amalgamated with the Arithmograph Co. and introduced to the market, both in America and in **Europe,** their typewriters combined with the arithmetic device belonging to the Arithmograph Co. In Germany, for example, the calculating Fay-Sholes was sold for a price of 800 marks. But the machine was not engineered thoroughly, and there also arose a number of difficulties in the administration **of** both companies, with the result that the production of the Arithmograph, in conjunction with the Fay-Sholes typewriters, was given up in **1907.** The adding device was situated above the typing keys, and the digit keys **of** the typewriter were connected to the adding device. The typewriter could, of course, also be used without the adding device.

Mallmann (1904)

Manufacture was carried out by the Mallmann Addograph Mfg. Co., Chicago. The machine is no longer manufactured and has not been for a number of years. In fact, it has never reached Europe at all. It is a full-keyboard adding machine in the same style as the Wales except that the printing **is not** visible. It is a nine-place machine and has **a** 25-cm-wide carriage. The price is $250.

Adder (1904)

This machine was built by the Adder Machine Company in Detroit. It could be employed in combination with a typewriter. It never appeared in Europe and it remained almost unknown in America. After a few years production was discontinued.

Figurator (1905)

This machine was also known under the name Ray and was manufactured and sold by the Ray Adding Machine Company, **465** Washington Street, New York. The present address of this firm is unknown, This machine was similar to the Lightning Calculator and its price was $25.00 for a seven-place device.

Twentieth-Century Computator (1905)

The Campbell Manufacturing Company of Hackensack. New Jersey, has been

mentioned as the manufacturer of this machine. It has not been possible to determine any details of the device.

Matador (1905)

This is a single-column adding machine with setting levers from the well-known calculating machine factory Grimme, Natalis and Company, A. G. in Braunschweig. **As** compared with their other products, this machine has the following advantages: the result of individual columns of digits need not be written on paper, nor the counting mechanism set to zero, nor is it necessary to reenter the carryover because the calculating mechanism may be shifted laterally place for place (which occurs every time after a column has been added up). whereas the carryover remains in its place with the additional digits being added thereto. The weight of the machine was 9 kg and its price 150 marks, but it has not been manufactured for many years because the time **of** the single-column machines has long passed and many improved machines are available at reasonable cost.

Gauss (1905)

Designer: Christian Hamann of Berlin-Friedenau. The first model of the machine was exhibited at the Paris Exhibition in 1900, but its construction was not entirely the same as the model to be briefly described here. Plant production commenced in 1905, and the sales were handled by the mail-order house R. Raiss in Liebenwerda in Saxony.

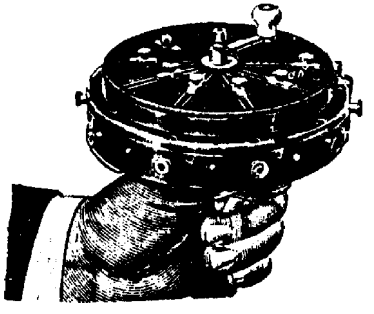

Figure 123

This machine has no stepped drums but possesses only a single actuating element in the form of a developed stepped drum that, by rotation of the crank. is moved past, or brought into mesh with, numeral gears positioned in a radial direction around the shaft of the crank. The entering of the value occurs with the aid of setting slides that move in six slots. with white and red digits. and are likewise radially located relative to the shaft of the crank. The machine may be lifted from its base. In a later version it was secured to a solid iron base so that it could not be displaced from its position during the turning of the crank. The weight of the machine, without its iron base, is only 850 grams; it has a diameter of 12.5 cm and is 10 cm high. The price was, at first. 175 marks and later rose to 200 marks. The cover plate may easily be lifted by means of a lever at the bottom of the machine (or when held on a handle, it is lifted directly with the right hand) to such an extent that the digit 1 on the edge of the cover can be positioned opposite the stationary indicator. When properly positioned. several cuts in the edge of the lid fit over corresponding projections of the lower part, and the gears of the two parts engage. Manufacture of this machine has been discontinued.

Mercedes-Euklid (1905)

Designer: Christian Hamann of Berlin. Manufacturer: Mercedes Office Machine Works of Charlottenburg 2. Berlin Street 153.

The principle upon which all Euklid models have been based differs entirely from the calculating machine systems so far described. The actuating mechanism consists of ten parallel racks that are proportionally displaced by a lever connected to the racks. The particular advantages of this machine show that the Euklid has not only overcome the defects of other machines but possesses a multitude of innovations and improvements, for instance:

Automatic Carriage Movement: The cumbersome lifting and shifting of the carriage by the operator has been eliminated. Movement occurs automatically by depression of a key or reversing lever.

Instantaneous Clearance: Clearing of one or both counting mechanisms is effected by a single. short manipulation without lifting the carriage, without operating winged handles, and may take place in any position of the carriage. The machine has complete tens-carry in the result mechanism. up to the highest place. and the same is true for the revolution counter, in a positive as well as in a negative direction. The negative tens-carry arrangement is important

because it enables dependable performance of shortcut multiplication with a correct multiplier indicated. Therefore, several multiplications with constant multiplicands may conveniently be carried out, without clearing or new settings. merely by changing the multiplier. Furthermore, it permits direct adding of multipliers and quotients. This tens-carry frees the operator from the red digits, which are so liable to cause errors. Direct setting of the dividend into the result mechanism occurs by setting knobs without the need for lifting the carriage and without previous setting in the selection mechanism. Since the divisor may be retained, several divisions with constant divisor may be carried out consecutively.

Automatic Division: Contrary to the usual method of division, the Euklid machine has completely automatic division, which is carried out entirely mechanically by rotation of the crank and manipulation of the reversing buttons, without requiring any attention or consideration on the part of the operator. It is bound to yield correct results even if the carriage has been placed incorrectly. An automatic lock of the crank takes the place of the bell signal, which may easily be missed by the operator. The entered digits may be read in a straight line. The machine offers a convenient and comprehensive view because the result mechanism, which is the most important part of a calculating machine, is positioned directly before the operator. The closely adjacent digit drums exhibit large white digits on a black field; they are clear and easily readable.

Figure 124 shows model I—a rnanual machine with slide settings. The machine has nine places in the setting mechanism, sixteen places in the result

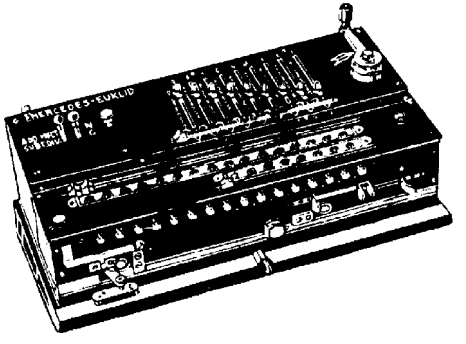

Figure 124
Model I.

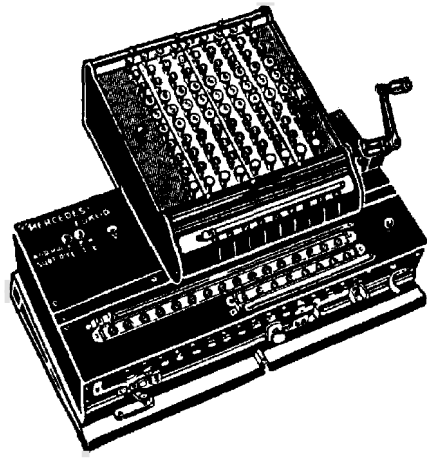

Figure 125
Model 4.

mechanism, and eight places in the revolution counter. The setting mechanism may be increased by four places, i.e., to thirteen setting slides.

Model **4** (figure 125) is a manual machine with keyboard setting; it has nine places in the setting mechanism, sixteen places in the result mechanism, and eight places in the revolution counter. Like model 1, the setting mechanism may be extended to thirteen places. Keys are the preferred setting means. They increase the reliability. speed. and convenience of entering data. Consequently this model is primarily suited for employment as an adding machine.

Apart from those already mentioned, the keyboard Euklid machine exhibits additional advantages. **A** small keyboard field, and therefore fast and dependable operation, facilitates the setting of multidigit values by simultaneous depression of keys. Simultaneous depression of two or more keys in the same longitudinal key **row** is impossible; the key touch is extremely light and of equal depth for all digits. The great clarity of the keyboard is increased by a checking row, positioned below the keys, in which the entered values appear in a straight tine; thus. the operator may immediately survey even the largest values. Every addition is followed by an automatic key release, which may be disabled for other types of calculation. Clearance of the whole keyboard, in multiplication and division, is done by a lever. The keys in any column release one another when depressed. Individual key columns may be released by themselves.

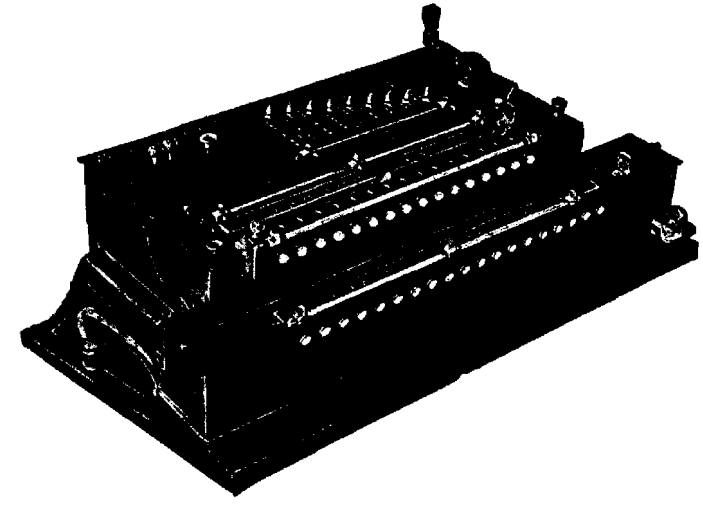

Figure 126
Model 5.

Key interlocks — when the crank is not in its basic position, depression or release of depressed digits is impossible.

Separation of the columns is accomplished by readily movable decimal point slides positioned before the key columns. The slides permit the key columns to be divided to the left **or** to the right as desired. The operator may survey at a glance which columns are occupied by the individual groups of numbers.

Figure 126 shows model 5. This is a manual machine with slide-setting and totaling mechanisms: it has nine places in the setting, sixteen places in the result, eight places in the revolution counter, and seventeen places in the totaling mechanism. When compared to model 1, this machine has the advantage of a totaling mechanism that serves for adding the individual products or for subtracting them from one another. The advantage of this arrangement is that a complicated calculation may be accomplished with only one result mechanism, rather than by the method used in other machines in which it is necessary to operate two result mechanisms simultaneously. After a problem has been solved, the product is easily transferred to the totaling mechanism by simply operating the clearing mechanism. Thus, in calculating invoices for instance. the individual items may be found in the result mechanism after

the multiplication, and after each clearance their total sum may be found in the totaling mechanism. This eliminates the separate addition of the items that is otherwise necessary. The manipulation of this machine is not tiring because only one mechanism is being operated at a time, and its handling does not differ from that of Euklid model I. Hence, the expenditure of strength required for the operation of the second result mechanism is saved; only one counting mechanism has to be displaced from place to place, and as this is done without lifting the carriage it requires no effort. Rounding of decimal places prior to totaling may be arranged *so* that the correct total is obtained. Direct setting up of small items for addition is possible without operation of the crank. The results of intermediate calculations, which are not to be added to the totals, can be cleared without being transferred. The subtraction of intermediate results can be accomplished in the simplest manner in a special counting mechanism, with the machine showing at the same time the positive and the negative values. Separate item counters enable the operator to check at once the number of positive and negative items that make up a total sum.

Model 6 is illustrated in figure 127. It is a manual machine with keyboard setting and totaling mechanism; it has nine places in the setting mechanism. sixteen places in the result mechanism, eight places in the revolution counter, and seventeen places in the totaling mechanism. Model 6 is an amalgamation of models 4 and 5 and possesses all the advantages of each.

Model 7 is illustrated in figure 128. It has slide setting and an electric drive; it has nine places in the setting mechanism, sixteen places in the result mechanism, eight places in the revolution counter, and eight places in the setting mechanism of the multiplier. The setting mechanism may be extended by four places to thirteen setting slides. This machine corresponds to the Euklid model I with the difference that it is driven by an electric motor. This drive operates so efficiently that the machine calculates entirely automatically. The operator is only required to enter the two values necessary for multiplication or division problems, even clearing occurs automatically. In fact, it is unnecessary to watch the place number of the multiplier. The automatic calculating machine forms the long-desired ideal of calculators since it relieves the operator almost completely from any mental or manual work. It is not possible in this place to recite all the advantages of model 7 individually. Suffice it to mention that the electric Mercedes-Euklid has not yet been excelled by any other calculating machine in speed and reliability. It carries out the calculations with a steady speed of approximately 240 to 260 revolutions per minute. The electric Mercedes-Euklid no longer tires the operator because it requires

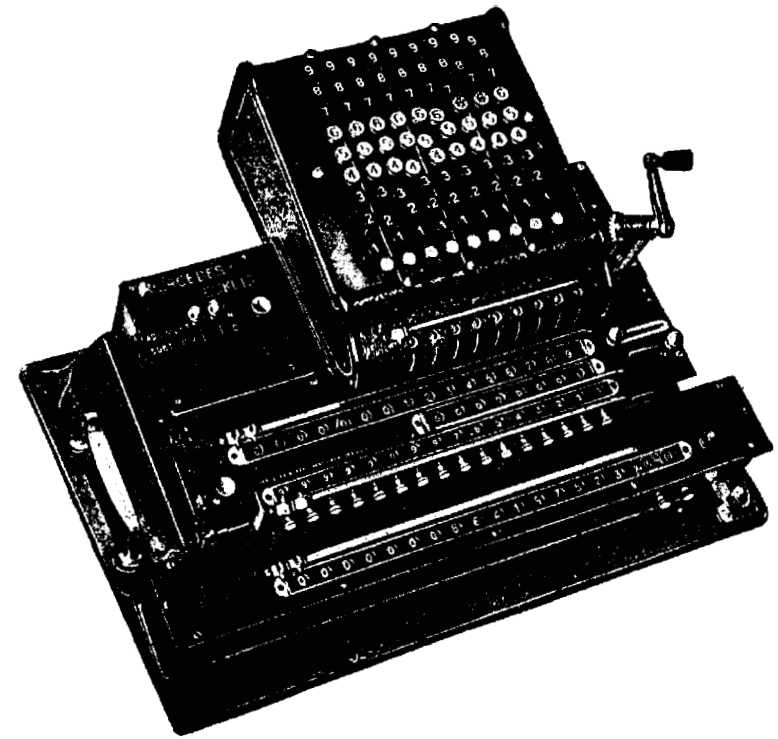

Figure 127
Model 6.

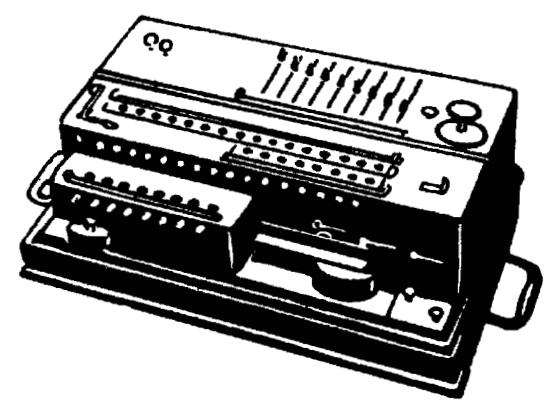

Figure 128
Model 7.

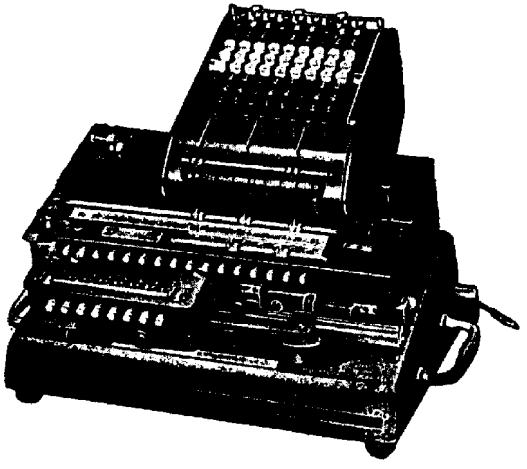

Figure 129
Model 8.

neither rotation of the crank nor displacement of the calculating mechanism, and apart from the setting of the problem, not the least amount of attention is required by the operator. The cost of operation is very small because the motor employed to drive the machine has a strength of only 1/40 horsepower and may be connected to any electric light system. When the calculating operation is begun, the motor is automatically connected and it is automatically disconnected upon termination. This saves electricity but most of all it avoids any unnecessary noise and any overloading of the motor. If, in a large business enterprise, model 7 should be required in several places where different kinds of current are available, the motor may be exchanged for another one in a few moments. The electric drive ensures an extremely uniform, speedy, and reliable operation. This smooth operation of the drive preserves the mechanism of the Euklid and hence extends the life of the machine.

Figure 129 shows model 8, which is the same as model 7 as regards the drive and number of places but is provided with key setting. The keys give it the distinct character of an electric adding machine. The clearly arranged and easily operable keyboard field corresponds with that of model 4. An addition bar, adjacent to the keyboard, enables convenient operation. This increases still further the applicability of this machine over that of model 7. This type of machine constitutes in every respect a perfect and entirely automatically operating universal calculating machine whose performance excels all others

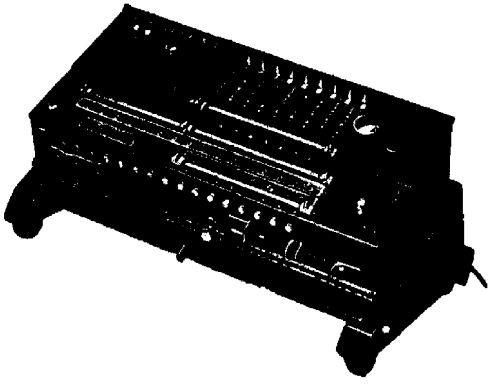

Figure 130
Model 11.

known. All that is necessary is to enter the problem, the machine calculates it automatically, and all the operator has to do is to mark down the result.

Figure 130 shows the semiautomatic model 11.[64] In construction and dimensions it corresponds entirely with the manual model 1, but it has an electric drive by a motor of ¼0 horsepower built into the base of the machine. This motor may be connected to any electric light system. The mode of operation is exactly the same as in model 1, the difference being that the hand crank has been eliminated and the revolutions are carried out by the motor, which may be started by depression of a button. The machine has slide settings; it has nine places in the setting mechanism. sixteen places in the result mechanism, and eight places in the revolution counter. The setting mechanism may be extended up to thirteen places.

The semiautomatic model 12, whose overall construction is the same as model 4, possesses an electric drive by a motor of a ¼0 horsepower, as described in connection with model 11. This model has not been illustrated. What has been said about model 11 as compared with model 1 logically applies to model 12 as compared with the manual model 4, model 12 is especially suited for use as an adding machine because of its keyboard setting and electric motor drive.

64. **At this point Martin switches back and forth between Roman numerals and Hindu-Arabic numerals for various model numbers. We have transcribed everything into Hindu-Arabic numerals.**

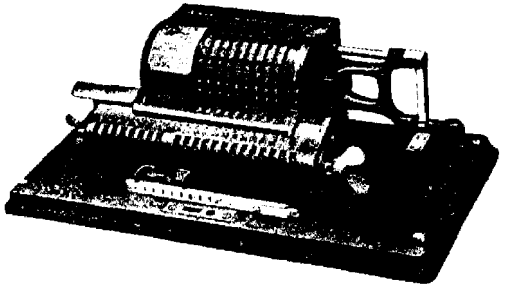

Figure 131
Chateau.

Chateau (1905?)

This pinwheel machine is manufactured in Foncine-le-Haunt (Jura); the owners of the factory are the Chateau Brothers, 125 Boulevard de Grenelle, in Paris. It became better known under the name Dactyle, which it received from the selling agent. It differs very little from the Original Odhner. It has nine setting rows, thirteen places in the result mechanism, and eight in the revolution counter. Its price, before the war, was 475 francs and afterward **425** francs. It was offered for sale at various places outside of France, but its distribution is rather insignificant, even in France. **Its** length is 40 cm and its width is 20 cm.

Goldberg (1905)

The Goldberg was an adding device for typewriters of all systems. To our knowledge **a** number of machines were sold, but only in connection with the blind-typing Remington. The machine did not gain any importance.

Bri-Cal (1905?)

This is a product of British Calculators Limited of Belfast Road, Stoke Newington, London N. This **firm,** as is generally known, produced and sold the Cosmos, but apparently no longer exists. The Bri-Cal is a small adding machine with automatic tens-carry. To add, the adding stylus is inserted into the opening next to the number to be entered and is pulled to the right until it hits a stop. whereupon the added digit appears in the respective result window.

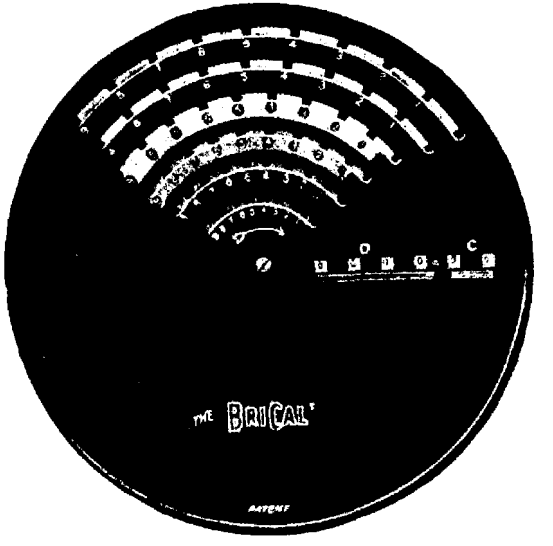

Figure 132

The two outer slots represent the pennies, and the following ones represent the units, tens, hundreds, and so on. Zero setting does not occur automatically on the machine. The adding stylus must be inserted into the outermost slot behind the red tooth and the calculating wheel moved to the end; the procedure is then repeated in the next slot, and so on. Naturally the machine is also furnished for English currency. Prices: five places **£4.4.0;** six places **£5.10.0;** seven **places** £7.00.0.

Outside of the British Empire only a few models of the machine were sold. In England the sales were also not large.

XxX (1906)

A stepped drum machine **of A,** G. vorm. Seidel and Naumann of Dresden. Since 1919 the manufacturing rights have been the property of the Presto Bureaumaschinenbau Ges.m.b.H, Rabenerstr. **6,** Dresden **24.**

The machine is manufactured in two main models: with setting slides and with keyboard setting. Both models are available with **8** × **8** × 13 places, 9 × 9 × 16 places, or 11 × 11 × 20 places. Both models have complete tens-carry in the revolution counter with red and white digits.

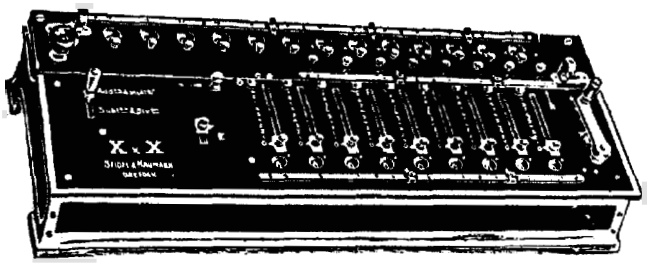

Figure 133

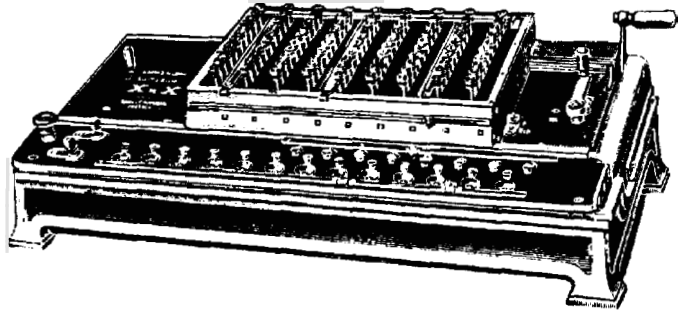

Figure 134

In the machine with slide setting, the carriage is arranged on the top. The setting checking windows are located below the slide slots. A total clearance device is provided for the setting slides.

Aside from the setting keys, the machine with key setting has an additional key at the top of each column with which an inadvertently depressed key may be released. A repeat key is also provided. Clearance of set up amounts occurs by means of a lever. and at the same time the numeral wheels of the setting checking mechanism are set to zero. In these machines the carriage is located below the keyboard. The keys are self-correcting. A printing model was built for a short time.

Gab-Ka (1906)

This small, inexpensive machine was manufactured by the Zephir Company in Paris but remained of no importance. It merely serves for adding columns

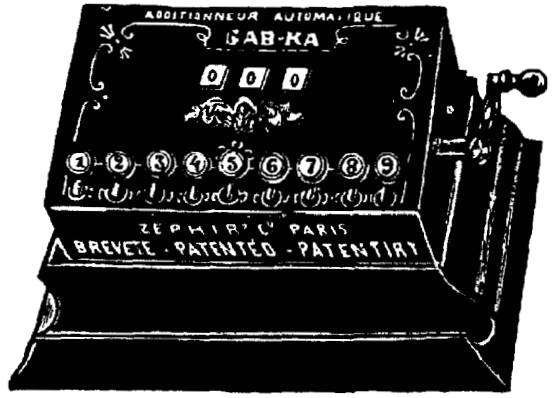

Figure 135

of digits, limited to a total of 999 per column. The unit digit of the result was noted down, and the remainder carried over to the new column, and so on, until all the columns had been added. The crank serves for resetting to zero.

Cram Writing Machine (1906)

This is not a typewriter, as you might think from the name, but rather an adding machine, In fact it is a Burroughs connected to a printing device attached above the machine and is similar to the Edelmann typewriter.

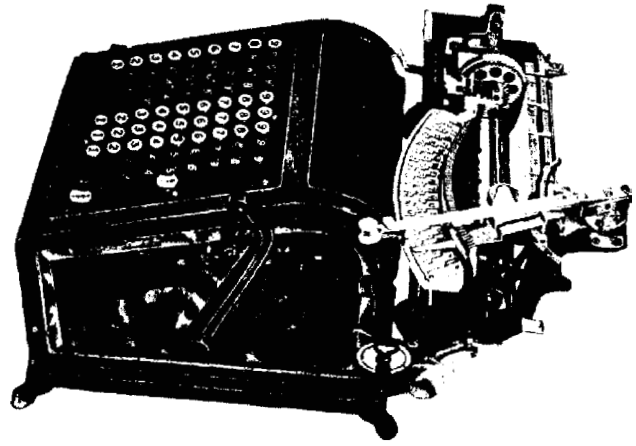

Figure 136

One drawback of the ordinary printing-adding machine is that the digits, but not the text belonging to them, can be printed. At times this has been overcome by attaching certain letters or special symbols to the keyboard, thereby enabling the machine to print specific notations like *C* for credit, ***D*** for debit, *S* for sum, and the like, but this was only a makeshift measure. With the Cram you can write any text you wish in capital letters, as well as not-added digits and various symbols, which can be used to explain in more detail the relevant item. **A** company was established in St. Louis for manufacturing these machines, but no business worth mentioning was carried out. The designer was B. Cram in St. Louis.

Goldschmidt (1906)

J. Goldschmidt of Rue de Chabrol 12, Paris, manufactured a stepped drum machine under this name. The manufacturer has moved away, and no other details regarding the machine could be ascertained. Presumably his machine is identical with the Multaddiv that was sold, before the war, by a well-known office machine dealer on the large boulevards of Paris.

Ellis (1906)

The inventor of this machine was Halmcolrn Ellis in East Orange, **N.J.** The Ellis is a full-keyboard adding machine connected to a typewriter. It is, however, different from the Burroughs machine. Not only does it print number columns, results, and. if necessary, a few symbols or words like debit, credit, balance, etc., but, just as the Remington, Monarch, Smith Premier, or Yost typewriters are supplemented by adding devices, so the Ellis **is** an adding machine that is supplemented by a typewriter. In considering this machine, it

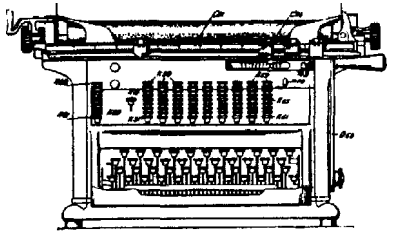

Figure 137

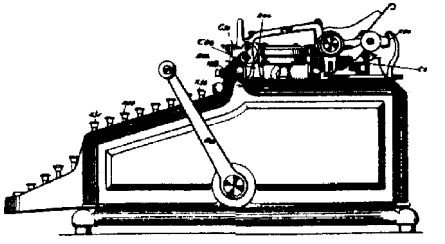

Figure 138

must be remembered that what is being dealt with here are two different groups of mechanisms. The number key mechanism, two adding mechanisms, and the number printing mechanism belong to the one **group,** while the other group contains the system for the typewriting mechanism.

The **Original Ellis:** In front of the machine there is the typing keyboard consisting of four rows (the universal keyboard with forty-two keys). Then there is the adding machine keyboard with nine rows—nine columns of numeral keys and nine operating keys, Behind this **is** the type lever mechanism and the carriage. The calculating keys are clearly shown in figure 138.

The Typewriter: The typewriter has a simple shifting device with shift keys on both sides of the keyboard. It is equipped with one tabulator whose setting key found in the uppermost row of keys on the right. There is also a release for the tabulator stop. In construction, these machines resemble the Underwood. The type levers **are,** of course, very long because they transverse the underbody of the adding mechanism. There is a carriage release key on the left side of the carriage where the adjustable setting device for spacing (three different spacings) is also found together with the carriage return and newline levers. Diagonally across the machine runs a toothed bar on which sit both the margin setters and the stops of the typewriter tabulator as well as the stop blocks of the adding machine tabulator; therefore, the typewriter and adding machine each have a separate tabulator. To the left, on the front part of the machine above the operation keys, is the ribbon key used to change from one color to another. The type hammers meet at the printing point in a central type control, and on both sides of this are the other stop blocks. To the right, on the carriage, is a lever that loosens the paper feed drums and another carriage release key. The ribbon **spools** are attached in the usual way. Both paper feeders are adjustable at the side.

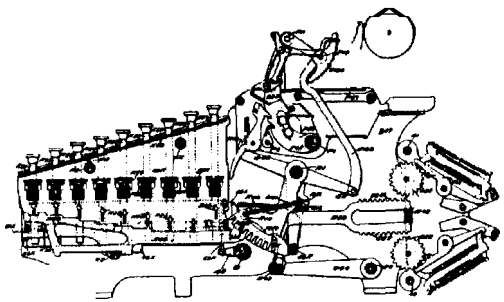

Figure 139

The Adding Mechanism: The eighty-one calculating keys are part of the setup mechanism for entering the numbers that are part of the calculation. When these keys are pressed down, both the setting of the corresponding digit-type head and the addition of the corresponding number is prepared. The lever (visible in figure 138), on the right side of the machine, operates the devices for printing numbers, adding numbers, and printing totals. In addition to the eighty-one calculating keys and nine operating keys, the adding machine has a tabulator key, which is between the row of operating keys and the first row of calculating keys. Nine operating keys are to the left of the calculating keys.

Release key: releases all the depressed keys (number keys and operating keys)

Repeat key: prevents the release of the number keys while using the lever

Total printing key: for the upper set of adding gears

Subtotal printing key: for the same set of gears

Line addition key: for the upper set of adding gears

Total printing key: for the lower set of adding gears

Subtotal printing key: for the lower set of adding gears

Line addition key: for the lower set of adding gears

Key for switching off addition

Calculation Possibilities

The following examples have to do with monetary values and their decimal places.

Example 1: There are several digits under each other in a single column, and the total is to be printed at the bottom.

543.25
23.76
40.00
0.37
1.00
608.38

Keys in columns K55, K52, K53, K54, and K55 are pressed from right to left[65] (the sequence of the entries is of no consequence). Then the sliding carriage is brought into the position of one of the two tabulators; for example, in concurrence with the left stop block, and the lever, which at this stage has been released. is pulled. This prints the number in the first row of the example. When the lever is shifted back, the adding of the number into the upper mechanism is performed, while at the same time the digit keys spring back to rest position. The other four items of the total are printed and added in the same way. Where there is a zero, naturally no key in the corresponding column is pressed. It is important to maintain the tabulator setting under all circumstances. Finally, the upper total printing key K63 is pressed and the lever pulled. This returns the adding mechanism to zero, and the total is printed. The lever, which automatically moves back, causes the total printing key K63 to return to its rest position.

Example 2: Once again there are columns of numbers to add, but this time the total must be carried over to a new column.

325.48	391.93
21.35	3.45
6.40	50.00
38.00	0.75
0.70	20.50
391.93	466.63

65. Although these columns are marked in figures 137 and 138. they are very difficult to read. Essentially Martin is saying you enter the first number in from right to left.

The five items in the left column are printed and added in exactly the same way as described by means of the upper adding mechanism. Then, instead of the total printing key K63, the subtotal printing key K64 is pressed. If the lever is now pulled, the total—namely, 391.93—is printed. The adding mechanism then returns to zero, as in the previous example, but, by the return of the lever, is reset to the earlier number. Meanwhile, the subtotal printing key K64 has been released and comes back up again. The sliding carriage is shifted to the left until the right stop block comes into effect. The upper total printing key K63 is pressed. If the lever is now pulled, the upper adding mechanism returns to zero, and the value 391.93 is printed as the first item in the new column. When the lever has moved forward, the lower adding mechanism is thrown into gear with the rungs (according to the position set up in the upper calculating mechanism). When the lever begins to return. the upper calculating device is disengaged and in the end remains on zero while the lower adding mechanism is set on the items. The total printing key of the upper adding mechanism is automatically released again. The addition is carried out as already described, until finally the end total 466.63 is obtained with the help of the lower total printing key K66.

Example 3: In adding a column of numbers, it is occasionally necessary to print a number that should not be part of the final total. In such a case, all that is required is to press down the nonaddition key K69 before pulling the lever to print the respective value.

654.60
45.04
11.11 *x*
130.50
830.14

The item in the third position marked with an *x* is not a part of the addition. Before printing this, the nonaddition key K69 must be pressed; with the return of the lever, it springs back to its normal position again. The symbol is itself not printed automatically but is put there by means of the typewriter. This number can easily be printed in a special color by changing the colored ribbon. This is done by means of one of the small buttons (which can be seen in figure 137) on the right, next to the row of operating keys, on the front part of the machine.

Example 4: When a balance sheet is to be set up, or an entry to be made where numbers in successive rows are to be entered alternately in two columns to be added independently, both tabulating stop blocks are set accordingly. By alternating operation of both stops, each number is printed and added up in their respective columns.

204.05	50.04
45.56	6.50
12.60	0.56
0.15	657.08
262.36	714.18

Here the first number in the left column, then the first number in the right column, then the second in the left column, etc. is printed. The totals are obtained in the usual way—that is, on the left by means of the upper total printing key K63, and on the right by means of the lower total printing key K66.

Example 5: When two columns of numbers have been added up on both adding mechanisms, it is, of course, possible to combine their totals.

54.30	76.00
4.07	45.05
300.66	0.46
3.03	600.05
40.10	5.70
1.32	3.02
403.48	730.28
	403.48
	1133.76

The total under the left column is obtained, as in the second example, by means of the subtotal printing key K64; it is then stored in the upper adding mechanism. Then, independent of this, the right column is printed and the total obtained similarly with the aid of the lower subtotal printing key K67. As in the second example, the upper total printing key K63 is pressed and the left total carried over into the right column again as a term of the total. With

the aid of the lower total printing key K66, the total of both columns finally appears in the right column.

Example 6: It is also possible to add only a part of a number in a column of digits to be printed, then to print this subtotal beside it on the right and, after printing the rest of the numbers in the column, to then print the equivalent subtotal next to it on the right, underneath the first subtotal, and finally compute the grand total.

45.67	
406.00	
2.40	
67.06	
50.06	
20.04	
200.00	791.23
550.00	
5.60	
40.06	
5.03	
22.02	
14.08	
2.35	639.14
	1430.37

The particular subtotals (there can, of course, be more than two) are obtained in this case by means of the upper total printing key K63, and then. as in examples 2 and 5, are transferred as terms of the totals to the right. Then, with the help of the lower total printing key K66, the grand total is calculated.

Example 7: In all the previous examples, the printing and adding has taken place in columns. If, on the other hand, individual numbers in a row are to be printed and added up, then one (or both) of the two line-adding keys K65 and K68 must be pressed down. Both adding mechanisms then remain engaged during the operation (as long as this is not stopped by means of the release key) independent of the position of the carriage, and however many numbers, in however many lines, can be printed and added in succession, and the total obtained.

12.35	40.70	33.65	6.50	5.00
1.70	50.00	8.70	25.00	5.01
2.77	0.66	9.00	30.44	120.00
3.33	0.55	= 355.36		

The nonaddition key K69 can, of course, be used exactly as it was in adding up columns, and the subtotal printing key can be used in place of the total printing key.

Example 8:

1.25	4.30	2.20	0.67	4.50	7.55 = 20.47
3.40	5.40	6.60	2.67	0.11	5.05 = 23.32
5.40	6.66	3.50	7.37	1.11	7.10 = 31.14
					74.93

In this case, the items that have been printed in each line are added by pressing down the upper line, adding key K65 on the upper adding mechanism. Each time the total is obtained (when the upper total printing key K63 has been pressed at the same time as the carriage is in gear with the right stop block, for the lower adding mechanism, and after measures have been taken to print it at the end of the right, it is stored as a subtotal in the lower summing mechanism. After this, the grand total is obtained with the aid of the lower total printing key K66.

Example 9:

$34.51 \times 32 = 1104.32$

Multiplication is carried out with this machine as repeated addition. The small button 10B (on the right in figure 137) is positioned so that the small indicator points completely to the left at the end of its sweep. This disengages the machine's printing action without stopping any of the other functions of the adding machine, with the exception of the paper feeder, which is automatically disconnected.

34.51
34.51
345.10
345.10
345.10
1104.32

This illustrates how the result is arrived at, except that printing does not take place. The arrangement of the items into columns should indicate that the carriage has been brought into tabulator position (pressing a line-adding key would do just as well). Next, the multiplicand. 34.51, is set up in the usual way by means **of** the digit keys, and at the same time the repeat key K62 is pressed down. The number 34.51 is added by pulling the lever as many times as indicated by the digit in the units position of the multiplier. By pressing the release key K61, the repeat key K62 is released, and this causes the digit keys that have been pressed down to return to rest position. The multiplicand is entered again with the aid of the digit keys in such a way that its individual digits have shifted one place to the left (that is, the 1 is entered in the second column **of** digits from the right, the 5 in the third column, etc.) When the repeat key has been pressed, and the lever has been repeatedly pulled, it then follows that the multiplicand (which has been multiplied by 10) is successively added up as many times as the digit in the tens position of the multiplicand—that is, in this example, three times. These operations are carried out repeatedly until the multiplication has finished. Finally, with the help of the corresponding total printing **key,** the total is obtained, and this represents the product. When the total printing key is pressed, the repeat key is released.

Example 10:

12 boxes at	1.45	. . .	17.4
18 chests at	2.35	. . .	42.30
			59.70

If calculations of the above form are to be written down, then the multiplication is carried out with the help of one summing mechanism **(say** the upper one), and the total is printed each time while the machine works together with the stop block of the other summing mechanism (say the lower one). The total sum is obtained as in example 8.

Example 11:

5 bales silk 51, 49, 47, 50, 53, = 250 m at **1.13** . . .	282.50
7 bales satin 48, 51, 53, 49, 49, 47, 52 = 349 m at 1.46 . . .	509.54
	792.04

This example is to some extent a combination of examples 7 and 10. In the first group, the numbers 51, 49, etc. are added and the total 250 is multiplied by 1.13.

Example 12:

36 572.81
– 14 975.36
21 597.45

On this machine, subtraction is carried out in the usual way for this type of calculation; that is. the number that complements the subtrahend is added to that which complements the capacity **of** the machine (plus 1).

36 572.81
14 975.36 *x*
9 985 024.64
21 597.45

The subtrahend is appropriately printed underneath the minuend after the nonaddition key has been pressed down (indicated by the symbol ***x),*** and when the printing operation has been switched off, the complement, which has been entered on the keys, is added to 10 000 000.00 in the tabulator setting.

Example 3:

705.00	767.50
340.50	440.00
4 400.00	6.00
160.04	**4** 354.87
5 605.54	7 746.00
	13 312.37
	5 605.54
	7 706.83

In order to get the difference between the totals of two columns of figures, first, as was done in example **5,** the totals of both columns must be obtained by means of the upper and lower subtotal printing keys. The left total is then carried as an item over to the right side by pressing the upper total printing key.

705.00	**767.50**
340.50	**440.00**
4 400.00	**6.00**
160.04	**4 354.87**
5 605.54	**7 746.00**
	13 312.37
	5 605.54
	9 994 394.46
	9 994 394.46
	7 706.83

Since the nonaddition key could not be pressed this time, the complement of the subtrahend, **5605.54,** must then be added twice, as is indicated here by the double printing (which is of course switched off).

It is easy to see by these few examples that the uses of the calculating Ellis are more varied than those of the calculating models of other systems so far described.

The Ellis Today: During the ten or more years that it has been on the market, the Ellis has. of course, been much improved. For example, on both sides of the paper support there are paper guide rails that can be moved sideways. Machines with three different carriage widths are available. In both the typewriter and adding machine, it is possible to print over the entire surface of the paper (with the exception of the small margin on both sides). **As** was mentioned at the beginning. the Ellis was originally supplied with a simple case shift; however, now it is usually supplied only with uppercase letters, just as the Remington. Smith Premier, and Underwood typewriters were only equipped for uppercase letters when they were designed for use in bookkeeping. Machines with a case shift are now supplied by the Ellis factory only on request. In this new model, the tabulator key for the calculating machine tabulator is attached to the right of the calculating keys.

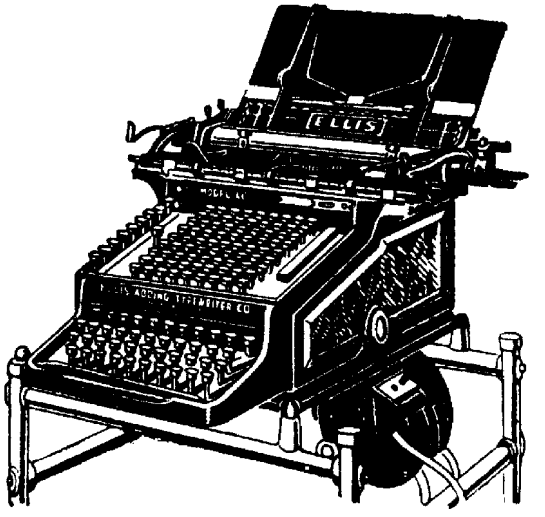

Figure 140
The newer Ellis

The greatest advantage this new model has over the old one is that the manual lever has been replaced by electric drive. The machine now stands on a massive frame made from hollow iron tubes. Underneath this is the electric motor. By simply pressing a key, the same work can be carried out that before would have involved a lot of tedious arm and hand movements. The motor contact key **can** be found on the right of the digit keys.

What are the advantages of the Ellis as opposed to the other typewriter systems with adding and subtracting devices?

1. With the Ellis it is possible to repeatedly use and print (or repeatedly print but only once use) the keys that have been struck on the keyboard.

2. It is possible to repeatedly print the end totals and carry the results over into the second adding mechanism as one prints them.

3. If necessary, it is possible to add a number that has been entered only once on the keyboard simultaneously in both adding mechanisms.

4. Transferring the totals from the calculating mechanism to paper is not done by copying them down (as with the Remington, Smith Premier, etc.) but follows automatically when the lever is pressed (and in electric models when

the contact key is pressed). Copying errors are therefore not possible with the Ellis.

5. The combination of the calculating machine with the typewriter is such that full annotation can be provided for items and this can be in any position desired—in front of, behind, above, or below the amounts. It is nevertheless impossible to mix up those amounts written by the typewriter with those written by the calculating mechanism because both mechanisms work fully independently of each other.

6. The Ellis is not only a bookkeeping machine; it can be used purely as an adding. subtracting. and multiplying machine for control operations, etc.

7. At the end of the line an adjustable stop causes the automatic carriage movement, with or without line feed, to move to the left margin. By pulling the lever mentioned earlier, the automatic paper feeder (which is otherwise present when digits are written vertically) is switched off. There are two other keys, one right next to the adding keyboard and the other right next to the typewriter keys. These can cause the automatic carriage movement at all times, even in the middle of lines.

This machine is also manufactured in a second model that, unlike the model just described, has only one calculating mechanism. On request, the machine is also supplied with a divided platen, so that it is possible to use one half of it for writing particulars on the page and the other for filling out monthly statements.

The Ellis is also supplied without a printing device, so that it then resembles other full-keyboard adding machines. This model is also made with either one or two calculating mechanisms, and both are equipped with a double-column writing device, just like the machine with typewriter described above.

The prices of Ellis machines are as follows:

Adding machine with one calculating mechanism	$450
Adding machine with two calculating mechanisms	$550
Typewriter and adding machine with one calculating mechanism	$850
Typewriter and adding machine with two calculating mechanisms	$950
Special machine for direct subtraction	$1275

All prices are for machines with 53-cm-wide, nonautomatic carriage but with electric drive and, in the case of the typewriter machines, without case shift. Machines with 45-cm and 60-cm-wide carriage and with case shift (that is, upper and lowercase letters) cost more.

Manufacturer: Ellis Adding Typewriter Company, East Orange, N.J.

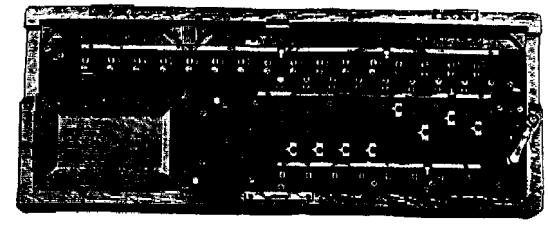

Figure 141
Model A.

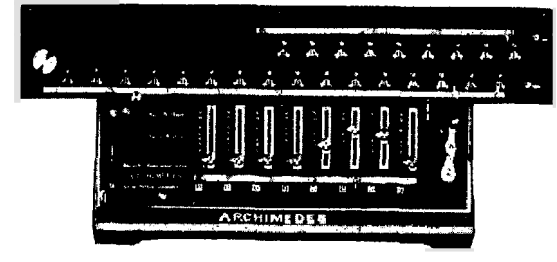

Figure 142
Model B.

Archimedes (1906)

This is a stepped drum machine similar to that described in the introduction. Both models A and B have the well-known slide-setting mechanism. Model A did not have tens-carry in the revolution; model B, however, was the first stepped drum machine to incorporate this feature. The two models do not differ materially from the remaining Glashiitter products with regard to size and weight.

Model C (1913) has slide setting, like model B, but was considerably smaller, so that the main disadvantage of the older stepped drum machines (widely spaced result windows) was considerably reduced. A setting check mechanism is provided that shows the digits of the entered value in a straight line. In the early model C machines the setting check mechanism was located below the setting slides. In a later version of this model it was located above the setting slides. Decimal point indicators are provided in all three window rows. Above the individual windows of the result mechanism are located knobs for setting the dividend or for correcting (rounding off) the result. They can only be turned either to the right or to the left when the carriage has been lifted.

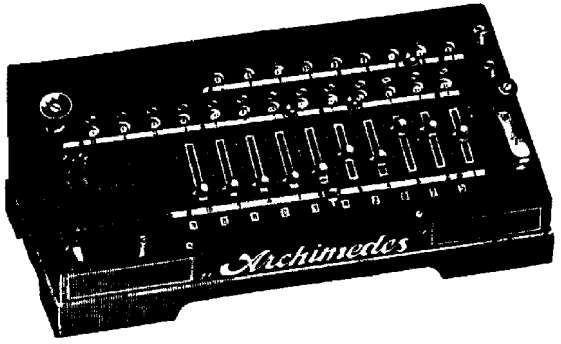

Figure 143
Model C (older version)

Model D (1915) is generally the same as model C, but it has key setting instead of setting slides. A lever is provided at the right of the keyboard that. when set to ***AS,*** results in automatic clearing of the depressed digits at the end of every crank revolution during addition and subtraction. This device enables stepped drum machines to add with the same speed as the full-keyboard adding machines. Shifting this lever to point to ***MD*** sets the machine for multiplication and division, or addition and subtraction, if an identical amount occurs repeatedly in a column—the amount need only be entered once and the crank is turned a corresponding number of times.

Below this lever a zero-setting key that clears all depressed keys. Individual keys may be cleared by slight displacement of the zero-setting buttons located below each key column. In this model the crank is arranged on the right side but, if desired, it may be provided on the left side so that people whose right arms are missing may operate the machine. The keys are only depressed to a depth of seven millimeters.

Models C and D may be equipped with an electric drive, which involves an additional cost of 900 marks. Machines with two calculating mechanisms are in preparation.

Model E is also a keyboard calculating machine. In multiplication and division the decimal shift of the counting mechanism occurs automatically in both directions by electrically driven actuating gears. The machine may be operated from any electrical power source. The motor operates only during calculation and requires approximately 16 to 20 watts—in other words, scarcely as much as a light bulb. If the electric current should fail, shifting a lever adapts the machine for operation by a hand crank; movement of the carriage also occurs automatically in this manual mode.

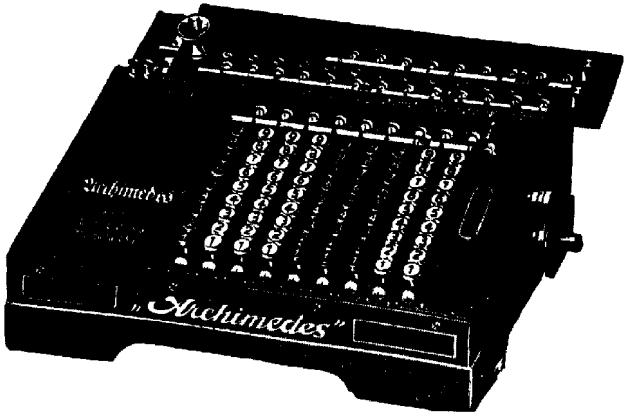

Figure 144
Model D.

The last model is the Archimedes Junior (1925), which meets the demands for a small, light, cheap, and yet entirely reliable calculating machine. It has all the advantages and features of the other Archimedes models.

Models:

Model	Places in the result mechanism	Places in the setting mechanism	Places in the revolution mechanism	Weight in kilograms	Price in marks
C 13	13	10	8	6.5	875
C 16	16	10	9	7.0	970
C 20	20	10	11	7.5	1100
C 12/24	24	12	12	9.0	1470
D 13	13	9	8	11.0	1260
D 16	16	9	9	12.0	1420
D 20	20	10	11	13.0	1630
D 12/16	16	12	9	12.5	1630
D 12/20	20	12	11	12.8	1800
D 12/24	24	12	13	13.0	2100
D 14/24	24	14	13	15.5	2300

Details regarding models E and Junior are still lacking.

Figure 145

Manufacturer: originally Fisher and Pöthig of Glashütte, and since 1912 Glashütter Rechenmaschinenfabrik Reinhold Pothig of Glashutte, Saxony.

Contostyle (1906)

Designer: Henry Goldman of Chicago. The machine was also called Arithstyle and was manufactured by Gesellschaft fur Maschinenbau und elektrische Neuheiten G.m.b.H., Hafenplatz, 5, Berlin, and sold by Henry Goldman of Berlin. The factory is no longer in existence, and production of the machine has been discontinued. It is a nine-place miniature adding machine, with chain setting, without check windows, but with a decimal point indicator. Zero-setting of the calculating mechanism occurs by forward rotation of the small gear that can be seen on the right side. Subtraction takes place by means of complementary figures; provision is made in the machine for the correction of the units place in subtraction; all other places are to be read according to the left complementary digit row.

Austria (1906?)

This is a stepped drum machine similar *to* that described in the introduction. Manufacturers: Rechenmaschinenwerk, "Austria" Herzstark and Company, of Vienna, originally V/2 Morizgasse 2c and now XIII, linke Wienzeile 274.

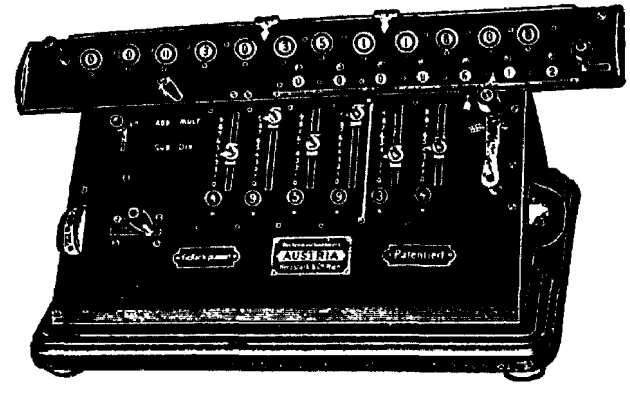

Figure 146
Model 3.

Model III: six places in the setting mechanism, twelve places in the result mechanism. and seven places in the revolution counter.

Model IV: seven places in the setting mechanism, twelve places in the result mechanism, and seven places in the revolution counter. The machine is provided with a crank lock against erroneous operation and also possesses a device for moving the carriage one place at a time by the push of a key. The machine may also be equipped with a double carriage or with a double-carriage electric drive, and a mechanism for setting the multiplier by multiplication keys provided on the right side of the machine, each of which, when depressed, carries out a multiplication by a single-digit amount. The maker calls this model Elektromens.

Model V: this model has seven places in the setting mechanism, fourteen places in the result mechanism, and seven places in the revolution counter. It has a device that, in division, locks the crank in place if a larger value is being deducted from a smaller value.

Model VI: has nine places in the setting mechanism, eighteen places in the result mechanism, and nine places in the revolution counter. It has a keyboard setting capable of automatic release during addition. This model may be supplied with electric drive.

All models have setting check windows.

In former years the machine was available in Germany. At one time it was sold there under the name of Austro-Germania.

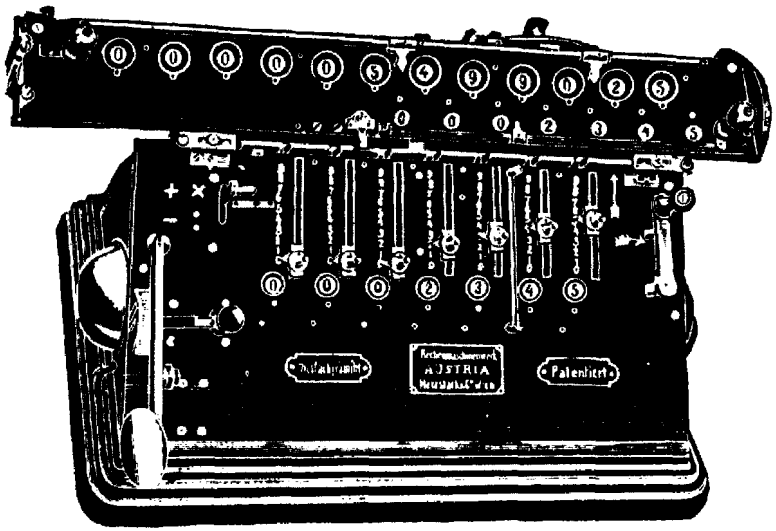

Figure 147
Model 4 (Austria)

Adsumudi (1907)

Designer: Alois Salcher of Innsbruck. Manufacturer: Uhrenfabrik C. Werner of Villingen in Baden. The factory is no longer in existence, and production of the machine was discontinued about 1908.

It is an adding and subtracting machine that is also capable of multiplication and division when multiplication slides (as shown in figure **148)** are attached. The machine has a second row of result windows so that the result of the main calculation may be stored for possible later use. Entry of numbers is done with the aid of the slides held under the pressure of springs. The even numbers may be found at the right side and the odd ones at the left of the slides, which are just above the setting check windows. These windows, in which every entered amount becomes visible, are driven by a double rack (which fornis an extension of the setting slide in the interior of the machine) that serves to convert the motion of the slide to a corresponding rotation of a gear located between the two racks, which turns a numeral dial located above the gear to the right or to the left. The right rack acts in an additive, the left in a subtractive sense.

If one intends to add with the machine, the first amount is entered by means

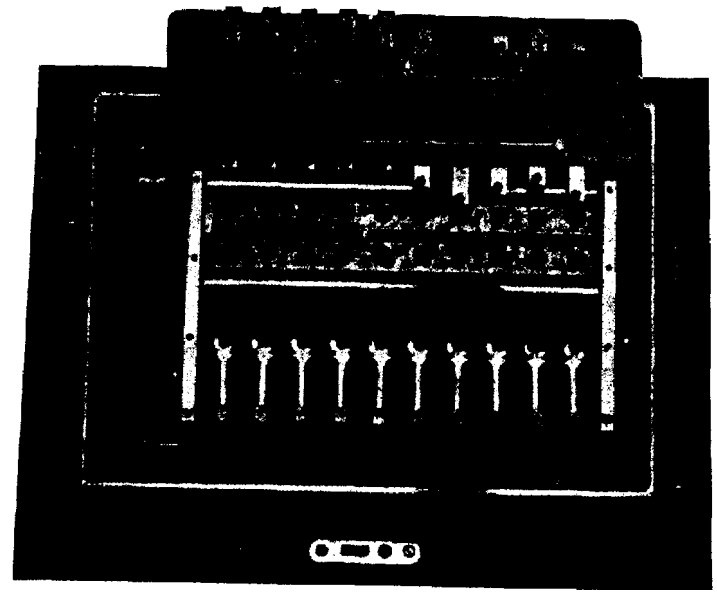

Figure 148

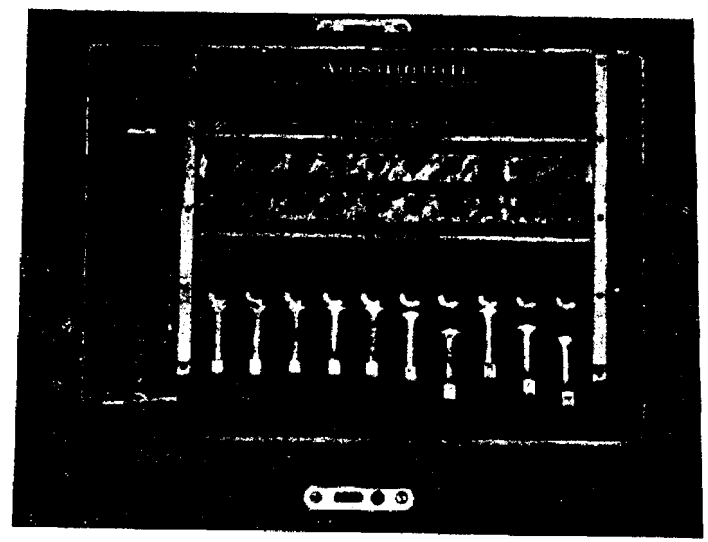

Figure 149

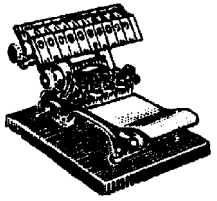

Figure 150

of the setting slides, then the machine is adjusted for addition, and the lever situated at the left of the machine is raised. This allows springs to return all setting slides their initial positions. The racks mesh with the gears of the adding disks and turn them so that the amount set may be read in the result windows. Additional items may be added in the same way.

In division the larger amount is first introduced into the result windows, then the smaller amount is entered by means of the slides.[66] The machine is adjusted for subtraction and the previously mentioned lever is raised, which effects release of the slides causing them to snap back into their initial position and thus turning the numeral disks in a substractive direction. As previously mentioned, multiplication and division occur by applying a special multiplication slide. The machine was available with ten places, but it never gained any importance.

Heureka (1907)

This is an adding machine with only nine keys but ten places in the result mechanism. It was manufactured and sold by the A.G. for the technical industry in Zurich. A small number of these machines were, in their time, sold in Switzerland and France and individual machines may be found in Germany and London. Production has long since been discontinued, and the firm that manufactured the machine has long ago ceased to exist.

Soll and Haben (1907)

The inventor of this machine is the bank accountant Karl Kettlitz of Breslau IX, Adalberstrasse 9. Models of this machine have been prepared, but up to now the machine has not been put into production.

66. Martin clearly has the word *division* at this point. but the editors believe that *subtraction* would be more to the point.

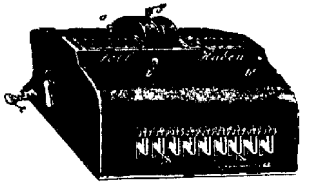

Figure 151

It is a nine-key adding machine with which columns of digits, and even multidigit values, may be added. It is intended for current account calculations and thus has two separate counting mechanisms, one for debit items and the other for credit items. Both types of numbers may be entered at random. If both columns have been added up and the balance is to be computed, the mechanism exhibiting the smaller sum is set to zero, which leaves the balance in the other calculating mechanism. The machine is said to perform multiplications and divisions as well.

Ensign (1907)

This is a highly developed, electrically driven adding and subtracting machine particularly suited for multiplication, and in this respect it exceeds many other American machines.

On the exterior of the machine is a keyboard containing complementary digits for subtraction and division. At the right of the keyboard there is a long

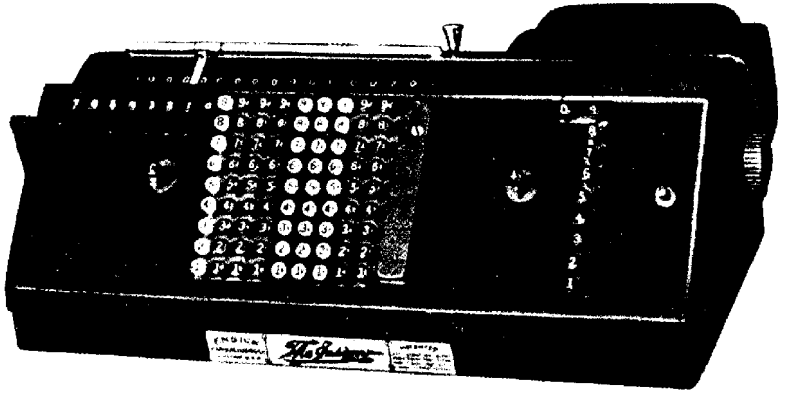

Figure 152

adding key, further to the right is the division key, and finally the multiplication keys marked 0 to 9. To the left of the keyboard is a key that allows the value entered on the keyboard to be locked in place. At the top left is the revolution counter, and above this, within the carriage, is the result mechanism with sliding decimal marker and the carriage handle. The keys are self-correcting.

Addition: The **first** amount is entered in the customary way; the long adding key is depressed, and this transmits the amount to the result mechanism. Any number of additional items may be added in this way. The added items are counted in the revolution counter. In order to set the machine to zero, the carriage must be placed to the extreme left. Then the small lever (to the left of the revolution counting mechanism) is quickly depressed into the machine, and both counting mechanisms are cleared. The keyboard may be divided so that two rows of items may be simultaneously added by the machine (for instance, debit and credit items).

Subtraction: This operation takes place in the same manner as addition, but the amount must be entered by using the small complementary digits.

Multiplication: The multiplicand is entered in the usual manner. If it is intended to multiply it by 205, the digit 5 of the multiplier keys is first pressed, then 0, and finally 2; the result may be read in the result mechanism. The multiplier may be read in the revolution counter and the multiplicand in the keyboard, which provides a check on the operation.

Division: First the division key is pressed, then the zero of the multiplication keys is kept depressed until the carriage is positioned to the extreme right of the machine. Now the dividend is entered, and the long adding key is pushed, which transmits this amount into the result mechanism. The digit 1, which appears in the revolution counter because of the above action, is cleared, and the divisor minus **1** is set into the keyboard, by using the complementary digits, in such a way that the left-hand digits of the values are aligned. All the keys to the left of the divisor must be set to nines. An estimate is then made as to how often the divisor is contained in the dividend: if, for example, the estimate is two, then the 2 key of the multiplication row is depressed, the machine commences operation, and the digit 2 appears in the revolution counter. The carriage is now shifted by one place to the left. and the division is continued in the manner explained. The result may be found in the revolution counter, a repetition of this quotient in the left of the result mechanism, and the undivided remainder, if any, in the right portion of the result mechanism (separated from the other numbers by zeros).

The machine is available in two models:

Model 75	7 × 5 × 12 places	$450.00
Model 90	9 × 7 × 16 places	$500.00

Manufacturer: The Ensign Company, Brighton District, Boston, Massachusetts. This machine has not, up to now, been introduced into Europe. The designer is Emory **A.** Ensign of Boston.

Tim (1907)

The Tim is a stepped drum machine (Thomas system), similar to the general description given the introduction. Manufacturer: Ludwig Spitz and Co. of Berlin-Tempelhof, Eresburgstr.

Originally the machine was supplied built into a wooden case. In 1909 the machine was improved by the engineer Robert Rein. The particular characteristics of the improvement will be described. A cast iron housing with a tight-fitting central bearing plate **took** the place of the wooden case and of the brass bearing plates. The bearing plate at the back, which serves as support for the result mechanism and for the locking disk shafts,[67] and the bearing plate at the front, which serves as support for the locking disk shafts, the stepped drum shafts, the drive shaft, the crank shaft, and the setting slides, are screwed to the housing. Thus all the movable parts of the machine are supported by three cast pieces.

The Tim machine differs materially from the other stepped drum machines with regard to the performance of the counter mechanism. To be sure, in the Tim machine the movement of the entire mechanism originates from the counter mechanism and the tip (3) of the actuating arm (2) is pressed down, the actuating arm (2) operates the lever ***(5)*** by means of a pin (6) that slides in the center of the bearing plate **(1).** In other words, in this machine the lever is located on the other side of the central bearing plate (1). Now comes the great simplification of design: the guide rod, with the spring and fork, has been dispensed with. The lever engages directly, without any intermediate mechanism, the annular groove (7) of the hub of the actuating tooth (8) for the tens wheel. Another improvement is the separation of this hub from the

67. **The editors freely admit that they have no idea what a "locking disk shaft" is.**

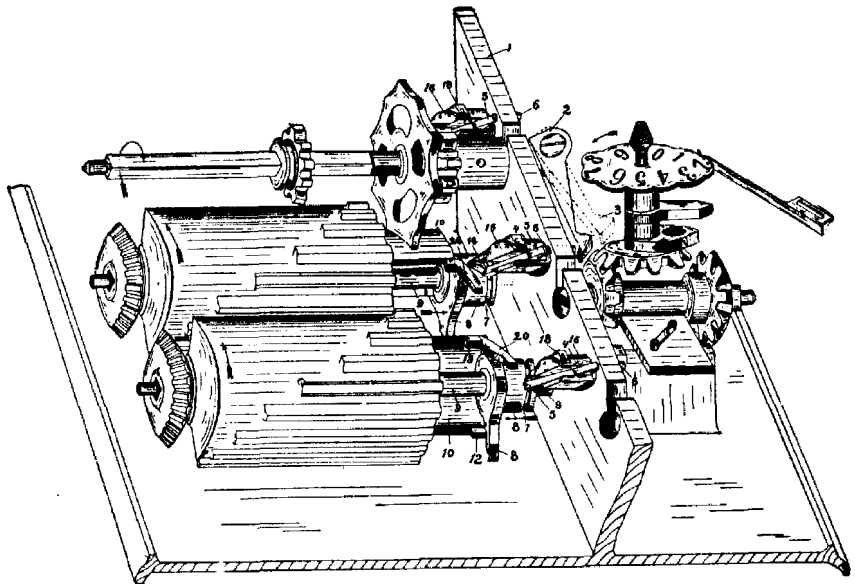

Figure 153

locking cylinder (10), thus this heavy part no longer partakes in the movement. Additionally the whole arrangement **is** made positive by the fact that lever (5), when actuated, is locked by steel piece (18), and is again unlocked at the appropriate time by cam (20). Thus, the number and mass of movable parts has been reduced. The number has been reduced by elimination of the guide rod (12) and spring and fork, and the mass has been reduced by the fact that the actuating knob is no longer integral with the locking cylinder, and hence this heavy part need no longer be moved. When in use, these improvements demonstrate themselves primarily by the quietness of operation, the easy rotation of the crank, and last, but not least, by correct results no matter how hastily the crank is turned.

It will be seen from the figures that the values entered are indicated in a special row of windows. The levers that can be seen below the setting slides serve as general or group clearing devices. They permit any desired number of setting slides, on the left or on the right, to be set to zero. If a lever in the middle is raised, then all slides to the right move to zero, and if it is depressed, all slides to the left move to zero. When either the rightmost lever is depressed or the extreme left lever is raised, **all** of the setting levers snap back

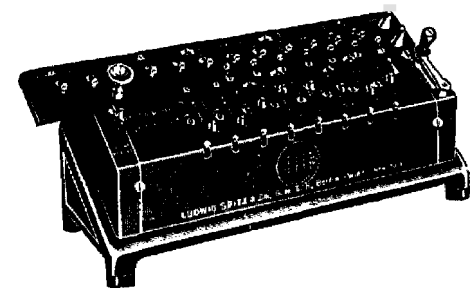

Figure 154
Slide setting, manual drive

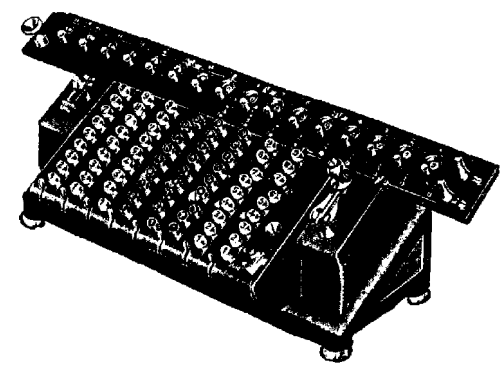

Figure 155
Key setting. manual **drive.**

to zero. This arrangement is an appreciable timesaving device. The front plate and the carriage are arranged in such a manner that they may be conveniently detached in order that the machine may be opened for cleaning and lubrication without using a tool. Multicolored decimal point markers are provided for all rows of windows.

Setting knobs are provided below the windows of the result mechanism ***so*** that digits may be entered directly.

The Tim machine also has a version with key setting. These keys allow one to set up eight- to ten-place numbers by a single depression of the corresponding keys. During addition the zero setting of the keys occurs automatically, in the usual way, during each turn of the crank. **All** advantages of the machine with slide setting have been fully retained.

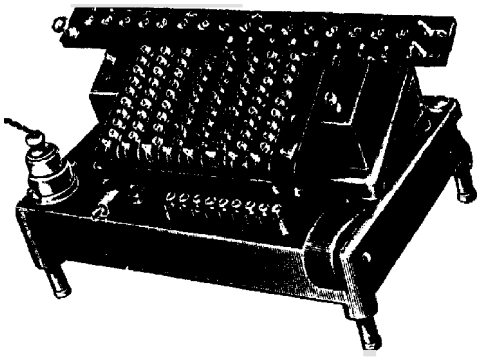

Figure 156
Key setting. electric drive

Both of the models described may be equipped with an electric drive usable with any kind of current; it may also be fitted to previously supplied machines, except those in wooden cases, by simply returning it to the factory for a few days. In a machine having electric drive, the turning of the crank is completely eliminated. It is only necessary to depress one of the multiplication keys and the machine immediately begins to calculate automatically; the entered amount and the desired value appear automatically in the result and revolution counter mechanisms respectively. Thus, in the Tim machine, both factors may be entered by means of keys.

All three models of the Tim machine and the Unitas machine are manufactured in the following sizes:

Size	Digits in the setting mechanism	Digits in the result mechanism	Digits in the revolution counter
II	8	12	7
III	8	16	9
IV	10	16	9
V	10	20	11

Unitas (1907)

Unitas is a trade name for the Tim equipped with a double counting mechanism, designed by the engineer Robert Rein, who passed away on 8 January

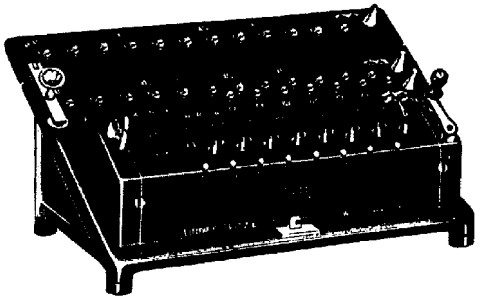

Figure 157
Slide setting. manual drive

1921. The Unitas was originally supplied in a wooden chest, but since 1909 it has been furnished in the form illustrated in figure 157.

The reversing levers, positioned to the left of the setting slides, are capable of setting both counting mechanisms to addition or subtraction, or of setting either one to add while the other subtracts. This considerably increases the applicability of the machine. It is possible to simultaneously subtract a result, computed in the first result mechanism by multiplication, from a given value in the second calculating mechanism. For instance:

63 meters @ 4.25 =	267.75
57 meters @ 3.75 =	213.75
78 meters @ 5.27 =	411.05
	892.56
Less 7¾% discount	69.17
	823.39

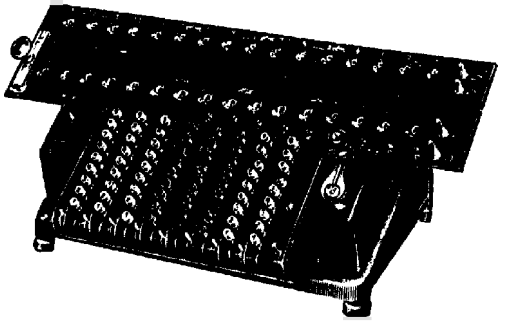

Figure 158
Key setting, manual drive.

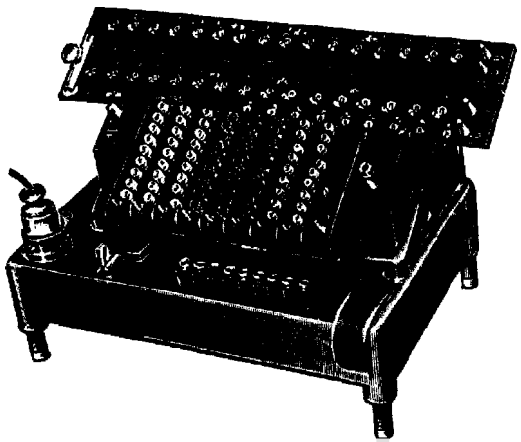

Figure 159
Key setting, electric **drive**

The Unitas may therefore be regarded as a machine unsurpassed in its efficiency.

The Unitas is also supplied with keyboard settings. and both models are available with electrical drive. Like the Tim, it is manufactured in four sizes, with identical numbers of places.

Manufacturer: Ludwig Spitz and Company, Ltd., Berlin-Tempelholf, Eresburperstr.

Madas (1908)

The word Madas is composed of the initial letters **of** the words Multiplication, Automatic Division, Addition, and Subtraction. The machine belongs *to* the class **of** stepped drum machines but has automatic division. In all other calculating machines, division requires great attention on the part of the operator because a relatively large number of different kinds of manipulations. and even corrections, are necessary for every individual place of the quotient. The Madas divides entirely automatically. All that is necessary is to enter the dividend and the divisor and then to turn the crank until the bell sounds, which indicates that the division has come to an end. The computation of the quotient, the shifting of the carriage, and the indication of the remainder are automatically taken care of by the machine.

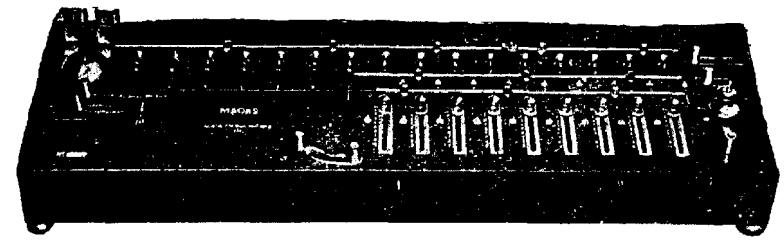

Figure 160
Madas with **slide setting. hand** drive.

Aside from automatic division, the Madas exhibits several additional advantages compared to other stepped drum machines. The lifting of the carriage has been eliminated, thus displacement **of** the carriage from place to place or **over** its total path of travel, clearing of the two rows of windows, and setting up of digits in the result row, may all occur when the carriage is in its normal position. Moreover the Madas possesses devices intended to prevent errors in operation: most of the handles in the machine have ingenious interlocks **so** that none of them may be operated when another one has been incorrectly set.

On the exterior, the Madas differs from the general description of stepped drum machines as given in the introduction in several points. Located between the slide slots are windows from which the amounts set may be read in a straight line. A lever is provided to the left of the last setting slot by means of which all setting slides may be returned to their initial positions.

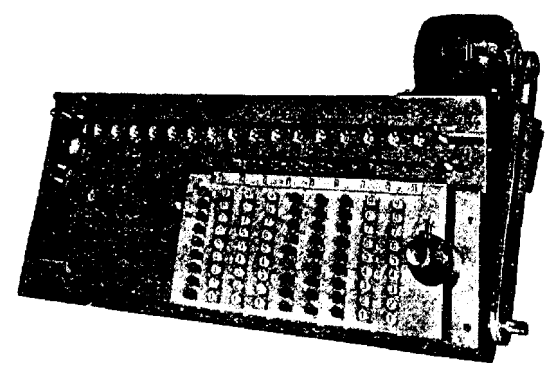

Figure 161
Madas with key setting and **electric drive**

The two levers located above the bell serve for moving the carrige from place to place and over its total path of travel. The knob for automatic division is located below the bell—this knob is to be pushed to the left. Upon termination of automatic division, the digit 0 must appear in the window below the automatic division button, otherwise it is necessary to make one or two additional turns of the crank.

Designer: Erwin Jahnz, Manufacturer: H.W. Egli, A.G. in Zurich, 2.

Models:

7 x 7 x 12 places, slide setting, manual operation or electric drive

7 x 7 x 12 places, with keyboard, manual operation or electric drive

9 x 7 x 12 places. with keyboard. manual operation or electric drive

9 × 9 x 16 places, slide setting, manual operation or electric drive

9 × 9 x 16 places, with keyboard, manual operation or electric drive

11 x 9 x 16 places, slide setting or keyboard, and a divided 0 setting, manual operation or electric drive

11 x 7 x 16 places (for English currency), slide setting, manual operation or electric drive; or keyboard, manual operation or electric drive

Bunzel-Delton (1908)

This is a stepped drum machine. The designer was Hugo Bunzel, a calligraphy teacher and former painter in Prague. The manufacturer was the Bunzel-Delton-Werk Fabrik automatischer Schreib- und Kechenmaschinen, Favoritenstrasse 194, Wien X.

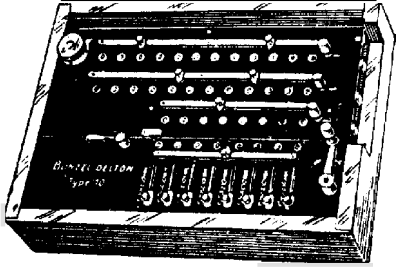

Figure 162

The machine was supplied with one and two result mechanisms, with and without tens-carry in the revolution counter, and with additional stepped drums. In some machines one could switch from addition-multiplication to subtraction-division by reversing the direction of the crank. A number of different sizes were available. Factories were set up in Austria, Germany, Italy, and France, although the number of units sold was never large. At the end of 1915. production was stopped because of the death of the factory owner. Since that time, a Bunzel-Delton calculating machine factory has been set up again (12 Klimschg., Vienna III/1), although there are no details available about their machine at this time.

Kosmos (1908?)

This is a full-keyboard machine. manufactured only for English currency, by the British Calculators Ltd.. Belfast Rd, Stoke Newington, London N. The firm is no longer in existence.

The machine has three columns for pounds, ten keys for shillings, eleven tor pence, and three for farthings. On the left of the keyboard is a zero-setting key; when this is pressed, while at the same time the crank is turned as far as it can go. all the viewing windows are simultaneously set to zero. Apparently there was also a model constructed with five columns for pounds.

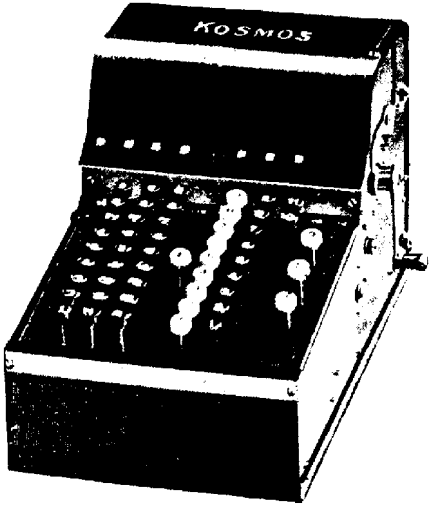

Figure 163