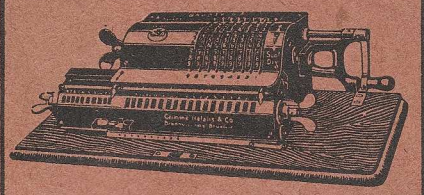
O. H. Barker



Instructions · for · using

THE

"BRUNSVIGA"

CALCULATING MACHINE

■

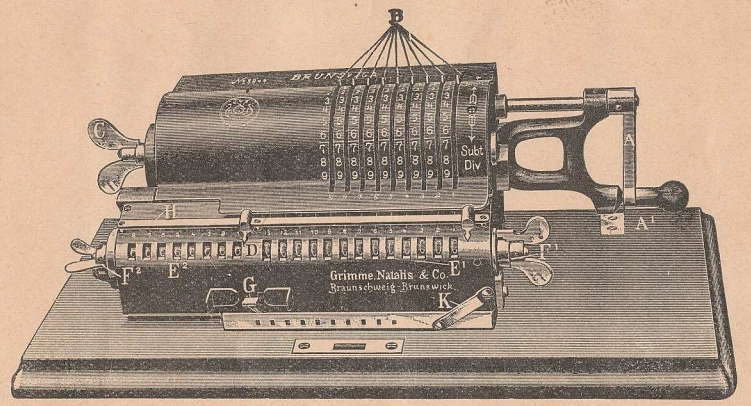
SOLE MANUFACTURERS

GRIMME, NATALIS & CO.

BRUNSWICK, GERMANY

(Entered at Stationers' Hall)

The BRUNSVIGA
CALCULATING MACHINE



CAUTION

Handle pin must be in socket before slide or thumb-screws are moved. Spring on carriage or slide must catch in groove before handle is turned.

All thumb-screws turn from you.

All thumb-screws should rest where they snap, before handle is turned.

Do not force handle back on half revolution.

Handle must make a complete revolution backward or forward.

Do not use any oil, except as stated in instruction book.

INSTRUCTIONS to be Carefully Noted before using the Machine.

PARTS.

The machine as shown in illustration consists of the following parts :

A. Handle with (A 1) Spring Pin.

B. Levers for setting up calculations.

C. Winged Nut to put back levers to naught after calculation is finished.

D. Sliding Carriage, which contains :

E 1. Apertures at which the product is shown.

E 2. Apertures at which the multiplier or quotient is shown.

F 1 & 2. Winged Nuts, right and left, for effacing results of a previous calculation—*i.e.*, setting all figures appearing at apertures back to naught.

G. Spring Catch to be pressed down when moving carriage, and which, on release, slips into slots (unseen) in bed of slide to stop carriage at correct position.

H. Bar with sliding pointers to mark the position of the decimal point.

K. Small Locking Piece or attachment screwed to both the Base and the Carriage, and used only in transit, to prevent strain to the Carriage.

THE USE OF THE PARTS.

Part A. The Handle. This can be turned in both directions, either toward the operator for addition and multiplication, or away for subtraction and division, as indicated by the arrows on the upper case on the right-hand side.

To Turn, take the Handle lightly between the thumb and first two fingers, and pull gently to the right, when the Spring Pin (A 1) fixing the Handle in its position of rest will become disengaged and the Handle freed. Continue to keep the Spring Pin extended during the whole revolution. A turn once commenced must always be completed, or the machine automatically locks, while at the completion of a calculation the Handle must

always be returned to its correct position of rest, with the Spring Pin (A 1) resting in the hole prepared for it. If in error the Handle has been turned too far, finish the revolution and then rectify by a turn in the opposite direction.

Important. Always turn, however rapidly, with a smooth and even motion, never in a jerky or uneven manner.

No attempt should ever be made to turn the Handle if (1) the Winged Nuts (C, F 1 & 2) are not in their normal positions, or (2) if the Spring Catch (G) is not in a slot.

Parts B. The Setting Levers. These project through slots in the upper case ; they are numbered from 1 upwards, and represent the units, tens, hundreds, thousands, etc. Each of these levers can be set to any desired figure, from 0 to 9, marked at the sides of the slots, and by their use the Multiplicand or Dividend is placed upon the machine.

To Set, place the tip of the index finger of the right hand on the desired lever and pull it downward till it is opposite the required figure. It will be found that a lever will not stop between two figures. The levers remain in position till the end of the calculation, when they may be set back to 0 either with the hand or by the Winged Nut (C).

Part C. The function of this part is sufficiently explained above ; note, however, that it must always be given a complete half-turn, when it will slip into place with an audible snap.

Part D. The Sliding Carriage. This most important part of the machine is that in which the results of all calculations made, appear. It is moved to the right or left for multiplication or division as the case may be.

To operate, place the thumb of the left hand on the outside of the right-hand flange beside the Spring Catch (G), and the second finger on the outside of the left-hand flange. It will now be found that a powerful grip has been obtained, and the index finger is left free to operate the Spring Catch (G) by pressing it down. Press down the Catch (G) and move the Carriage very slightly to the right. Release the Catch and continue the movement, when the Catch will automatically slip with a click into the next slot, bringing the Carriage to rest in the correct position for working in the next place. A small arrow upon the Upper Case, above the smaller row of apertures on the left (E 2) in which the Multiplier or Quotient always appears, will always indicate the place in which we are working. In the larger apertures to the right (E 1) the Product or Dividend always appears.

To cancel or **efface** the results of a previous calculation, the Winged Nuts (F 1 & 2) at the right and left of the carriage must be turned, care

being always observed that they make a complete revolution, when they will be heard to snap into their places. It will be noted that the Nut (F 2) on the left can be turned with the carriage in any normal position, while that on the right (F 1) can only be turned when the carriage is in its first, or normal, position, as far to the left as it will go.

Part H. The Decimal Bar. This is used only when working with decimals, the Pointers being slid along to any position necessary to mark the Decimal Point.

Part K. This is brought into use only when the machine is to be packed for transit, to prevent the carriage starting if subjected to rough handling. **It has always to be unscrewed before the machine can be used.**

HINTS AND WARNINGS.

It will be noted that in learning to calculate with the machine, the operator is called upon to master only four operations :

1. To set the Levers (B).
2. To turn the Handle (A) backward or forward.
3. To move the Sliding Carriage (D).
4. To turn the Winged Nuts (C, F 1, & F 2) for the purpose of eliminating the results of a previous operation.

Before beginning a calculation make sure that all levers and result holes are at zero. After finishing a calculation slide the carriage back to its normal position, and cancel out results by turning both Winged Nuts with both hands simultaneously.

It may be noted that in order to eliminate as far as possible, as a factor, the personal error of the operator, the machine is so constructed as to lock itself, if an attempt be made to work it, when any part is out of position.

Thus :

1. When the Spring Catch is not in place in a slot, neither the Handle nor the Winged Nuts (F 1 & F 2) can be turned.
2. When either of the Winged Nuts are partially turned, neither the Handle nor the Carriage can be moved.
3. When the Carriage is in any place but the first (its normal position), the Right-hand Winged Nut (F 1) cannot be turned, and consequently results cannot be eliminated.

4. When the Handle is in any position but that of rest, no other part of the machine can be worked or moved.

5. If a lever should be found to be set not properly on a figure—*i.e.*, between two figures (a most unusual event)—the Handle cannot be turned.

It is most important to note that **a smooth** and **even** method of turning the handle should be acquired, since if the machine should ever become faulty the trouble may almost invariably be traced to a neglect of this necessary precaution. Speed matters not at all, if the motion be even.

The interior mechanism should never be oiled; only the journals of the Handle Shaft and the bed in which the Carriage slides may be occasionally lubricated. The machine should be kept covered and free from dust when not in use.

CALCULATION.

Every calculation is composed of one or more of the Arithmetical Processes —Addition, Multiplication, Subtraction and Division. To work any or every calculation with the aid of the Machine, it is necessary only to master these four rules as performed upon it.

ADDITION.

Addition is performed on the machine in the following manner.

Example: 5+4+6.

Set lever in first slot at figure 5 in Case B and make one complete turn with the handle (A) in direction shown by arrow ↑, till it rests again in its original position.

The result, *i.e.* the figure 5, will then be shown in the large holes on the right of the carriage. Now set the same lever at figure 4 and make another complete turn with handle, and the result, *i.e.* figure 9, will be seen at the large holes. This is the result of adding the 5 and 4. The same process is performed with the figure 6, when the figure 15 appears as the answer wanted.

Shortly repeated, the process is as follows:

1st lever to 5 and one turn.
Same ,, ,, 4 ,, ,, ,,
,, ,, ,, 6 ,, ,, ,,
Result is shown in large holes in carriage.

Do not forget at the end of every sum to efface the result with the Winged Nuts (F 1 and F 2).

Second Example:

503
874
1165
2542

Proceed as in the previous example—viz., take, first, the 503 and set the third lever (for the hundreds) to 5, the second lever (for the tens), which is already at naught, do not touch, the first lever (for the units) to 3, and make one complete turn with the handle. In the large holes below the number 503 appears. Take the second number 874. Set the third lever to 8, the second lever to 7, and the first lever to 4, and make another turn. In the large holes below now appears 1377 = the sum of 503 and 874. Treat next number 1165 in the same manner, and total result 2542 appears in large (or product) holes. Obviously an almost unlimited series can be added in this manner.

SUBTRACTION.

Example: 476 — 254 = 222.

Set levers as for addition and make one turn with handle, when 476 will appear at large holes; now set same levers to 254 and make one turn in reverse direction, (as shown by arrow for Subtraction ↓) and the answer 222 will appear at large holes.
If from any number we attempt to deduct a larger, the machine will accomplish it, but will show a minus result at all 13 places, while the little bell on the left side will ring, thus indicating that an impossible calculation has been attempted.

MULTIPLICATION.

Multiplication is simply a process of Addition—that is to say, we add to the number to be multiplied (or multiplicand), itself, as many times as is indicated by the multiplier. Thus 4 multiplied by 3 is really 4 added to itself 3 times.

Every Multiplication sum consists of three parts: the Multiplicand, the Multiplier, and the Product. Thus:

962 (Multiplicand) × 343 (Multiplier) = 329966 (Product).

Multiplication is effected on the machine in the following manner :

Example : $43 \times 5 = 215$.

Set levers at 43 (units lever to 3 and tens to 4) and make five turns with handle. 215 (the Product) appears in the large holes and 5 (the Multiplier) in the small.

The following tabulation shows the progress of the calculation, and gives complete control of the work being done :

After the 1st turn 43 will appear at large holes and 1 at small.

,,	2nd	,,	86	,,	,,	2	,,
,,	3rd	,,	129	,,	,,	3	,,
,,	4th	,,	172	,,	,,	4	,,
,,	5th	,,	215	,,	,,	5	,,

Note :—In multiplying, the first turn always shows at once whether the multiplicand has been correctly set up or not.

Multiplication by more than one figure.

Example : $52 \times 34 = 1768$.

First set levers to 52 and make four turns ; 208 appears in the large holes, and 4 in the small. This is the result of multiplication by the unit figure of the multiplier.

To multiply by the remainder of the multiplier, *i.e.* 30, we must bring the Carriage (D) into position for multiplication by tens.

For this purpose depress the Spring Catch (G) and slide Carriage one place. (See instructions, Part D.) When the Catch clicks into slot the small arrow on the lower margin of Upper Case will be found pointing to hole No. 2 of the small holes, thus indicating that we shall now be multiplying by tens. Make three turns, *i.e.* multiply by 10 three times. In the small holes will appear 34 and in the large holes 1768.

Examination will show :

52 (levers) multiplied by 34 (small holes) = 1768 (large holes).

Thus perfect control of the completed calculation is established, and a mistake rendered absolutely impossible.

Example : 72983×13542.

Set levers as already shown to 72983. With Carriage in normal position make two turns.

Slide carriage to 2nd place and make 4 turns.
,, ,, 3rd ,, ,, 5 ,,
,, ,, 4th ,, ,, 3 ,,
,, ,, 5th ,, ,, 1 turn.

Examination shows :

72983 (at levers) × 13542 (at small holes) = 988335786 (at large holes). Product 988335786.

DIVISION.

1st Method.

As multiplication can be shown to be simply a process of Addition, so Division is simply a process of Subtraction.

Every Division sum consists of three parts : the Dividend, the Divisor, and the Quotient. Thus :

8450 (Dividend) ÷ 26 (Divisor) = 325 (Quotient).

It is to be noted that to divide on the machine, we use a similar process to that adopted on paper. We first set up the Dividend and then proceed to find the number of times the Divisor will go into it, starting as on paper, from the higher, or left, end of the Dividend.

Example $9 \div 3 = 3$.

Set up 9 (Dividend) on the machine (units lever to 9).

Multiply by 1 to bring down to large holes. Eliminate the Multiplier 1.

Important Note. This 1 has always to be effaced before proceeding further with the Division.

Set the lever immediately above Dividend (in this case units lever) at 3 (Divisor). Turn the handle in direction shown for Subtraction and Division as many times as three will go into 9—that is, until no Remainder (or a Remainder less than the Divisor) is found in the Dividend (large hole).

Control examination gives the process :

1 turn shows 1 in small holes and 6 in large.
2 ,, ,, 2 ,, ,, ,, ,, 3 ,, ,,
3 ,, ,, 3 ,, ,, ,, ,, 0 ,, ,,

Thus 3 is shown to have gone into 9 three times without remainder.

It will be noted that in Division it is not necessary to watch for the disappearance of the Remainder, since, if the handle is turned more times than the Divisor will go into the Dividend (in this case 4 times, an impossible operation,) the little bell to the left of the carriage rings, and a row of 9's, the minus result, appears in the large holes. A turn in the opposite direction will cause the bell to ring again, when the correct Quotient appears at the small holes. It will thus be seen that Division on the machine is largely made automatic.

Important. It may here be noted that in proceeding to Division it is best to slide the Carriage as far to the right as it will go, thus bringing No. 13 large hole ("B" Machine) under No. 6 lever, and the small arrow, indicating which of the small holes is being worked, over No. 8 small hole. This is done in order to obtain as many places as possible for the Quotient, since, as before explained, we proceed in Division from left to right.

Thus it will be seen that, in the last example, we should have set up both our Dividend (9) and our Divisor (3) with the 6th lever, while our answer would have appeared in No. 8 hole. The importance of this position of the Carriage will appear in the next example.

Example : 7÷3.

Set up 7, as explained in last example, but with Carriage as far to right as possible.

Do not forget to eliminate the Multiplier.

We have now the figure 7 (Dividend) in No. 13 hole. Set the lever (6) immediately above, to 3 (Divisor). Now we have set on the levers, 3 followed by five naughts—that is, we may consider, if we wish, that we have set as Divisor 300000. But since we thus add on five naughts to our Divisor, we must also add the same number to our Dividend, for which we then obtain the number 700000. This is in accordance with the rule that $7 \div 3 = 70 \div 30$, or $700000 \div 300000$.

It is in doing this that we discover the use of the Decimal Bar and Pointers.

Slide the Pointer along above the large holes until it marks off five naughts after the figure 7, *i.e.* place it between holes 7 and 8. This will mark the end of the Dividend. Proceed to divide as in previous example.

After two revolutions, which appear in No. 8 small hole, we have a remainder of 100000, a figure less than 300000, our Divisor.

We could also have proceeded without watching for the Remainder, and worked by ear alone, for at the next revolution the bell would have rung, when a return of the handle and a second ringing of the bell would have brought us the same result.

Now, were we working on paper, we should proceed to pass our Decimal Point and bring down another naught. We employ an analogous method on the machine. We slide the Carriage one pace to the left, thus bringing another of the large holes (No. 7) into the working. Note : this hole is past the Decimal Point.

Now we come to the use of the Decimal Pointer over the small holes. We slide it along to a position immediately following the figures of the Quotient obtained by dividing the whole number of the Dividend—*i.e.*, following figure 2 between small holes 8 and 7. All further figures in the Quotient will consequently be decimals.

Proceed again with the division. This time we obtain 3 for our Quotient (small hole 7) and a remainder of 100000 in large holes. Again slide Carriage one place to left, bringing another large hole (No. 6) into play, and again divide. Carry on this process to the full capacity of the machine, when a Quotient (in the small holes) of 2.3333333 (or 2.3) will be obtained, with a negligible Remainder of 1 in large holes (No. 6).

Example : 2016÷325=6.2030769, etc.

Set up Dividend 2016. Eliminate the Multiplier 1.

Set up Divisor 325 (commencing, since 325 is greater than 201, with lever No. 5).

Now we have 2 naughts to add to Divisor, and, consequently, 2 to Dividend ; therefore place Decimal Point after large hole No. 8. Proceed with Division as in other examples. Note that at first shift of carriage we bring the first Decimal Place (large hole 7) into play, and therefore place Decimal Point in Quotient immediately after first figure of Quotient obtained, *i.e.* between small holes 8 and 7.

Our control examination of the progress of this calculation will give us the following results :

1st result	32500	(levers)	6600	(large holes)	6	(small holes)
2nd	,,	,,	,,	1000	,,	,,	6.2	,,	,,
3rd	,,	,,	,,	10000	,,	,,	6.20	,,	,,
4th	,,	,,	,,	2500	,,	,,	6.203	,,	,,

and so on to capacity of machine, giving a Quotient to 7 decimal places of 6.2030769.

It will be noted that in obtaining our third result the bell rang as soon as the handle was turned once, thus showing that the Dividend was too small for the Divisor to go into, and necessitating the bringing down of another naught, *i.e.* shifting the Carriage another place. The result of this operation appeared as a naught in the Quotient.

DIVISION.

2nd Method.

Another method of Division, one which is not so hard on the working parts of the machine and which, when mastered, is speedier than the method already described, is carried out as in the following example :—

$$2133 \div 199 = 10.71859.$$

Instead of first setting the Dividend 2133, transferring to the Carriage below, and then setting the Divisor with the levers, this method requires only *one* setting—namely, that of the Divisor (199).

Set the Divisor 199 with the levers on the extreme left (using "A" size machine), move the Carriage as far to the right as possible, turn the handle once in multiplying direction, and 1990 will appear in the Carriage below, setting Decimal Pointer between spaces 14 and 15. A second turn of the handle would cause 3980 to appear : this, being greater than 2133, is a turn too many ; therefore reverse one turn, and move Carriage one space to the left. One turn now causes 2189 to appear ; this is again greater than 2133 ; therefore reverse one turn, and move Carriage another space to the left.

Turning the handle in multiplying direction now causes 2009.9, 2029.8, 2049.7, 2069.6, 2089.5, 2109.4, 2129.3, to appear in rotation ; the last number 2129.3 is the one nearest to, but *less* than, 2133.0 (another turn would give 2149.2). Again move Carriage one space to the left and proceed in the same way, always observing that the number appearing in the Carriage is as near as possible to, but *less* than, 2133 (the Dividend).

In thus operating, the number of turns registered in the left-hand portion of the Carriage gives the desired Quotient—namely, 10.71859.
The position of the Decimal Point in the Quotient is found in a similar way to that described in previous pages.

This method of Division is only recommended where Division alone is to be carried out. If a product of multiplication is afterwards to be divided, the first method will be found more applicable.