The mysterious Brunsviga PJ

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The Brunsviga P J 16 and a proposal for its operating principle are presented. The Brunsviga PJ is a machine only known until now from a few confusing advertisements in the GNC-Monatsschrift, but it can and does apparently exist.

Brunsviga, the famous Brunswick calculator manufacturer, published a single advertisement in 1916, which was repeated in the 1918 war issue of the GNC Monatsschrift, and then exhibited during the 2008 exposition on Brunsviga in the Braunschweigisches Landesmuseum. This advertisement shows a machine denominated "Brunsviga P J 16" and is reproduced in Figure 1 below. The Rechnerlexicon shows this advertisement on its webpage on the Brunsviga PJ16 (1).



Figure 1: Advertisement for the Brunsviga "P J 16" from the 1918 war issue of the GNC periodical.

An existing example of this or a similar machine had not been found until 2009, nor does any documentation on its mechanism exist. The suspicion arose that it was in fact an error of the author of the drawing, who possibly drew (erroneously) the handle of a regular machine onto one of the machines with non-moving setting levers. This is not too ridiculous, as in the war issue of the GNC Monatsschrift, three pages away from the advertisement in Figure 1, there is another advertisement for a "PJ 16" machine, which shows a standard MJ, with all the parts present that are missing in Figure 1. This advertisement is reproduced in Stephan Weiss' monograph on early Brunsviga models (2)



Trinks-Brunsviga, Type PJ 16

Figure 2: Advertisement in the same 1918 war issue of the GNC periodical, showing a standard MJ labeled as "PJ 16". Notice the long crank support, thumb button and release button, and half of the locking bar – see text below.

Both of the drawings in these two advertisements have been retouched. In Figure 2, the thumb button and all the associated machinery, as well as the locking bar below the crank support have been erased as well as possible in order to disguise a standard MJ as the new PJ. The advertisement in Figure 1 is a different drawing, but has also been retouched to erase the bar below the crank support. The complete and unretouched drawing of this machine appears in the April-May issue of the GNC Monatsschrift in 1920 (and in Figure 3 below). There however, this same machine, now with the locking bar but still with short crank support and without the thumb button is labeled MJ.



Trinks Brunsviga M J

Figure 3 The unretouched version of the picture used in the advertisement of Fig. 1, in the April-May issue of GNC Monatsheft of 1920. Notice the (complete) locking bar, and the denomination as Brunsviga MJ

A comparison of the handle part of the three advertisements is shown in Figure 4

Figure 4 Left to right : 1916/1918 PJ advertisement (Fig. 1), 1920 MJ advertisement (Fig. 3) and 1918 PJ advertisement (Fig. 2)

If the reader is confused, it is probably because the Brunsviga advertising people were a bit confused themselves. One thing is certain, the real-life PJ must have had a crank *without* all the added machinery and *without* the locking bar, as the makers of the advertisements went through a lot of difficulty trying to convey this fact as well as possible with the image material at hand.

In the Brunsviga archives, there is only a single very short entry in the board of directors meeting of Oct. 16th 1916, which mentions that "the new model P.J. 1916 is presented" without giving any further details (3).

The stationary setting levers are in fact the whole essence of the controversy – the "P J 16" has the long setting levers that remain in position as the pinwheel drum turns ("System Trinks"). In all other respects it is similar to the Brunsviga J and MJ, but the long levers require the presence of the button and locking bar (shown in Figure 5 on a Brunsviga J) which free up the setting levers for input of a number, and have been erased or not drawn in the advertisements for the machine. It is not immediately clear how the PJ machine would/could function without the presence of this lever and the associated mechanism.



Figure 5: locking button for the setting levers, on the left side "free", on the right side "locked", ready for calculation

In the Brunsviga J and MJ, the mechanism works by shifting a rod which sits below the pinwheel drum and runs completely through the calculator, to actuate a lever on the other side of the machine, which pulls yet another indented rod which runs through the centre of the pinwheel cylinder.



Figure 6: the left side of the machine with the lever for operating the security for locking the pinwheel discs while in use

By the shifting of this lever, not only are the indents lined up and the setting discs to which the setting levers are attached freed up, but also the mechanism which transfers the input of these levers to the actual slotted disc on the pinwheels is engaged by a detent on the bar in the bottom of the machine.



Figure 7: Inside the machine, the bar that operates the lever which tilts the axle of the transfer gears, left "free", right "locked"

This works as follows: the input lever discs have gear sectors, as do the slotted setting discs. The transfer mechanism consists of a set of broad gears on an axle which is pivoted forwards at the back of the pinwheel cylinder, thus engaging both the gear sector on the input lever disc, and the corresponding gear sector on the slotted setting disc. A movement of the setting levers thus results in a corresponding movement of the slotted setting disc. Actuating the release button at the bottom of the crank lever reverses this whole operation, disengaging the setting mechanism, blocking the setting levers in their current position, and at the same time freeing the crank for turning. This release mechanism is actually mechanically quite different from what Trautschold describes and draws in much detail in his 1910 monograph about the Brunsviga machines with long setting levers (4).



Figure 8: Inside the machine, the axle with the transfer gears, on the left setting levers are "free", on the right "locked"



Figure 9: top view of the pinwheel cylinder, showing how the setting lever discs operate the actual slotted pinwheel input disc through the transfer gear

The elimination of this entire mechanism with the rod and lever would necessitate another mechanism for holding the setting lever discs fixed when the pinwheel cylinder is rotating, while freeing them when the machine is in its rest position.

I could not imagine the kind of technical solution such a mechanism would infer, since another actuator for the blocking and unblocking of the levers would need to be found, which would have to be entirely internal to the machine, and not operated by a separate user action, but by the mere start of the rotation of the main crank. For Brunsviga to create a machine so revolutionary and then not market it would be insane ... unless the mechanism was somehow so complicated that the cost of production in relation to the sale price was to be prohibitive.

And this, it turns out, is in fact how it must have happened – as an example of such a machine has surfaced, for sale on an auction site in February 2009, and then, after some questions were asked, wisely retracted from sale by its owner. The machine appears to have been owned at one point by the Technische Universität München, but there are no vendor tags or any other indications of whether it was actually commercially sold.

Notice in this machine (Figure 10) the smallish setting levers, of MJ proportions, possibly using the latter's ivory cover cylinders. The machine is however of the large 16kg variety.



Figure 10: Brunsviga P J ?

The Brunsviga J illustrated higher and this machine, are quite close in serial numbers, dating back to approximately 1911 (5).



Figure 11: Brunsviga P J N° 18751, Brunsviga J N° 18140, both approx. 1911

As shown in Figures 10 and 12, the machine is shown to lack the button and rod on the right side, and the lever mechanism on the left side, although the support for it is present due to the castings being common to the PJ and J machines. Also the hole under the crank support for the locking bar is present.



Figure 12: right and left side of the machine (top) showing the casting for the locking lever being present, and detail of the right side (bottom) showing the hole for the locking bar.

Initially, the pictures shown in Figure 12 led me to believe that the machine was simply a Brunsviga J with a few missing components. The owner however, insisted that the machine operated flawlessly, which was a complete surprise to me.

As a consequence of this, inside, things have to look rather different. The owner has kindly made available some photographs of the inside of the machine, so we can now witness the exact function of this remarkable mechanism.

Whereas the MJ has two discs per input number, one thin one with the setting lever that remains stationary, and one consisting of the actual pinwheel with its slotted input disc, which rotate together, this machine appears to have three discs per input number, and no slotted input disc for the pinwheel.



Figure 13: Pinwheel cylinder of Brunsviga J (left) and of Brunsviga P J (right)

In the PJ machine, there are the input lever discs on the left, which are very similar to those in the (M)J machine; then there is a large fixed iron ring in the middle, which is solidly connected to the bottom of the machine and cannot move; and then there are the usual brass pinwheel discs which do turn when the pinwheel cylinder is rotated, and complete the calculation. There appears to be no slotted input disc.

Figure 14 shows some of the pertinent features of the machine, *i.e.* the lack of the transfer mechanism, and the fixed connection of the large iron rings to a bar below the pinwheel cylinder.



Figure 14: Details of the back of the machine, showing the complete lack of the locking mechanism, and the pins locking the iron rings to the base

But now ... how does it work ?



Figure 15: The PJ pinwheel cylinder with various numbers set (from left to right, 7, 8 and 9)

As the pictures in Figure 15 show, the large iron rings contain large pins as well, which move in and out together with the actual pins that do the calculating. After some thinking, the mechanism is dead-obvious, and surprisingly simple.

The sketches in Figure 16 and 17 should hopefully clarify what is going on. The internal parts of this mechanism have not been observed or photographed, as that would necessitate disassembly of the pinwheel cylinder, but the fact that the machine functions perfectly allows the deduction of this mechanism as the only possible or sensible solution consistent with the evidence.



Figure 16: arrangement of the setting disc and the two pins, in the "in" position (left) and the "out" position (right)





The large iron rings contain the large "intermediate" pins, of which the only allowable movement is in and out, as they are fixed in position. It is these large "intermediate" pins that are actuated by the setting ring in the usual way by a protrusion on the side falling into a stepped groove in the setting ring. The intermediate pins in turn are connected to the actual pins which do the calculating, in the same way that the pins in a normal pinwheel cylinder are "connected" to the setting ring – with a protrusion on the pin, and a groove in the intermediate pin. The iron ring which is fixed has two small grooves around its entire right side, allowing the protrusions on the calculating pins to rotate without interference with the fixed part of the cylinder. This feature also removes the need for a locking bar through the pinwheel cylinder, as it is impossible for the calculating pins to accidentally move during the calculation cycle once they start rotating away from their own intermediate pin. The large intermediate pins have three grooves. With the machine in the rest position, the intermediate pin engages with its own calculating pin in the middle groove, and this is also how the calculating pins are set by means of the in-out movement of the intermediate pin. The upper groove in the intermediate pin is necessary to let a calculating pin in the outward position rotate by without interference when the intermediate pin is in

the inward position, and likewise the lower groove must be present to let a calculating pin in the inward position rotate by with the intermediate pin in the outward position.

This mechanism seamlessly integrates in-out connectivity of the calculating pins with the fixed part of the cylinder with complete rotational freedom of the pinwheel discs, without any other necessary transfer mechanisms that need to engage or disengage before operating the machine. It is marvelous in its simplicity, but its fabrication probably implied an economically non-viable amount of additional machining operations for the additional intermediate discs and pins, which necessitated unrealistically high pricing for the machine, which in turn must have been the reason why very few of these machines were ever made and sold – or is this perhaps a prototype?

Now to return to the advertisements that started it all (Figure 1/2), they depict machines that have the later advanced carriage lock, and long carriage (15 numbers in the result register), like the MJ machine. Also, they appear, though it is difficult to tell, to have the proportions of a miniature machine. Since the writing on the revolution register cover is also consistent with miniature machines (just Trinks-Brunsviga, without the logo in the middle), I think the "new" PJ16 presented to the board of directors in 1916 was the miniature version of the 1911 machine presented in this article.

Since machine N° 18751 should date back to around 1911, the suggestion was made that it could be a prototype, and since Brunsviga has been known to use "old" serial numbers for prototypes, that the machine might actually be later (3). However, since all the details of the mechanism and shape are consistent with machines from the 1911 era, I do believe that this particular example is really that old. Between Brunsviga J N°s 18762 and 20222 (1910-1911 and approximately 1913) the shape of the carriage was changed slightly to a more convex shape in the later machine, without a sharp angle at the front (Figure 18). Brunsviga P J N° 18751 shows the "old" carriage and cover, as visible in Figure 12.



Figure 18: differences in the carriage between Brunsviga N° 18762 (right) and N°20222 (left). The front of the carriage in the older machine has a sharper angle, and the comma bar is mounted higher.

There are a few more mysteries: in the large 1916/1918 advertisement, where the PJ16 machine does not have the thumb button, the J/MJ lever for actuating the locking device for the setting pins is (just)

visible on the left side of the machine in front of the input clearing lever, but this is probably because that part of the drawing is too busy for it to be retouched away.

It may be that another version of the PJ machine with the locking bar did exist, in which case this drawing could be a faithful rendering of a prototype.

Another issue is the direction safety switch which pokes through the input cover in the advertisements – this switch is to the best of our knowledge not present on the miniature machines, which only have a +/- direction indicator, or nothing at all. This is another strange mix and match between the large and small machines. Finally, there is the complete lack of the GN&C logo, which should be on the input cover in a miniature machine and on the revolution counter cover in large machine. To the best of our knowledge, there are simply no known Brunsviga machines which show the exact configuration of either of the advertisements, whether MJ or PJ.

For a comparison between some early and late MJ's, see Figure 19, with Brunsviga MJ N°s 24645 (6), 40426 (6), 40565 (7). Notice the different comma pointers and the different orientation of the revolution counter clearing wingnut in N°40426. Also notice the complete absence of the direction indicator in 40565, and again the different comma indicators. These may be end-of-production oddities to use up available parts and substitute others for those that ran out.



Figure 19 From left to right, Brunsviga MJ N°24654, 40426, 40565.

Clearly, the main remaining mystery which we cannot answer right now is, if machines with this operating principle existed in 1911, and apparently were sold too, why were they never patented or advertised? And was the machine introduced in 1916 indeed the miniature version of the large machine discussed in this article? Any information on the existence of more PJ-type machines would be most welcome!

In conclusion, now at least the purely technical part of the puzzle with regard to this machine appears to be solved, by exposing its principle of operation, 95 years after an unsuspecting commercial director made and published those mystifying advertisements...

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Bibliography

1. Weiss, Stephan. Brunsviga PJ16. *Rechnerlexicon*. [Online] [Cited: 01 31, 2011.] http://www.rechnerlexikon.de/artikel/Brunsviga_PJ16.

2. Weiss, Stephan. Modelle der Rechenmaschine Brunsviga bis 1920. *Beiträge zur Geschichte des Mechanischen Rechnens.* [Online] [Cited: 01 31, 2011.] http://www.mechrech.info/publikat/BruviMod1920.pdf.

3. Ramm-Ernst, Jasmin. personal communication.

4. **Trautschold, W.** *Die Rechenmaschine Brunsviga, ihre Bedeutung für Staat, Wissenschaft, Technik und Handel.* 2nd edition. Braunschweig : Grimme, Natalis & Co, 1910.

5. Anthes, E. Zur Datierung von Brunsviga-Rechenmaschinen. Leertaste, 6, 1982, pp. 13-15.

6. Ernst, Olaf.

7. Szrek, Walter. on www.rechenmaschinen-illustrated.com.