniline paint dyes, adhesives, etc."

Meissner pointed expressly to Weiskopf's products and their importance:

> Iris and luster, and different metallic reflexes [Plate 10B] were very much the fashion for decorating beads and other jewelry articles, also gilding and silver coating for seed beads, and for that reason the demand for chemicals for these purposes increased enormously... (Meissner 1954:22).

In 1886, Duisburg & Co. in Gablonz and Anton Bröckner in Morchenstern were awarded a privilege (no. 36/1586) for a process for achieving a mother-of-pearl effect on glass buttons, glass beads, and similar glass products by "incorporating iridescent glass clumps, pieces of glass or glass beads into the glass batch."

Iridizing and lustering, developed during the Historicism period, became one of the characteristic Art Nouveau finishing techniques, also used for glass and porcelain beads. A display of these achievements was provided at the German-Bohemian Exhibition in Reichenberg. Here Joh. Pitter of Neudorf showed innumerable drawn beads: "About 100 of the many color effects are presented and achieve various lusters or iridescent effects by firing" (Arnold 1909:89, 90). The pressed beads from the Pitter Company were, "for additional refining,... cut, iridized, decorated with melted-on "brocade glitter" or rapidly cooled after pressing so that the surface becomes strangely crackled" (Arnold 1909:92). One can presume that this company was one of many which made use of iridescent and lustered effects, which were also very well received throughout the Art Nouveau period and into the Art Deco period between the two wars.

An excerpt from a list of products found in a contemporary source from 1930 appears to be characteristic for the period: The chemical laboratory of Anton Rössler in Gablonz, founded in 1919, produced silver nitrate and gold chloride for processing blown beads and imitation stones using the wet method, also bright gold and silver luster for exterior metallizing of glass and porcelain wares (Lodgman and Stein 1930:387).

Gustav Keil in Gablonz also had an extensive listing to point to:

> Fabrication of solid French beads. Strung beads from the plainest to the finest execution in oriental-iris for jewelers, etc., etc., wax gems and components for jewelry, iris bugles, pears, buttons, stones, single and double hole, smooth, baroque, etc., in all shapes (Lodgman and Stein 1930:414).

One of the most important companies was the glass-bead factory of J.G. Schöler in Wiesental a. N. Founded in 1884 and expanded during 1925-1927, it employed 25 executives and workers along with 80 cottage workers. Their products included:

> Glass beads and bugles of all types which are used for dress trimmings, hat ornaments, lamp fringes, ornaments, embroideries, etc. In addition to the modern glass-bead coloring works, glass beads and bugles are lustered, iridized, and electroplated in an adjacent building (Lodgman and Stein 1930:434).

BEAD SIZES

The sizes of Gablonz beads ranged "from the smallest bead visible to the naked eye, to the nut and pigeon-egg sized beads, in all colors and shapes..." (Winter 1900:8, 9). This poetic description corresponded to a system of numbering at whose center lay the null-bead (0-bead). The smaller beads ("under null") were indicated by zeroes (i.e., 0-00-000-0000) although for the sake of simplicity the manner of writing them as 2/0 (00) to 20/0 (20 zeroes) was preferred. The fact that this numbering system is not mentioned by Karklins is conspicuous. Karklins (1985:113) himself deemed the five size categories proposed by Kenneth and Martha Kidd (very small, under 2 mm; small, 2-4 mm; medium, 4-6 mm; large, 6-10 mm; over 10 mm) insufficient.

Grouping beads according to size was necessary for various reasons. The raw product for making beads (rods, tubes, and canes) had to be sorted, usually according to diameter. The bead blower used a measuring device (Figure 16) in making blown beads. The finished beads could be sorted by putting them through seven differently sized holes and, finally, a bead gauge was used to measure the beads. We have Ludwig Breit to thank for important information on the sorting of glass canes and the making of the sieves for sorting the finished beads:

> The... collected bundles were brought to the big sorting room; there the individual thickness of the canes was sorted with sorting machines. The women working there were extremely adept at placing the canes on moving chains that transported the canes across holes with very exact sizes; these were set at gradations of 2 tenths of a millimeter. The diameters of the individual canes were prescribed as follows:

14	16	18	20	22	24	26	30	35	40	50	etc.
14-13/0	13-14/0	11-12/0	11/0	10/0	9/0	8/0	and thicker				

> The bottom row shows the sizes of the beads that are usually expected of canes.... The finished heat-rounded beads... were then taken to the bead siever. Sieving was done with shaking machines that were equipped with 4 to 5 metal sieves (ca. 50 x 30 cm in size) with holes to separate the individual beads. The sieves were made of thin galvanized sheet iron. Before we made the sieves in our workshop ourselves, we got them from the famous sieve-maker, Josef Stecker of Hochstadt in the Riesengebirge. Stecker was a Czech and made his sieves almost exclusively for all the various requirements of the Gablonz industry. The man had the most primitive equipment possible for making these metal sieves. From a strong leaf spring there hung a punch which he moved up and down with his foot so that the punch fell upon the metal several times a second. He pushed the metal sheet back and forth with his hand so skillfully that he finished one metal sieve in about 15 to 20 minutes. How he managed to punch out the holes of the sieve so that they were almost exactly evenly spaced is a puzzle to me (Breit 1987-1990:69, 70).

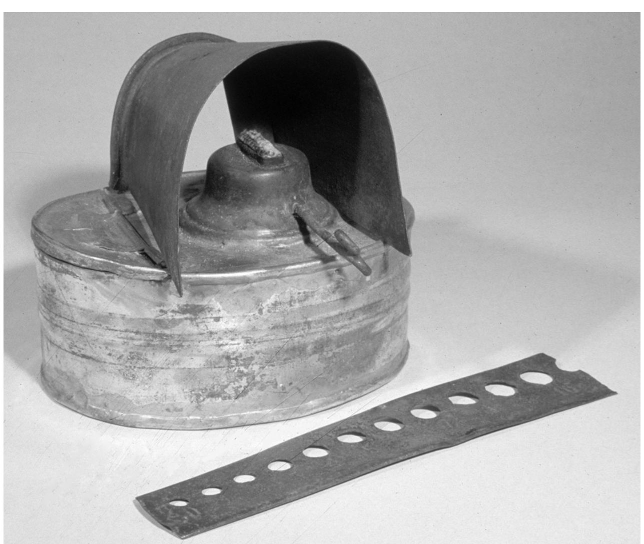

Figure 16. Lamp and measuring device for a blower of hollow glass beads; height (lamp): 11.3 cm; length (measuring device): 16.7 cm (Gablonz Archive and Museum, Kaufbeuren-Neugablonz).

If we seek to pursue the numbering systems for the sizing of beads chronologically, we find the oldest examples of Bohemian provenance among the Gablonz beads of the Biedermeier period. I know of no comparable, early concordances of Venetian beads. The printed sources available to me and the sample books from Barbaria and Barbini from the beginning of the 19th century (Technical Museum Vienna, TH 32865, 32744) do contain consecutive numbers for the corresponding samples, but no number/size equivalents. Bussolin (1847:23) and Zanetti (1874:131) only mention sieves that sort the beads according to size. Only in Keess (1823:904) was I able to find a reference to Venetian blown beads "in 15 different numbers."

Zanetti classifies beads according to the quality: *fine* (fine), *mezzo fine* (medium fine), *piombo* (lead), *vetro* (glass), *nero* (black), and according to size: *collane, cannettine, cannette da 3, 3½, da 4, 5, e da ½*. The French called the *collane, charlottes* or *rocailles* depending on their size (Zanetti 1874:133).

In contrast to these vague specifications, the sizes of Bohemian Biedermeier beads are more exactly defined. The solid and blown beads on a sample card from Ferdinand Unger in Liebenau (Figures 17-18) are labeled in so-called graduated sizes from 4/0 to 24. These graduated sizes or their fractions were normally measured with the "French line" (or "Parisian line"): 1 foot = 12 inches = 144 lines; e.g., 1 inch = 12 lines. The millimeter equivalent for the lines differed from country to country: 1 Parisian line = 2.2558 mm, 1 Rhine line = 2.179 mm, 1 Viennese line = 2.195 mm, 1 English or Russian line = 2.116 mm (Meyer 1877:840).

Basically, the sizes on the Unger sample cards – especially the one showing the faceted beads – are identical to the measurements listed by Kleinert (*see* below) for mold-pressed beads (diameter of the 0-bead: 2 lines = 4.5 mm). Deviations can be observed among the blown beads (Series Q, in certain areas, between one- and ten-tenths[!] of a millimeter larger) and the coral beads and coral olives (Series L, P, larger). It is worth noting that the olive beads

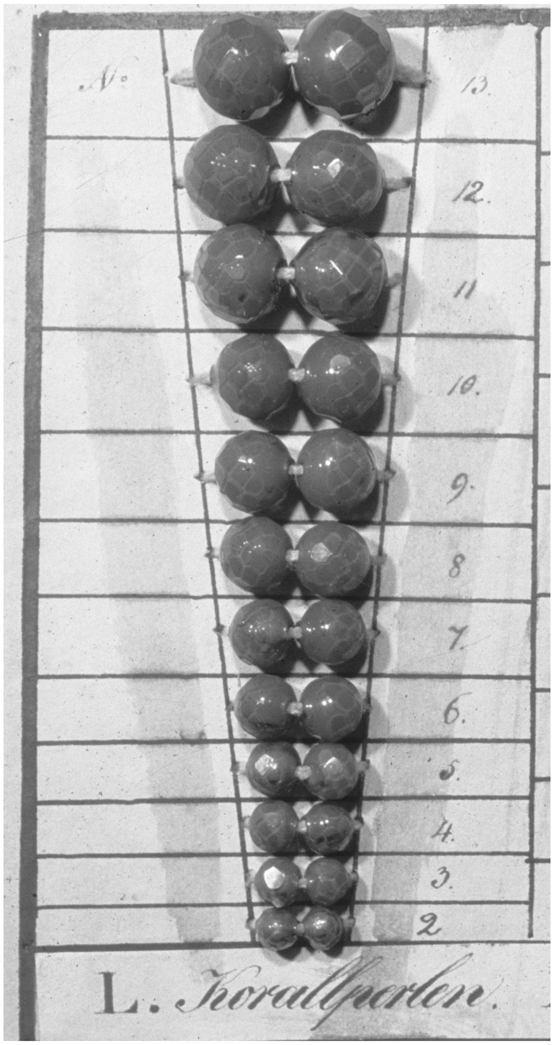

Figure 17. Bead-size card (nos. 2-13); F. Unger, Liebenau, prior to 1839; original size (Technical Museum Vienna [TMV], TH 34341).

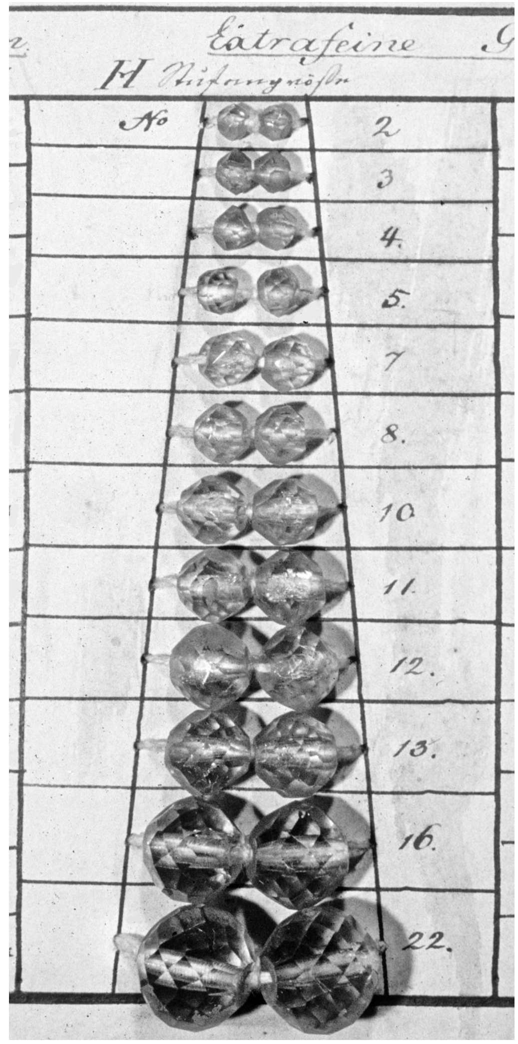

Figure 18. Bead-size card (nos. 2-5, 7, 8, 10-13, 16, 22); F. Unger, Liebenau, prior to 1839; original size (TMV, TH 34341).

were apparently measured differently; while the size of satin olives was based on diameter, the garnet olives and coral olives were measured according to length (Series K, P: as a whole, somewhat larger).

The diameter of faceted beads is easier to measure the finer they are cut; 3-cut beads or irregularly cut beads make exact measurement more difficult. Therefore one must reckon with certain tolerances amounting to as much as several tenths of a millimeter. Divided into bead types, the Unger sample card includes the following sizes:

A - Glass beads with 3 facets: size gradation 0-12
C - Lapis lazuli beads with 3 facets: 0-12
D - Glass beads with 5 facets: 0-12
E - Fine composition beads, ruby: 0-12
F - Fine composition beads, garnet: 0-12
H - Extra-fine glass beads: 2-5, 7, 8, 10-13, 16, 22
K - Garnet olives: 4/0, 3/0, 2/0, 0-9
L - Coral beads: 2-13
M - Wound satin beads: 9-17
N - Satin beads: 5, 7-13, 17
O - Satin olives: 3-5, 7-12
P - Fine coral olives: 0-11
Q - Silver or gold beads: 4-7, 10, 13, 15, 20, 22, 24

Bead samples in graduated sizes from 4/0, 3/0, 2/0 to 15 are contained in a different collection (this time in book form) by Unger of Liebenau (Figure 19). Apparently several mistakes occurred in stringing the beads, since numbers 6 and 7 of the blue faceted beads appear to have been switched and numbers 12-14 are practically the same size; the red

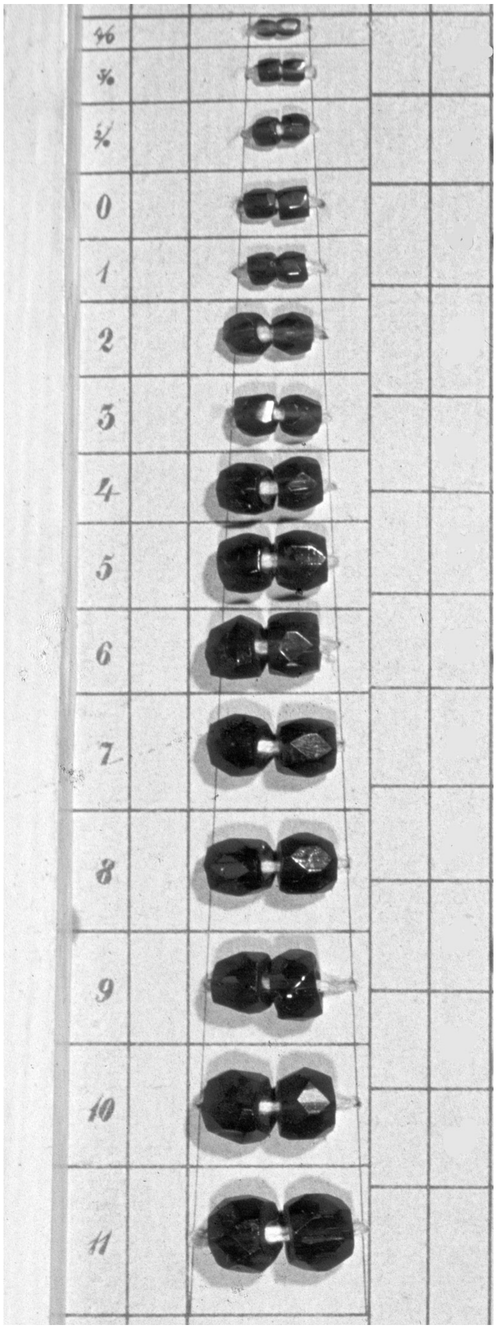

Figure 19. Cut beads (nos. 4/0 to 11); F. Unger, Liebenau, prior to 1839; original size (TMV, TH 32748).

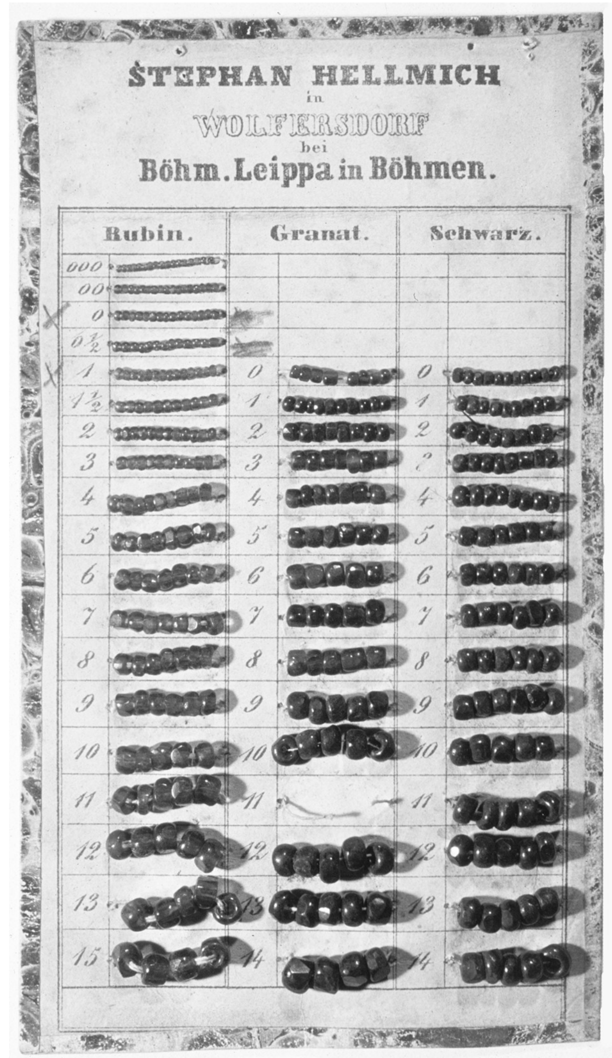

Figure 20. Sample card from S. Hellmich, Wolfersdorf, probably last quarter 19th century; 13.6 x 7.7 cm (original size) (Museum for Nature and Urban Culture, Schwäbisch-Gmünd).

faceted beads are accurately assigned to sizes. Taking these apparent mistakes into account, an assumed graduated system produces averages that correspond approximately to those of Kleinert.

Cut beads in number sizes from 000 to 15 are shown on a sample card from Stephan Hellmich (Wolfersdorf) which likely dates to the last quarter of the 19th century (Figure 20). The intermediary sizes, 0 ½ and 1 ½, were even used here. These number sizes are not the same as those of Unger or Kleinert: the "0-bead" – normally one with a diameter of 2 lines (4.5 mm) – on the Hellmich card measures about 1.40 mm; i.e., less than a third the size of the Unger beads. The situation becomes even more confusing with the observation that the Hellmich 0-bead does approximately have the aforementioned 1.40 mm diameter in garnet beads, but not in the black beads which measure ca. 1.9-2.0 mm.

Unfortunately, one sample card of blown beads listed in the inventory as "a small sample card with white blown-glass beads in 19 sizes; unknown" (Plate 20C) is not as clear about its provenance as the cards from Gablonz. Blown-bead production was widespread so assigning it to a specific region is very problematical. The numbered beads, diminishing in size from 1 to 19, have the following measurements in millimeters, although one must take into account that the beads strung in a row and labelled with a number can often differ from one another in size by as much as one-tenth of a millimeter.

The largest size (ca.)...	is about the same as Kleinert's
No. 1 = 11.5	12
No. 2 = 10.5	11
No. 3 = 10	9
No. 4 = 9	8
No. 5 = 8.5	7
No. 6 = 7.5	5
No. 7 = 6.8	4
No. 8 = 6.2	3
No. 9 = 5.7	2
No. 10 = 5.2	1
No. 11 = 4.7	0
No. 12 = 4.2	
No. 13 = 3.8	2/0
No. 14 = 3.4	3/0
No. 15 = 3.1	
No. 16 = 2.8	4/0
No. 17 = 2.5	
No. 18 = 2.1-2.2	
No. 19 = 1.9-2.0	

Blown, drawn, and mold-pressed beads naturally did not achieve the miniscule size no. 20/0 of pearls, but could go up to the impressive size of no. 24.

According to Posselt (1907:16), the "number system for mold-pressed beads... [was] different from that used for drawn beads; it started with no. 0. No. 0 for the mold-pressed bead is about half the size of a no. 0 drawn bead." I was not able to confirm this statement, but Posselt's claim is sometimes accepted uncritically in specialized literature. The size of the so-called "null-bead" (0-bead) was apparently not valid universally. According to Kleinert (1972:54), size 0 pressed beads had a diameter of 2 1ines (1 line = 2.25 mm), therefore 4.50 mm. A different source gives the 0-bead a diameter of 4 mm (Gablonz 1897:81) and Parkert (1925:140) describes the measurements of the 2/0 bead as "2 lines long and 2 lines thick."

Blown beads came in innumerable types and shapes: "According to size, one divides them into numbers, and there are 10 numbers below 0, whereby the 0-bead follows with a diameter of 2 lines. For numbers 1-20, the diameter increases each step by 1/4 line" (Tayenthal 1900:24; comparable to Hannich 1931:60).

The sample cards of the Redlhammer Brothers and the Mahla Brothers probably date from the beginning of the 20th century. They, too, include sizes, both in numbers and in millimeters, that were better suited for certain kinds of beads (e.g., elongated beads, oval beads, etc.). The sizes on the Vienna Redlhammer series go from 4/0 to 12, with an in-between size of 11½; the range of sizes in greatest demand went from 3/0 to 9. One Redlhammer card (no. 166) provides a color scheme that shows the shades of color in the uniform size of the 0-bead (Plate 3C). The cylindrical beads on a different card (no. 124) are listed in millimeter sizes (3-10 mm) (Plate 30B).

The Mahla cards contain all three size standards: number, line, and millimeter measurements! The number system is used for round and oval beads (Plate 45A), faceted solid beads (Plates 45B-C, 46A-B), and specific hollow beads (round with color lining [Plate 47C]; faceted gold beads [Plate 47B]; golden melon beads [Plate 48B]; and Atlas beads [Plates 46C, 47A]). Millimeter sizes distinguish the cubic blown beads (Plate 49C), the internally ribbed melon beads (Plate 48C), and beads with different kinds of internal ribbing (Plate 49B). We find the three superscript lines belonging to the line system used for bugles (Plate 43B) and for different kinds of olives (smooth four-cornered olives [Plate 44B] and blown glass olives with color linings [Plate 48A]).

All of the abovementioned variations (the number system and measurements in millimeters and lines) are found on sample cards of more recent date, most of which probably postdate the Second World War. The reliable number system apparently continued to be used wherever it seemed practical. For a certain sector (metalized blown beads), Schander ([1954]:7) adds a comparison of the (older) number system and the (newer) metric system: no. 4/0 (old) = 2 mm (new), 3/0 = 3 mm, 2/0 = 4 mm, 1 = 5 mm, 2 = 6 mm, 3 = 7 mm. We find the best – and already frequently referred to – overview of the sizes of mold-pressed beads according to the old and the new systems in Kleinert (1972:54), who got corresponding documents from an old printer:

> Up to the 1930s, the "kernels" [*Kernl*] were measured by numbers, the "*Seitnzeug*" according to lines. Since these systems have mostly been forgotten today, the following table [Table 2] is intended to show a list of these earlier measuring units. When using the "kernel" number, the "kernel" was called the "double-null kernel," "null-kernel," "one-kernel," and so on.

Table 2. Overview of Units of Measure Previously Used for Machine-made Articles (1 Line = 2.25 mm; 1 "Kernel" Number = 1/4 Line).

"Kernel" Number	Lines	Millimeters	"Kernel" Number	Lines	Millimeters
0000	1 ¼	2.81	9	4 ¼	9.56
000	1 ½	3.37	10	4 ½	10.13
00	1 ¾	3.94	11	4 ¾	10.69
0	2	4.50	12	5	11.25
1	2 ¼	5.06	13	5 ¼	11.81
2	2 ½	5.63	14	5 ½	12.38
3	2¾	6.19	15	5 ¾	12.96
4	3	6.75	16	6	13.50
5	3 ¼	7.31	17	6 ¼	14.06
6	3 ½	7.88	18	6 ½	14.63
7	3 ¾	8.44	19	6 ¾	15.19
8	4	9.00	20	7	15.75 etc.

Measuring devices for the bead industry have survived (Figure 21) in Neugablonz, and the sizes range from 1-62 (1 is the smallest size, 62 is the largest). There were also tools for counting beads (Figure 22).

Rocaille Sizes

The term "rocaille" was mostly used as a synonym for small (rounded) beads in sizes from nos. 20/0 to 10; i.e., from the size of a "millet seed to one of a small hazelnut" (Zenkner 1983:110). The name embroidery bead (*Stickperle*) designated small rocailles with a diameter of less than 1.5 mm (nos. 12/0 to 20/0)(Gablonz Archive and Museum n.d.b). The "charlottes" were the very smallest beads.

According to Ludwig Breit (n.d.a:4), the smallest bead (20/0) had a diameter of 0.8 mm while the largest made by the "rounding" method was about 10 mm in diameter. With the help of information from Breit and other sources, it is possible to draw up the following size concordance (Table 3), which we may not regard as universally valid, however.

Table 3. Size Concordance for Beads.

Size	Millimeters	Size	Millimeters	Size	Millimeters	Size	Millimeters
20/0	0.8	11/0	2.1	4/0	5.0	4	8.5
19/0	1.0	10/0	2.5	3/0	5.5	5	9.0
18/0	1.1	9/0	2.7	2/0	6.0	6	9.5
16/0	1.3	8/0	3.1	0	6.5	7	10.0
14/0	1.6	7/0	3.4	1	7.0	8	10.5
13/0	1.7	6/0	4.0	2	7.5	etc.	
12/0	1.9	5/0	4.5	3	8.0		

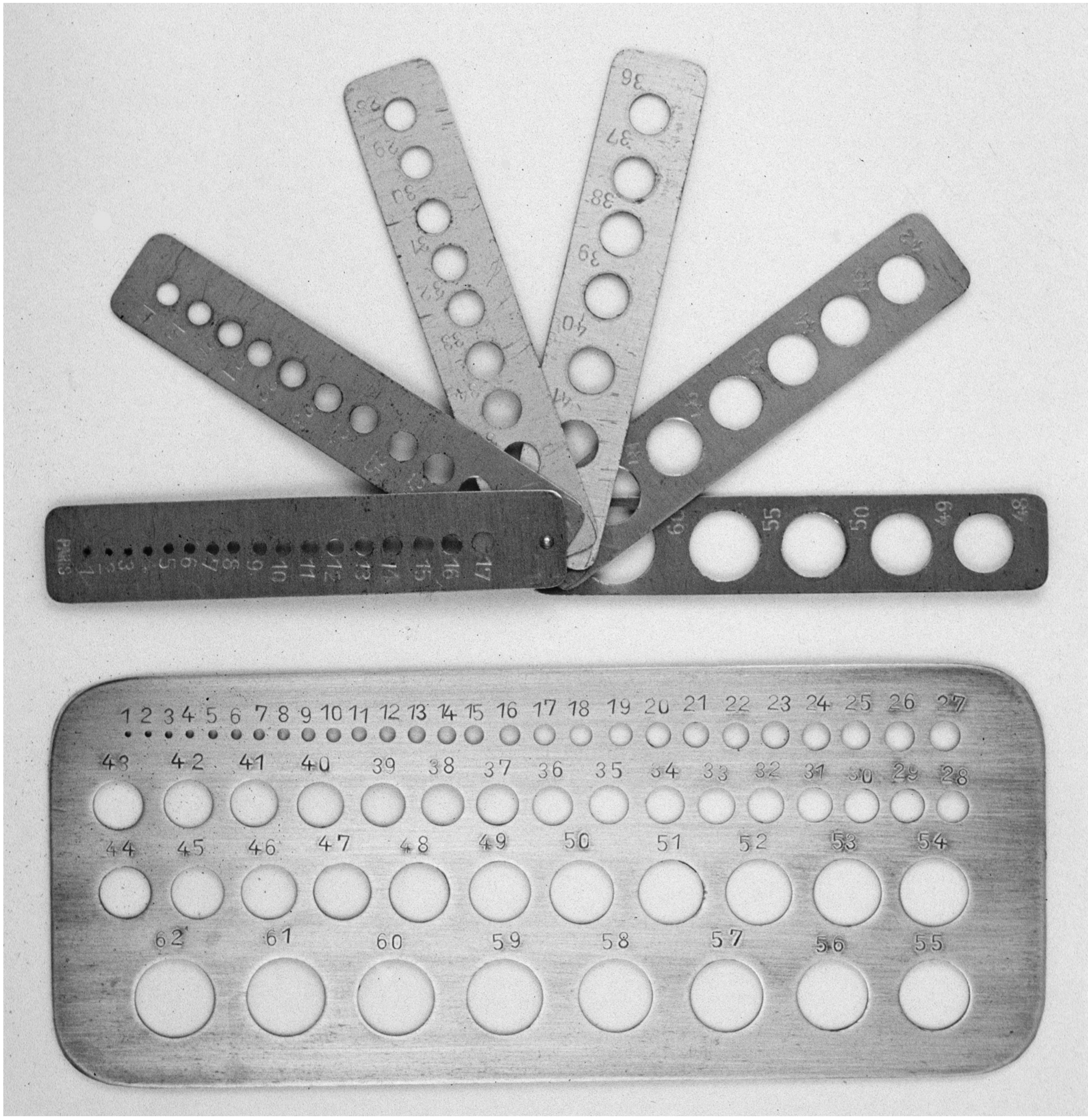

Figure 21. Measuring devices for the bead industry, nos. 1-62 (no. 20 = ca. 4.5 mm = 0-bead), Wenzel Stracke, Kaufbeuren-Neugablonz, about 1955.

Virginia Blakelock (1994:37) provides an overview of modern Czech bead sizes (from 20/0 = 1.0 mm to 10/0 = 2.3 mm) that deviates only slightly from the above.

Sample cards from different provenances provide stark proof of the lack of uniformity in the numbering system. Even within the one and the same company, striking deviations or changes were possible, such as the renumbering of the rocailles, as evidenced by article no. 1004 of the Breit Company in Schwäbisch-Gmünd. In one instance, a card with white rocailles (Figure 23) shows sizes 10/0 to 8 printed on the left side and on the right are numbers written in by hand which change the 5/0 into 15/0 and continue the changes up to size no. 6 (which becomes a 5/0).

Both vertical rows of numbers are then found already printed on a different card (Figure 24). Whether the older specifications go back to the time of the old Breit factory in Bohemia can no longer be ascertained. The numbers 13/0 to 8/0 are also written in by hand for black and white rocailles on another card (Figure 25), although the differences between the sizes listed for the black and the white beads are quite noticeable. The green rocailles (Figure 26) appear to match the altered number systems. Sometimes people

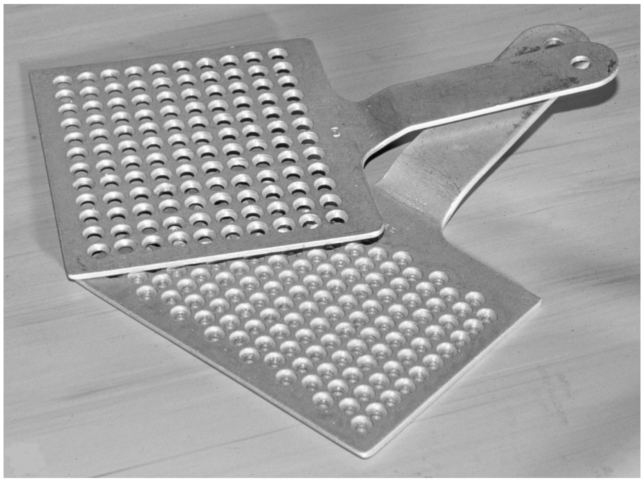

Figure 22. Shovel-shaped devices for counting beads (Ilse Kratzmann Company, lampbead factory, Enns (Upper Austria).

had a hard time with the sizes listed on unfamiliar sample cards and tried to contrive a concordance according to their own system, as notes made in pencil indicate (Figure 27). If additional proof had been required for the variability in sizing systems, this would most likely have sufficed.

Tiny beads appear under the name “Rocailles and Seed Beads” on a sample card from the “Czechoslovak Glass Export Co., Ltd.,” in Gablonz, Bohemia (after 1945) in sizes 18/0 to 5/0 (Figure 28). Sample cards from an unknown company show bugles in lengths from 1 to 4 (1-4 lines)(Figure 29). The bugles from the Breit company in Schwäbisch-Gmünd are labeled as 1 to 10 and 4x25 (Figure 30).

From the accounts of Ludwig Breit, we learn that the ballotini (made from ground glass fragments, sieved and rounded), had their own numbering system, probably because of their extremely small size: “...the size most used was the small size, no. 8. The different sizes were 10, the smallest no. 8, the most popular nos. 7, 6, and 5. Beads no. 10 and no. 8 were smaller than 1 mm. Sizes 7 and 5 were not much in demand. The still larger beads were called scatter beads [*Streuperlen*]....” Ballotini were used for gluing onto walls in bars, for beaded cinema projection screens, for street signs, and even picture postcards. Scatter beads were used for children’s toys and restaurants used them to clean their tin beer pipes (Breit 1987-1990:71, 72).

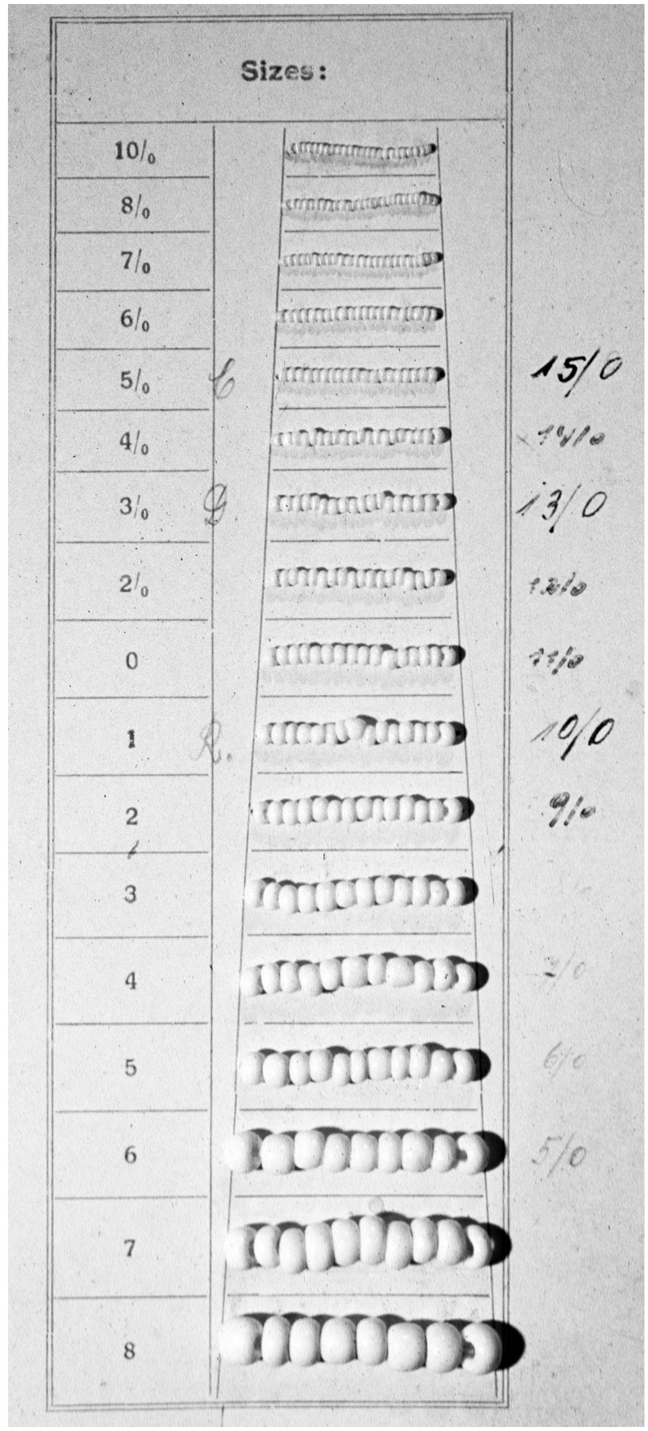

Figure 23. Rocailles, art. no. 1004, probably Ludwig Breit, Swäbisch-Gmünd, before 1957 (original size) (Dr. Klaus Breit, Schwäbisch-Gmünd).

Numbering Systems in Other Fields

The system of numbers and zeroes was also common in other fields, above all for measuring the gradations of fineness in wire. Systems and measuring instruments (Figure 31) were not uniform, but could vary according to material (metal), country, and factory. Sometimes the thickest wire had the smallest number; at other times the finest wire had the lowest number. In a third method, the

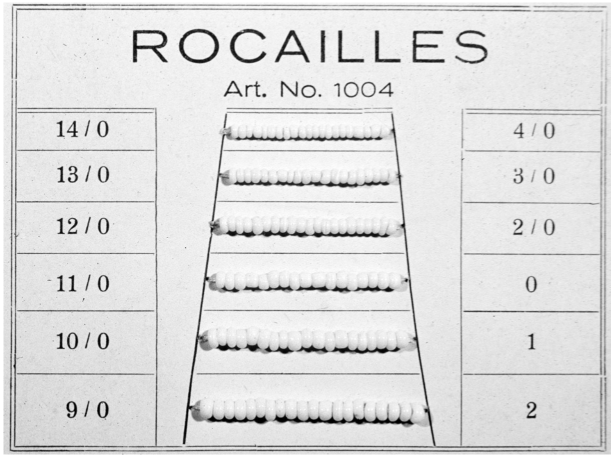

Figure 24. Rocailles, art. no. 1004, Nos. 14/0-9/0, 4/0-2, sample card without company name, probably Ludwig Breit, Schwäbisch-Gmünd, before 1957 (original size)(Dr. Klaus Breit, Schwäbisch-Gmünd).

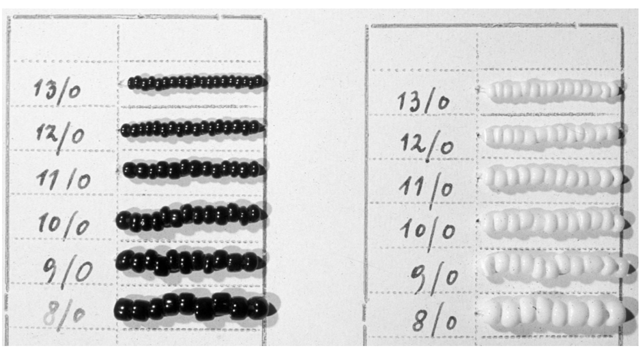

Figure 25. Rocailles, no. 13/0-8/0, no company name, probably Ludwig Breit, before 1957 (original size)(Dr. Klaus Breit, Schwäbisch-Gmünd).

medium sort was indicated by the smallest number (1) and then counted upwards and downwards. When a series of numbers began with 1, a certain number of zeroes was added to it, a procedure we already know from measuring glass beads (Prechtl 1833, 4:144, 145). "The wire is differentiated according to numbers," writes Keess. "The tinsel wires [*Flitterndrähte*] go, for example, from nos. 1 to 10, or even 12, the sizes used for horse bridles up to 16, the "plash" [*Plashdrähte*] wires from nos. 1 to 6, the bullion wires from nos. 6 to 9, the "tirage" [*Tiragedrähte*] wires from nos. 7 to 8, the fine wires for lace, spun objects, etc., up to nos. 9, 10, and 10 ½" (Keess 1823:457).

A piece of metal called a "wire measure, wire handle, or wire gauge" had "notches or holes of different width, corresponding to the diameters of different kinds or numbers of wire. Every incision is labeled with the number that belongs

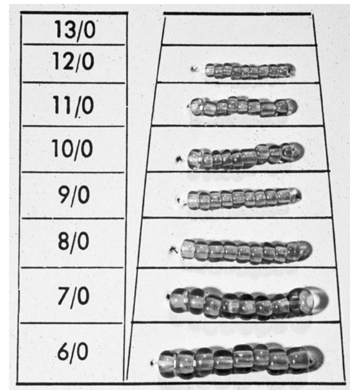

Figure 26. Rocailles, art. no. 1004, nos. 13/0-6/0, original size; no company name, probably Ludwig Breit, Wiesenthalhütte, Schwäbisch-Gmünd, after 1957 (Dr. Klaus Breit, Schwäbisch-Gmünd).

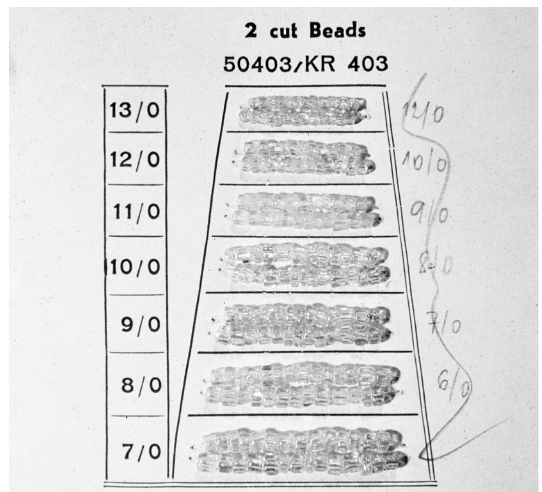

Figure 27. Two-cut faceted beads, no. 50403/KR 403, nos. 13/0-7/0, detail of a card without company name, probably after 1950 (original size)(Dr. Klaus Breit, Schwäbisch-Gmünd).

to it" (Prechtl 1833, 4:149). Despite the inaccuracies that resulted in using them, these devices for measuring wire were held on to because they were easy to use. Prechtl sketches the devices that had the same number of holes as the assortment numbers (Figure 31). He also mentions the wire gauge of the Englishman, Robison, which gave measurements of the wire in hundredths of an inch (Prechtl 1833, 4:149-151). Watch springs were also measured with a spring measuring device, a sheet of brass with notches on the edge of different widths that corresponded to the numbers (Prechtl 1834, 5:526). Every spring factory had its own special assortment; the spring gauge from Carrisot in Geneva had 47 numbers, from the narrowest (no. 1 = slightly more than ½ line) to the widest (no. 47 = 2 ¾ lines). The difference between the

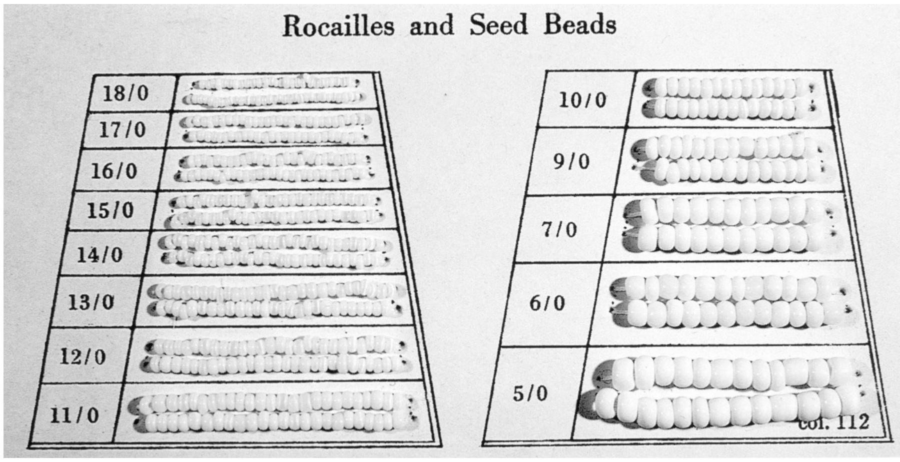

Figure 28. Rocailles and Seed Beads, nos. 18/0-9/0 and 7/0-5/0, "Czechoslovak Glass Export Co. Ltd., Section Beads," Jablonec, after 1945 (original size)(Gablonz Archive and Museum, Kaufbeuren-Neugablonz).

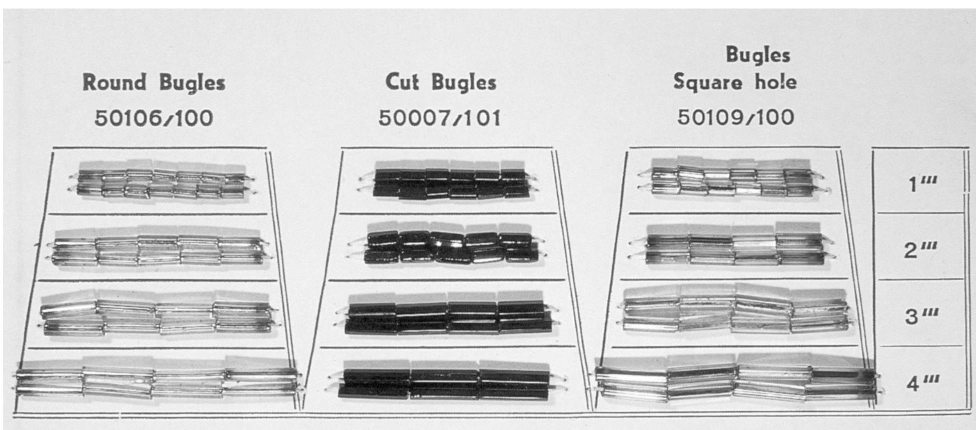

Figure 29. Bugle beads ("Round Bugles, Cut Bugles, Bugles - Square hole"), nos. 1"'-4,"' detail of a sample card without company name, probably after 1950 (original size)(Gablonz Archive and Museum, Kaufbeuren-Neugablonz).

incisions was not quite 1/20 line. On a different Swiss spring-measuring device the difference was slightly more than 1/15 line. The finest gradations are seen on a spring gauge from Dutrambler in Geneva (nos. 1 to 34, with a difference of 1/23 line). Piano strings were also measured using numbers; the 31 types of Nuremberg piano strings started at 9 ½ null as the largest type, running to 7 as the smallest. In Vienna there were 17 types, from the number 8 null to 9 (again the smallest!) (Harzer 1851:109). The finest gradations of gold and silver wire were also identified by numbers: no. 1 was the smallest, no. 11 usually the largest. Half-steps were also possible; the silver-plated wire or "Paternoster wire" ranged from nos. 0 to 14, drawn silver from nos. 0 to 8, heavy wire from nos. 0 to 12, and drawn brass from nos. 0 to 8 (Harzer 1851:134). The length and thickness of pins were also measured using numbers (Harzer 1851:197), and sieves were also sorted according to numbers (Harzer 1851:350-352). From the material presented here, it is easy to see that although number systems – including some with multiple zeroes – were common, they were anything but uniform or universal. Bead gauges must have deviated from one another, too, as the variations shown on the Unger cards of faceted beads and blown beads prove.

Bundles, Bunches, Threads, and Strings

The commercial units for beads (quantity or weight) were determined by various criteria, but chiefly by their

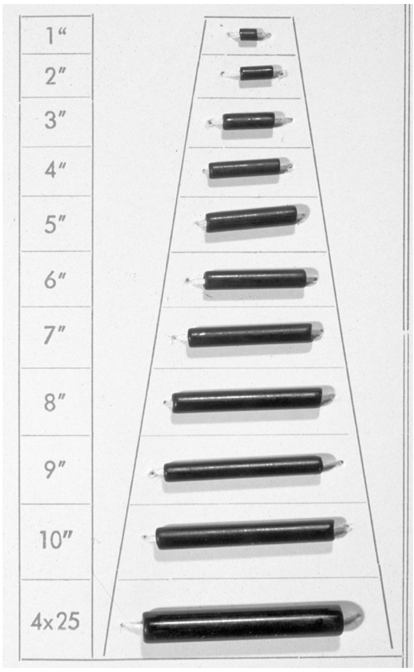

Figure 30. Bugle beads, art. no. 1012, 1"-10" and 4x25, Ludwig Breit Wiesenthalhütte, Schwäbisch-Gmünd, after 1957 (Dr. Klaus Breit, Schwäbisch-Gmünd).

size or their value. Keess (1823:899) gives the pound as the weight unit for two types of Venetian beads. Sizes, too, were differentiated: *collane* (*margherite*) and *conterie* (½-, 3-, 4-, and 5-pound units). The differences in bead weights depended on the metal content: the yellows were the heaviest (1 bunch with 10 strings = 95 grains), the pale blues the lightest (55 grains) (Altmütter 1841:92).

Real pearls were often sorted according to weight: the pearl measuring device was a thin piece of brass with round holes "of different, gradually decreasing sizes; they were shaped so that, for instance, one hole would pass a pearl of exactly ¼ carat, the next one a pearl of ½, then from ¾, 1, 1¼, 1½ carat, etc..." (Altmütter 1841:73). There is frequent mention of pound beads in the crafts publications of the Historicism period.

Generally speaking, beads characterized neither by unusual size nor value were sold by the bundle (1 bundle = 2 bunches, 1 bunch = 12 strings, 1 string = 50 beads) which contained 100 dozen beads (1,200 beads) (Tayenthal 1900:24; Winter 1900:20; Zenkner 1983:110). Depending on regional practices, expressions could also vary; we sometimes find the terms thread (*Fäden*) and string (*Schnüre*) interchanged. The bundle (1,200 beads) was already common as a pricing or sales unit during the Biedermeier period (Prague 1833:58, no. 1288). The unusual size of some beads, their value or a particular customer preference were often the reason for a kind of stringing that differed from the usual norm of the bundle. Schander provides the following details for the expensive real gold beads:

> Strings of 25 or 50 beads, or the well-known 38 cm length, or the also well-known string of pear-drop beads holding 15 beads with each side ending in an end-drop. According to regulation, 10 or 12 or 15 strings are then bound together, that means both ends are tied off and that is 1 bunch. Again, the gold beads are an exception; whereas the bunch of silvered beads is now ready, the gold bead bunch is tied at both ends with braid-silk, usually green" (Schander n.d.:9).

So far I have found the bunch used much more often than the bundle as a commercial unit in contemporary (*Bazar*) and other sources. We do not know with any certainty how many beads were contained in these bunches, since the bunch can sometimes hold differing numbers of beads: at the Munich Industrial Exhibition in 1854, Fischer's bunch (*Masch*) held 1,200 beads while Hermann's bunch (*Masche*) of larger beads contained 100 pieces; for smaller beads, the amount was 1,000 per 1 bunch (Munich 1855:47).

Venice and Murano

The following figures have been handed down for the small strung Venetian beads. With differences depending on size and weight, one bundle (a *mazza*) contains 12 bunches, each bunch contains 10 strings or strands (1 bundle = 120 strings). A bundle could therefore contain up to 22,000 beads (Altmütter 1841:92). Contemporary information is frequently very general. This is also true of Bussolin who points to bundles ("masses") of various dimensions depending on the quality and size of the beads, and mentions that the embroidery beads are strung into bundles of 120 strings, each of which is 5 inches long (*les margaritines à broder sont enfilées en masses de cent et vingt fils de cinq pouces de longueur*)(Bussolin 1847:25).

Zanetti only mentions bundles; these consist of varying numbers of strings depending on the type of items and whether they are longer or shorter (...*donne e piccole ragazze... facentone matasse, mazzi, dozzine composte di più o meno fili più o meno lunghi secondo il genere della merce e le ordinazioni*) (Zanetti 1874:131, 132).

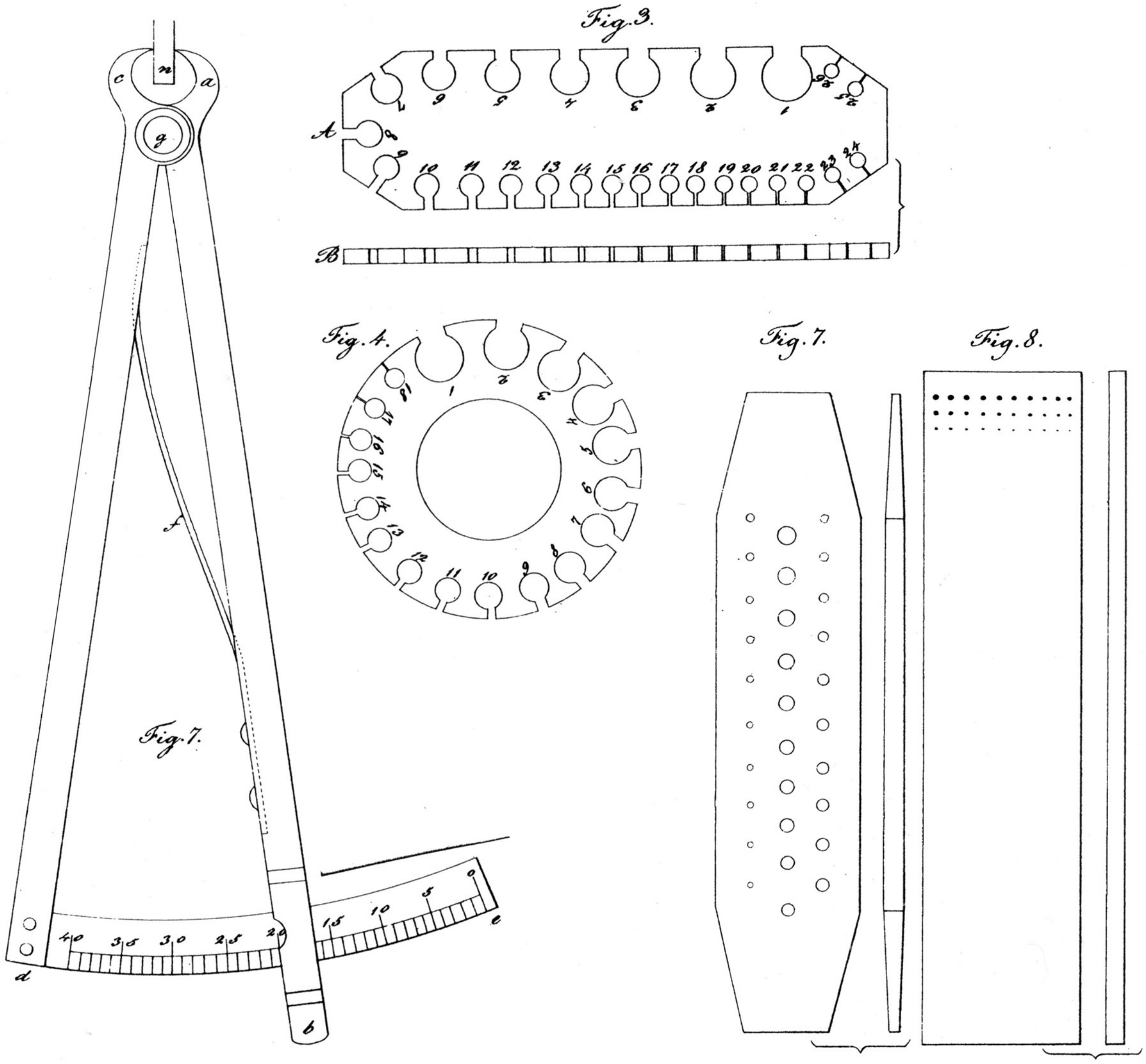

Figure 31. Measuring instruments (Prechtl 1834, 3: Plates 65, 66).

BEAD PRICES

The prices of glass beads, subjected to drastically changing fashions, popular taste, the introduction of tools and machines and other factors, can only be given here in examples. There is naturally more information available to us from the late 19th century than from the beginning. Here, too, we are limited to the few sources that were published.

Venetian Beads

In 1819, the small Venetian beads or *collane* cost "for a dozen strings, depending on the difference in color, from 30 centesimi to 2 ½ Ital. lire; the scarlet red ones are the most expensive" (Keess 1823:899).

One important factor that determined bead prices was their color; the cheapest were the black beads (4 ½ kreuzer assimilated coinage), the dark brilliant reds the most expensive (23 kreuzer) (Altmütter 1841:92).

Bohemian Beads

The prices for Bohemian Biedermeier beads were listed by the 100 dozen (1,200 pieces, in general, = 1 bundle). Prices for drop earrings and pear ear-drops were by the gross (12 dozen = 144 pieces). In rare cases prices for special strings were listed separately.