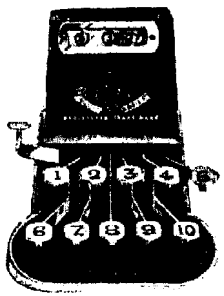


Figure 164

Adder (1908)

This is a ten-key adding machine intended only for the addition of single columns of digits. In operation it is similar to the Adix. It was manufactured in London and sold for two guineas, although production has been stopped for some time now.

Lightning Calculator (1908)

This is a seven-place adding machine, similar to the machine of Michel Baum, although it does not equal it in quality. For any digit over five, it is necessary to move the adding stylus quite a distance. It is not possible to check whether or **not** the correct amount has been entered, and all the calculating gears used have to be returned to zero individually. The viewing windows. visible above the setting gears, are used to read sums, while the results from subtraction appear in the setting windows of digit 9. Tens-carry is automatic. Dimensions: 30 × 8½ x 5 cm. Price $15. Manufacturer: Calculator Company. Grand Rapids, Mich.

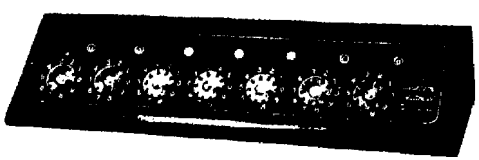


Figure 165

Figure 166

Figure 167
Calculator.

Pangborn Adding Machine (1908)

This machine comes from the same factory as the Lightning Calculator, but it docs not have any special viewing windows for sums. Results of addition appear as red figures and subtraction results as white figures in the setting gears. In **ail** other respects, the Pangborn is identical to the Lightning Calculator — including the price.

The same machine is also available without a stand and is **simply** called Calculator. The price of this machine is $7.50 (out of sheet steel) and $10.00 (out of plated steel), although these prices may no longer he valid. It can be assumed here that the Calculator is identical to the Calcumeter described earlier.[68]

Pebalia (1908)

This is the design of Vinzenz Edlen of Pebal. It has the same type of digit disks that were in the machine Michel Baum brought onto the market **as** a torcrunner to his machine. It has direct subtraction, which means that the digits to be subtracted arc entered by turning the gears backwards. This would

68. Examination of devices in the National Museum of American History Collections suggests that while the Lightning Calculator. the Calculator, and the Calcumeter are similar, they arc not identical.

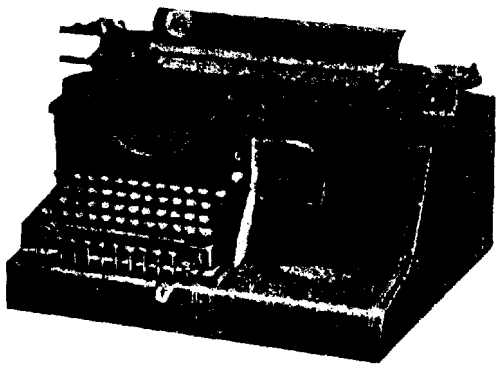


Figure 168

have been an ideal solution if the machine had not become too long, thereby slowing down the entry of numbers. There was also a five-place model of this machine (Triona) that was built into a case; this was used as a household money box with calculating device, however manufacture was soon halted.

Duntley (1908)

Figure 168 shows the Duntley adding and subtracting machine of the Duntley Adding Machine Company, 1010 Fisher Bldg., Chicago, in combination with a Monarch typewriter. For some time now the machine has not been manufactured and has remained essentially unknown, even in America.

Bordt (1908)

The Bordt is from the same designer as the Adix described earlier but is a printing, full-keyboard, adding machine. Digits to be added are simply entered into the keyboard according to their decimal place and value, the crank is moved up and then down again to carry out the addition, and the keys return once more to their rest position. The result can be seen through the viewing windows above the keyboard every time movement of the crank is complete. Before the beginning of any new addition, the machine must be cleared, i.e., set on zero. This is done by raising the zeroing lever and then turning the zero-position crank from left to right—all the viewing windows will then show zero.

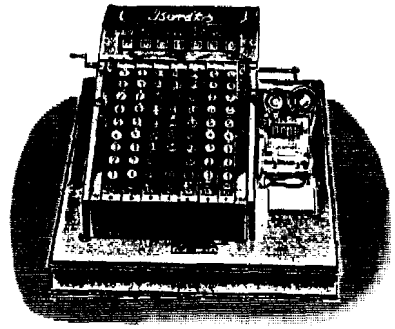


Figure 169

For each decimal place there is a correction key located below the 1 key. Each time an incorrect digit has been entered, the correction key, at the relevant decimal place, is pressed, and the incorrect key springs back to the rest position. In addition to these keys, there is also a correction lever on the left side of the machine used to erase a complete number, several digits long, that has been incorrectly entered. If this lever is pressed down, it raises all the keys in all decimal places. As soon as a key has been pressed, all those in the corresponding decimal place are locked to avoid accidental entry errors. The correction lever also saves having to press the same keys more than once—it can be pushed up, causing those digits that have been pressed once to remain in their position; all that is needed to add the same number several times is to move the crank up and down.

There is a printing device attached to the right side of the machine that may be used to check the numbers entered. During addition it is possible to check the digits entered and, if necessary, to add any notes by hand. Printing is visible immediately. The holder for the roll of paper is installed at the front right edge of the board upon which the machine is mounted. The roll is then fed to the paper transport feed reel, and the wing nut next to the reel is turned from left to right until the paper passes out about two centimeters above the rubber base. The paper strip will automatically move again as soon as the crank moves. The machine can add and print, or add without printing, depending on the position of the lever attached to the crank shaft. If it is pushed up so that it is in the same position as the crank shaft itself, then the machine is set for printing. If the lever is pulled down, then the printing device is switched off.

If zeros are not to be printed in front of the numbers, there is a zero-

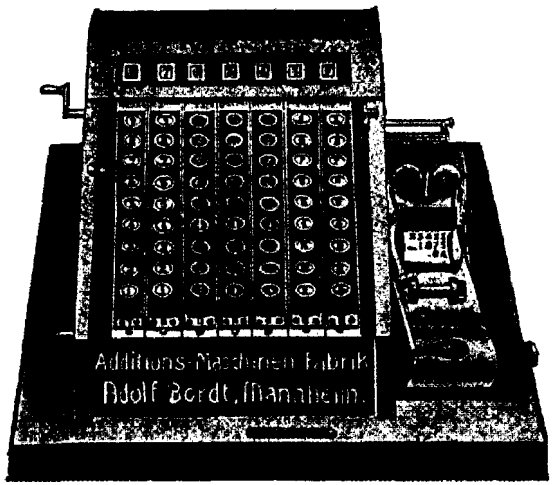


Figure 170

covering mechanism that automatically removes the zeros on the left side by means of a sturdy little plate. This plate has to be replaced from time to time, but this is easily done by simply taking out the old one and inserting a new one onto the shaft.

When a column has been added up, and the result is to be printed, the crank must first be moved: i.e., a dummy operation is carried out in order to make a gap on the paper strip. It is then necessary to enter the number appearing in the windows of the result mechanism. A key, standing alone on the left side next to the keyboard, is then pressed, after which the crank is moved, and the result appears on the checking paper strip. If this key is held down, then the printing repeats itself as long as the crank is operated. The digits are not printed by means of a colored ribbon but rather a colored pad, which from time to time must be resoaked with fresh stamping ink. This can be done using a small paintbrush.

In 1910 the Bordt was improved. The result mechanism now has an eighth digit place, so that the seventh column of keys may be used for addition. The printing mechanism has a colored ribbon that runs automatically and switches automatically from one side to the other. The machine is also available without a printing mechanism. Price: 450 marks.

Manufacture was later moved to Leipzig, and the name of the firm changed to Bordt and Behrens. The Adma, which has already been referred to in the discussion of the Adix, was later to develop out of the Bordt.

Greif (1908)

This is a small adding machine with chain drive, similar to the Argos. It was distributed in both Germany and France (Griffon-Duplex). Manufacturer: Gesellschaft Fur Maschinenbau und Elektrische Neuheiten, G.m.b.H., 2 Bach St., Berlin NW, and later 22 Karlsbader St., W. 35. The firm is no longer in existence, and the machine is no longer manufactured.

Dennis (1908)

This is an adding and subtracting machine that can be used with a typewriter. It is from the same designer as the National although it has never gotten past the trial period.

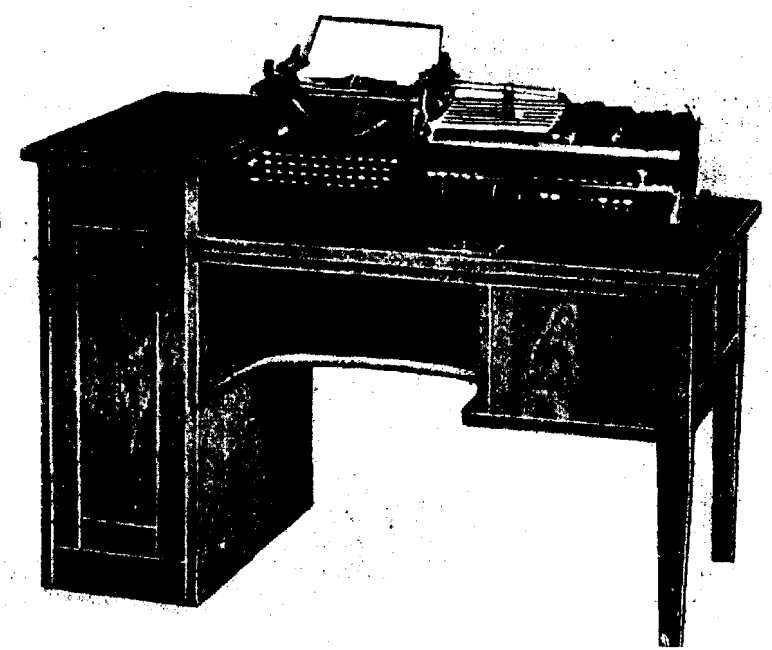


Figure 171
Dennis.

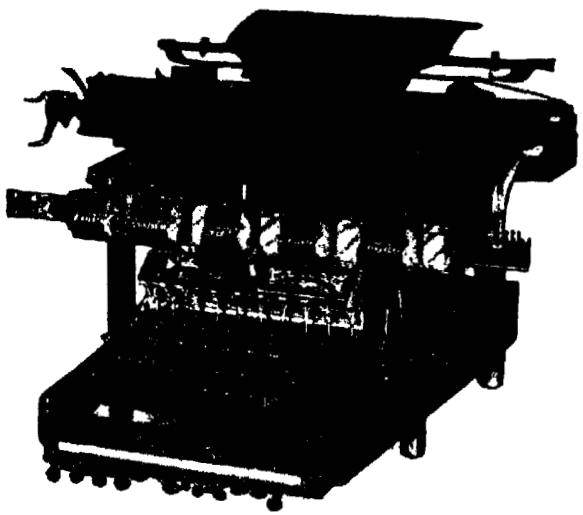


Figure 172

Wahl Adding and Subtracting Device (1908)

The Wahl adding and subtracting device can only be used when connected to a typewriter. Exclusive right of use was acquired by the Union Typewriter Company. the well-known manufacturer of the Remington, Smith Premier (with full keyboard), Monarch, and Yost. It is only with these four machines that the Wahl adding and subtracting device can be used. The Remington. whose printing was of the blind. or hidden, variety at this early date, was the first to be supplied with it. Shortly afterwards the company brought out a model with visible typing. This model was immediately equipped with the device and, somewhat later, so was the Monarch. Production of the Monarch machine stopped in 1921; that is, the product was renamed from this time onward the Smith Premier, although. as opposed to the Smith Premier (with full keyboard), it operated with only uppercase. It is illustrated in figure 178. Both the Smith Premier (with full keyboard) and the Yost (visible printing models of both these kinds only) were equipped with the Wahl device, white the earlier hidden printing models were not equipped for addition and subtraction. In 1923. the typewriter firm discontinued both brands. Today only the Remington and the Smith Premier, both dual case, are available with the Wahl adding and subtracting device.

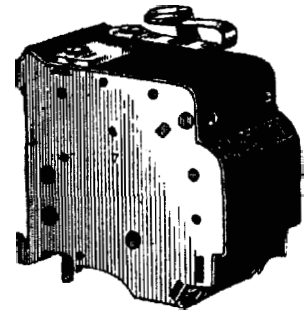


Figure 173

The device consists largely of an actuator and one or more calculating mechanisms. Above the typing keys is a boxlike device that belongs to the counting mechanism. This is the actuator from which rods lead down and connect. in turn. to the digit keys. The calculating mechanisms are placed on a rod running diagonally across the machine. One such calculating mechanism is shown in figure 173. This case is less than 4 cm high and 3 cm wide. On the inside there are small disks, indented on one side, printed with the digits 0 to 9; these are placed vertically next to one another. They are set in motion by pressing the two gear wheels attached to the typewriter. This is the same system, only on a smaller scale, as it used in the well-known large calculating machines. The two gears rotate around themselves simultaneously with the number disks. The typist will meet a certain resistance when typing the numbers, arid this causes a delay in the action of the machine. The bigger the value of the digit to be added, the longer the delay in action is. although it should be pointed out that this is really quite minimal and something one soon gets used to.

To attach the device to a rod, a small lever must be pressed. This automatically causes the lower groove of the calculating mechanism to lock into a lower disk. After it is attached, it is possible to shift the calculating mechanism to either side but with little or no clearance either above or below. When the place where the column should appear on the paper has been located, the calculating mechanism is shifted to this position and fixed there. If there are several columns in the calculation, then several calculating mechanisms will be needed. Up to thirty calculating mechanisms (Monarch 32) can be attached depending on the width of the carriage. As the typewriter moves

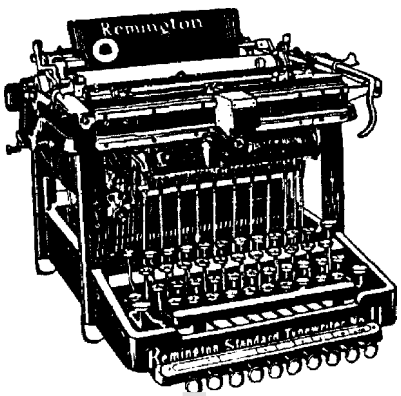


Figure 174
Remington with one calculating mechanism

sideways, the calculating mechanisms move along with it. The actuator. however. does not move, as it is fixed to the body of the machine.

In order to add or subtract, the typewriter must first be connected to the adding and subtracting machine. This is done by shifting a lever on the left side of the actuator. In order to add, the actuator must be set on addition. When this is done. and the digit key (say 3) is pressed, then the calculating mechanisms mesh in the row of digits that is in gear with the actuator. The number 3 appears in the result window. If the carriage of the typewriter is shifted back the space of one letter and the digit 4 is pressed. the corresponding calculating mechanism will show 7. In order to subtract 2 from this sum, the actuator must be set on subtraction and the carriage shifted back one letter space; when the digit 2 is pressed. the calculating mechanism will move to show 5. The gears rotate forward or backward according to whether they are performing addition or subtraction. The machine only begins to add if the actuator. itself stationary, comes into gear with the calculating mechanism which moves along with the carriage.

How does such a machine operate in practice'! In order to produce a statement of account, all the debit items are entered in the first column and, by so doing. are automatically added up. The calculating mechanism is then shifted to the second column where all credit items are entered. The entering of the credit items must only be done after the calculating mechanism has already been set on subtraction—this ensures that each individual credit item, as it is typed. is subtracted from the sum of debit items without the typist having to

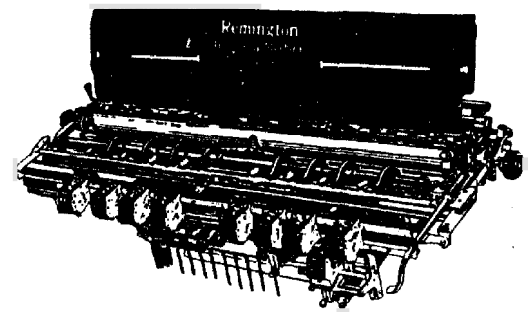


Figure 175
Carriage of a Remington with eight calculating mechanisms and cross footer.

do anything extra. When all the credit items have been entered, the amount remaining in the calculating mechanism represents the balance that must be typed into the credit column (in red if necessary). If the calculation is correct, that is, if the typist has not made a mistake in reading or typing, the calculating mechanism will show a result of zero. To finish off the account, there is nothing to do except enter the sum of the debits underneath the calculation. This example shows that it is possible to use one calculating mechanism for two columns.

Let us assume, for example, that there are accounts to be written, the amounts of which have already been entered into the account book and totaled. The individual entries are added up while being typed in and, as soon as the last item has been typed, the result of all the written totals appears in the calculating mechanism. If this total agrees with that already added up in the book, then this is proof that not only is the addition in the book correct but also that the individual amounts have been correctly entered. For this sort of work a single calculating mechanism is sufficient. For other operations. two calculating mechanisms are necessary. and in certain cases as many as thirty can be attached and used. All of these work independently of each other, and each gives the total for its column as soon as the typing has been finished. When transferring to another task. the calculating mechanisms must be reset to zero. This is done by setting the machine on subtraction; the amount in each calculating mechanism is entered, and this will cause the mechanism to return to zero.

In addition to those calculating mechanisms already mentioned, which can be provided in whatever number is convenient, the machine can also be

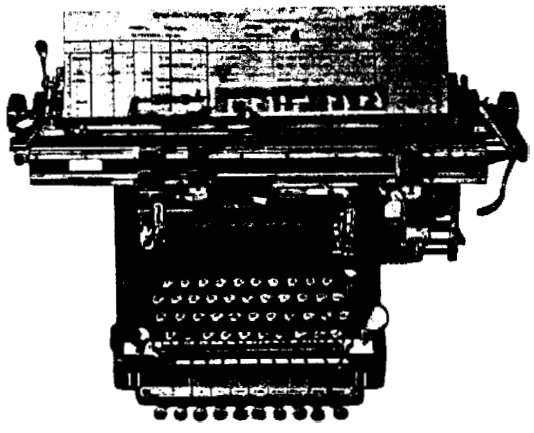


Figure 176

equipped with another adding and subtracting device. This does not move when the typewriter carriage shifts sideways but is situated to the right of the actuator and is used to add or subtract the amounts in calculating mechanisms, for vertical columns of numbers, in order to work out the balance. This second machine is called, in the United States. *cross-footer*—a name we have adopted; more correctly. however, we should say transverse adder.

How does such a machine operate? Let us assume, for example, that the following four columns are to be filled out:

old balance debit credit new balance

First the blank form is put into the machine. The four calculating mechanisms necessary for the task are attached in such a way that each comes over one of the four columns. All calculating mechanisms must be checked to make sure they are registering zero. Then the typewriter carriage is shifted (with the help of the proper tabulator) to the first column. The first amount, 200 marks, is entered and at the same time it is transferred into the respective calculating mechanism; it also appears in the viewing window of the cross footer. The carriage is shifted into the debit column and the amount of 50 marks is typed in; this is added in the second calculating mechanism, while the amount in the viewing window of the cross footer increases to *250* marks. The next amount, 10 marks, is typed into the credit column after the adding device has been set on subtraction; it immediately appears in that column's calculating mechanism but is subtracted from 250 marks—the amount which

is in the viewing window of the cross footer. If this amount is then entered into the column for "new balance" so that it appears in the calculating mechanism for that column, then, at the same time, the amount disappears from the result mechanism of the cross footer. If, however, a mistake has been made so that the cross footer does not go to zero, the machine becomes locked. The rest of the items are added in the same way. The calculating mechanisms above the individual headings indicate the sum of all

old balances debit carryovers credit carryovers new balances

At the end of a day's work, it is possible to make a check; namely, the sum of the old balances, plus the sum of the debit items, minus the sum of the credit items should give the sum of the new balances. The cross footer mechanism can also be switched off so that, if necessary, amounts only appear in the respective calculating mechanisms without effecting the result in the cross footer.

The description so far concerns not only the Wahl device in combination with the nonvisible and visible typing Remington but also the Monarch, Yost, and Smith Premier with shift key. The Monarch and blind Remington were in fact available only with actuator and calculating mechanisms but not with cross footer. The next few lines will be given to the description of Remington-

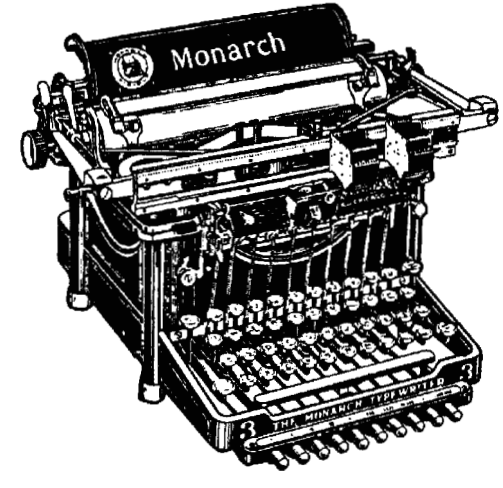


Figure 177
Monarch with two calculating mechanisms

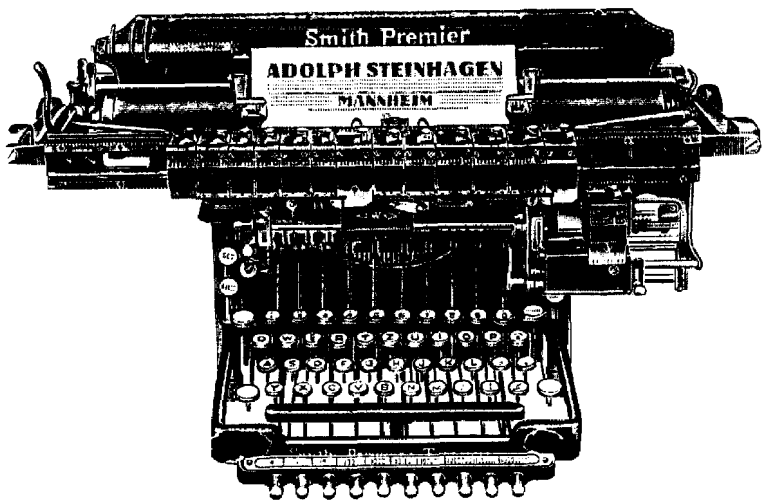


Figure 178
Smith Premier with provision for vertical and horizontal addition and subtraction

Wahl, since their factory made an especially large number of units for use in billing, or rather bookkeeping.

As is well known. the Reniington is also supplied with a divided (or divisible) platen cylinder. In this model, the right half responds to the right platen roll control knob. the left half to the left knob, although both halves can be connected so that they work as a whole, like the paper cylinder of a normal typewriter. With this machine it is possible to insert two forms next to one another and enter information into each of them. An example would be to take the account form on the left half and on the right half the book page containing only the total, not the details of the account. Making out the account and transferring the items to the book can be done simultaneously on the same machine. This method has three advantages. First, the work is carried out by one clerk. There is no longer any need for the clerk to wait for the account to be made out before he makes the transfer. Second, carbon paper is not needed to transfer to the book, as is standard practice in other billing methods, and, as everyone knows, carbon copies easily become indistinct when the book is frequently used. But the greatest advantage of all is that the columns are added simultaneously as the typing is being done.

For other reasons. it may well be desirable to have a machine available not only with a decimal place tabulator but also a column tabulator. Whereas the first is used. as is well known. to print columns of figures aligned according

to their decimal place, the second is to stop the carriage at the column positions of a form, allowing one to move from the first directly to the fourth, tenth, or fifteenth column by simply pressing a key and using the decimal place tabulator to align the value in use. Of course such a machine is only required when there are forms to be filled out with a great many columns. The column tabulator keys are attached above the calculating mechanisms of the respective columns. The label for each column can be attached to the key. Such a machine is illustrated in figure 175.

There is another special machine that, on payday, makes out the check at the same time as it fills out the statement of payment or the respective ledger page. The check forms used are simplified so that the name of the recipient and the amount in words and figures are all on one line, and the date is printed or is put in by means of a stamp. Since this machine is equipped with the standard calculating mechanisms and billing device, it permits the use of a ledger page and, independently, another form. Hence the booking entry and check may be typed in one operation. For example, if the ledger page has fifteen lines. and can therefore take fifteen entries, it is possible to insert fifteen different check forms. one check for each line of the ledger. The machine is equipped with type heads that perforate the paper so that it is not possible to increase the amount or write in another payee (with intent to defraud). There is also the added security that the value of the check should correspond to the amount in the ledger and furthermore the possibility of automatically adding the individual amounts in the columns of the ledger at the same time as the values of the checks. With this machine up to 800 ledger entries, and just as many checks, can be made in an eight-hour working day. A machine like this is illustrated in figure 176. It is usually only supplied with capital letters, therefore it comes without shift keys.

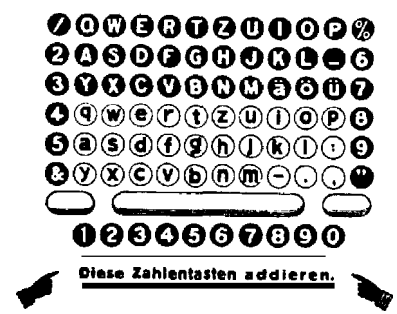


Figure 179

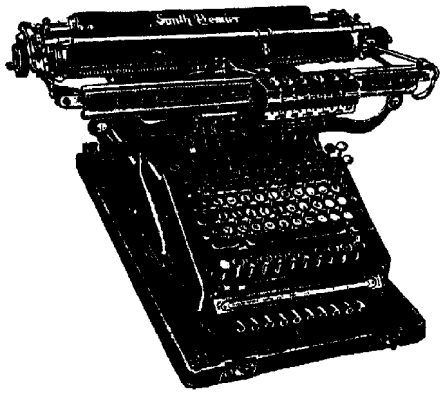


Figure 180

These are only a few examples of both the capability and versatility of the Remington in combination with the Wahl adding and subtracting device. It is the responsibility of the retailer to tailor the machine to the individual needs of the buyer. The fact that no less than ninety-six different totaling mechanisms are available for different currencies; apothecary's weights; tons and hundredweights; hours, minutes, and seconds; dozens and fractions; yards, feet, and inches, etc.. shows how the machine has developed in versatility, to the extent that there is hardly a business in existence for which the Remington with an adding device would not be of use.

The prices for the Remington Typewriter with actuator, but without calculating mechanisms. range between $210.00 and **$277.50,** depending on the width of the carriage. With actuator and cross footer, they range from **$397.50** to $480.00, again depending on carriage width. Calculating mechanisms cost, for example, $55.00 for a four-place one, and units up to ten-places can be obtained at a cost of $5.00 for each extra place. Prices for the Smith Premier with shift are similar, as are those of the Smith Premier with full keyboard as well as the Monarch and Yost.

In **1924** there appeared a new model of the Remington with the Wahl adding and subtracting device. This has a lever on the left side, in the front of the keyboard, that is used to shift the carnage from column to column. There is also a special key for calculating the balance, a correction key, and a cross footer. The actuator is built into the machine and the digit keys are not in the uppermost row but underneath the space key. The machine only types capital letters and is therefore used less for correspondence than for bookkeeping. It

Figure 181

is available with or without electrically driven carriage return. This machine, shown in figure **182,** is known as the Remington 23.

At the same time the Remington 21 also appeared. This does not have a cross footer mechanism but is only equipped for column addition and subtraction. It has the standard four rows of keys of the older Remington **and** operates with a shift key. In this model, as in the previous one, the keys of the tabulator are on the front edge.

The device for the Smith Premier with full keyboard is different from those machines mentioned with shift keys (with the exception of the Remington 23), insofar as the digit keys of the typing keyboard do not operate on the calculating mechanisms. Rather. underneath the space key (see figures **I79** and 180) are another ten digit keys that are only used if the values entered are also to be added and subtracted. The decimal place tabulator is attached on the front edge. Whereas with the shift machines it is necessary to switch on the digit keys before beginning to add or subtract (that is, to connect the typewriter to the calculating device), this is not necessary with the Smith Premier with full keyboard. The digit keys of the typing keyboard have the same light typing action as for typing letters. Only the special calculating keys

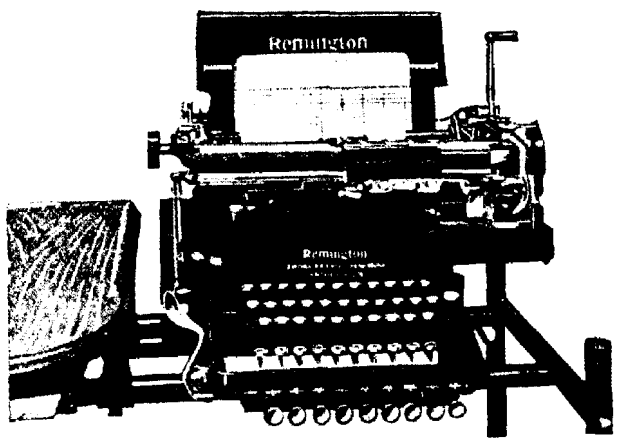


Figure 182

arc a little harder to press. These can never be confused with the usual digit keys since they are set quite apart from them. These calculating keys are much closer to the decimal place tabulator and, when operating the tabulator, one's hands do not have to go far **to** reach them. In machines with a larger and therefore heavier carriage, there is the added advantage that this carriage does not have to be raised for capital letters as with the familiar shift machines. The Smith Premier. if requested, **is** also supplied with only fifty-eight typing keys, so that they only type capital letters (this is sufficient for bookkeeping **purposes)**.

Each of the calculating **keys** operates

1. the typing hammer, throwing it against the platen where the printing then takes place

2. the driving wheel in the actuator (by means of a special lever underneath the type hammer), moving it the required number of teeth forward in addition, and backward in subtraction.

Manufacturer: Remington Typewriter Company Inc., Ilion, Smith Premier Typing Company, Syracuse.

Comptator (1909)

This is the same design, although somewhat improved, as the Rapid Computor Adding Machine mentioned earlier. The manufacturer was originally

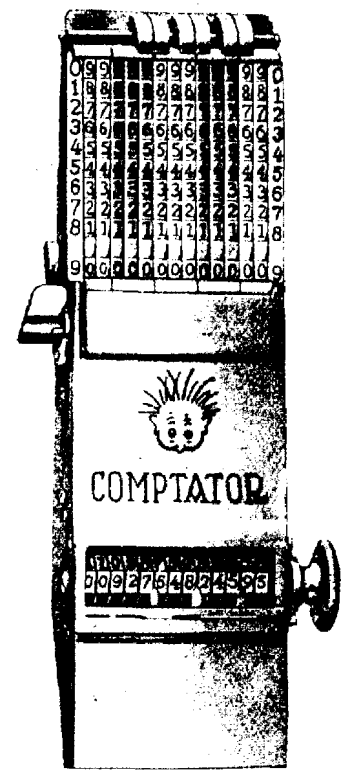


Figure 183

Schubert & Salzer, Maschinenfabrik, **A. G.** Chemnitz, Sa. but, since **1922,** it has been Hans Sabielny, la Bismarkpl., Dresden, A. **24.** This **is** a small adding machine with rack drive. It is available with nine **or** thirteen places, an adjustable decimal point indicator in both the entry and result mechanisms, steel margins with complementary figures for subtraction, setting control mechanism, and release key controlling the return of the setup racks to their normal position. The release key can be locked, which **is** a distinct advantage in addition from dictation and in multiplication. To set the result mechanism to zero, the knob on the right side is pulled **out** and then turned to the left until it can go no further; it must then **be** turned to the right again until it has clicked back into its normal **position.** If the whole reset operation is not completed, the setup mechanism is locked.

The thirteen-place machines allow amounts to be entered in two columns

next to one another (debit and credit, for example) and the smaller sums to be subtracted from the larger ones.

Price:

9-place	105 marks
13-place	150 marks

for English currency:

9-place	125 marks
13-place	175 marks

Adam Riese (1909)

This machine. shown in figure 184, has a control mechanism for adding individual items, automatic deletion in the control mechanism as soon as a number is added, and continual tens-carry in the summing mechanism. It works quickly and reliably. An error in entry is corrected by pressing the small knob mounted on the hand lever. Whereas the sum is visible in the upper row of viewing windows, the individual entries can be seen in the lower row. The machine is operated as follows: the sliding knob in the slot (position indicator) is shifted far enough to the left to show the position of the leftmost digit of the item to be added; the hand lever on the right is moved along a scale until it is opposite the digit to be added and then pulled all the way

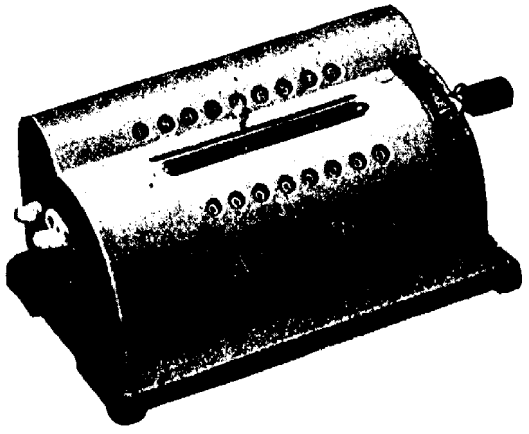


Figure 184

down. This action moves the position indicator one place to the right, where the operation is then repeated. When the position indicator has reached the far right. the upper and lower rows of viewing windows will show the same number; however, this automatically disappears in the lower row as soon as the position indicator is again moved to the left. The wing knob on the left is turned to reset the upper row of viewing windows to zero, although this can, and should, only happen when the position indicator is on the far right. Designer: Chr. Hamann. Manufacturer: Chr. Hamann, Math.-Mech. Institut. G.m.b.H., 19 Charlotten Street Berlin SW 68. Price: 175 marks. This machine was manufactured and distributed for only a short period, and the firm has been out of existence for some time.

Morse (1909?)

This is a ten-key adding machine. The printing is hidden and can only be read if the carriage is raised. It has visible result viewing windows for nine digits and viewing windows below these from which it is possible to check the amount entered. It is supplied with a single-color ribbon. Ribbon direction change is automatic. Total, subtotal, repeat, and correction keys all lie above the numeral keys. Dimensions: 20 cm × 20 cm × 15 cm. Price: $125. The machine has never reached Europe and is no longer manufactured. Manufacturer: Morse Adding Machine Company, Chicago.

Mercantile (1909)

The Mercantile is a nonprinting, full-keyboard adding machine with complementary numbers for subtraction. It has eight places in the setting and nine places in the result mechanism. The result mechanism is above the keyboard; the addition mechanism is powered by the crank. The machine weighs only 5 kg and is therefore extremely light to carry. Manufacturer: Mercantile Adding Machine Company, Norwalk, Conn. The machine has never reached Europe and apparently is no longer being made.

Elliott-Fisher (1910)

The Elliott-Fisher is well known as the only typewriter with typebars that has, instead of the usual typewriter cylinder, a flat typing surface. It is, as a con-

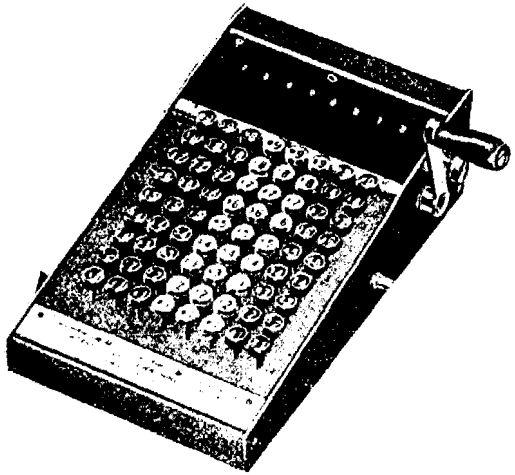


Figure 185
Mercantile

sequence, the only machine with which one can write in bound books. All other so-called bookkeeping machines can write only on loose sheets of paper, which are later collected in books with the help of well-known permanent accounting procedures. It is self-evident that the machine is provided with adding and subtracting calculating mechanisms. so that with it one automatically adds the columns of numbers as they are typed, and eventually can obtain the balance without special effort by the typist.

The keys for calculations are found above the keyboard, and the separate calculating mechanisms are behind the machine. Each column to be added requires a special calculating mechanism; from 1 to 29 of these mechanisms can be attached. These do not share in the sideways motion of the typewriter but rather remain sitting over the columns upon which they have been set by the machine operator. Thus addition or subtraction can be carried out if the typewriter is first at the point of typing the corresponding column. The calculating mechanisms only add or subtract; the operations cannot both be carried out at will.

The machine is produccd in two models, namely as the Simplex and the Universal bookkeeping machines. The Simplex has only calculating mechanisms, the number of which are specified by the purchaser of the machine. These mechanisms are so placed that the typist has the viewing windows just in front of his eyes without having to change his position in front of

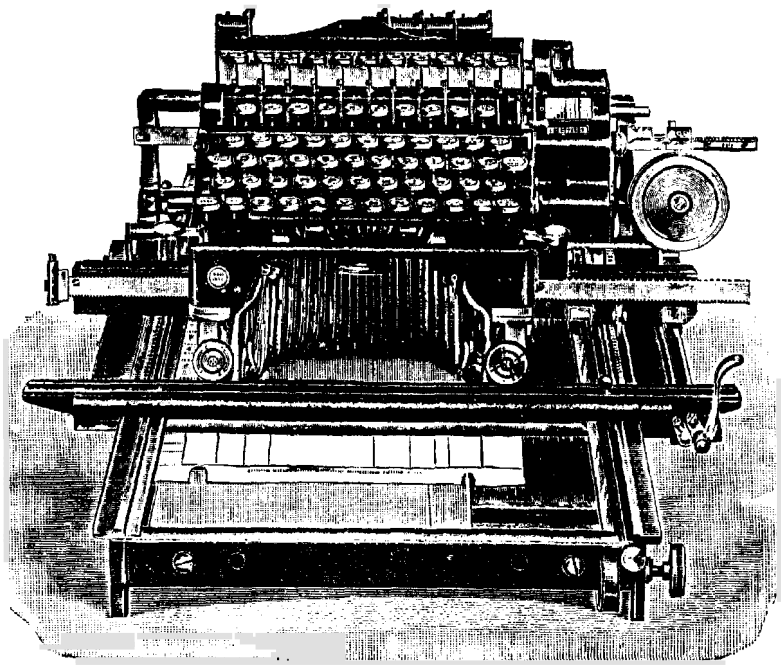


Figure 186

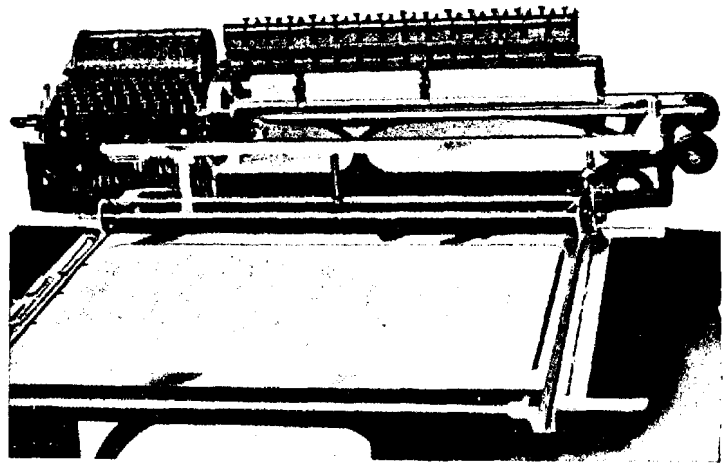


Figure 187

the machine. The calculating mechanisms are set to zero by subtracting the amount in them. This occurs with the help of complementary digits in the usual way. There are also calculating mechanisms that can be set to zero by hand; these cost $5 more. If desired, subtractions can be printed in red so that they stand out. The Simplex is mainly used for bookkeeping, statistical accounts, numerical statements, check statements, and in general for simpler tasks. For example, with one calculating mechanism the individual postings may be added, with the second subtotals, and with the third amounts in the daybook, etc. The daybook can be kept in short or detailed form. In the latter case, the separate quantities can be divided into their respective coiumns and then added.

The Universal generally resembles the Simplex. However, it also has (next to the calculating mechanisms mentioned, to the right of the typewriter) a further mechanism for addition and subtraction. This shares in the sideways motion of the typewriter during typing and, moreover, serves to add or to subtract all quantities in the calculating mechanisms for the vertical columns

Figure 188

and to ascertain the balance. This second mechanism is the cross footer, known here from the description of the Whal Adding and Subtracting Device.

How does such a machine work? Suppose that it is necessary to supply the following four columns:

old balance debit credit new balance

One brings a calculating mechanism over each of these four columns, then shifts the typewriter to cover the first column and types in the quantity, say 200 marks. At the same time, this number is transferred into the corresponding calculating mechanism and also appears in the viewing windows of the cross footer. The machine is then shifted to the debit column, and the quantity 50 marks is keyed in. This number is, at the same time, transferred into the corresponding calculating mechanism and counted on the cross footer. so that in the windows of the latter the quantity 250 marks is visible. The credit of 10 marks is typed into the credit column and at the same time transferred to the corresponding calculating mechanisms and also subtracted from the total in the cross footer, so that there remains in its calculating mechanism only 240 marks. One now enters this quantity in the new balance column so that it appears in the corresponding calculating mechanism. This cancels the amount registered in the calculating mechanism of the cross footer, and, assuming that the whole calculation contains no typing errors, the viewing windows of the cross footer show zeros in all places. The subsequent postings are done in the same way. The calculating mechanisms over the individual columns therefore give:

1. all old balances
2. all debits transferred
3. all credits transferred
4. all new balances.

At the end of the day's work a check can be made, namely, the sum of the debits posted minus the sum of the credits posted gives the sum of the new balances. This is, naturally. only one example of the applications of the Universal. How easily it can be applied to a variety of problems is evident from the fact, already mentioned, that no fewer than twenty-nine such calculating mechanisms can be set on one Elliott-Fisher.

The Elliot-Fisher is available in three writing lengths (for machines with cylindrical platens, one would say carriage widths), and the machine can be

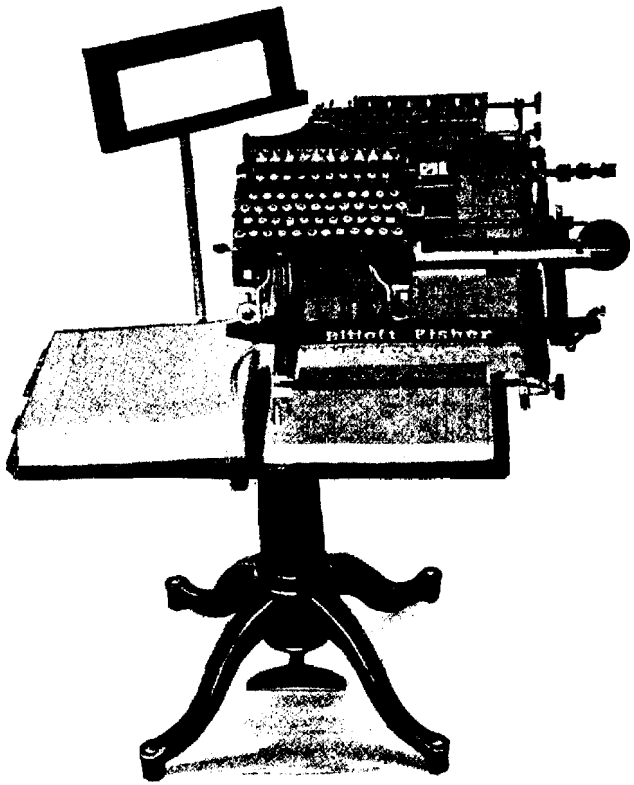


Figure 189

provided for just typing or bookkeeping, purposes—thus, with or without calculating mechanisms, and with or without cross footer, with a massive stand that adjusts in height, etc. In general, when supplying a machine, the factory will adjust it to suit the requirements **of** the buyer. However, in order to give an idea of the relative prices, the cheapest version **of** the smallest model. without tabulator, without calculating mechanism, without stand. etc. costs $156. The same machine with tabulator and cross footer but without calculating mechanisms costs $572. The cost of individual calculating mechanisms ranges from $42 for five places to $67 for ten places. In Europe, higher prices must be expected.

Manufacturer: Elliott-Fisher Co., Harrisburg, Pa.

Triumph (1910)

The Triumph is a small adding machine. It has four movable parts: the knob above the last two viewing windows on the left, the crank, the release-rail, and the operation chains.

The knob can be shifted up and down. When up, it separates the **two** left viewing windows from the rest and records the number of items added or subtracted; when down, it reestablishes the connection with the other place positions.

The crank is used to reset the machine to zero. It is turned until red zeros appear in all the viewing windows. The crank may not be turned backwards.

The release-rail stretches out underneath the calculating chains for the entire width of the machine. It must be pressed down before entering each new item in order to release the locking device of the machine. If not pressed, the chains only move with difficulty, and if force is used it can damage the machine. It is the action of pressing the release-rail that causes the items to be counted and the number registered.

Addition is carried out in the usual way. The finger is placed on the digit **to** be added, and the chain link is pulled down as far as it can go, thereby transferring the respective digit into the calculating mechanism, or rather adding it to the amount already there. Digits are always entered from left to right, although it is possible to move several chains at once. Subtraction is done with the help of complementary digits. Multiplication can be done according to the multiplication table method, or the repeated addition method, although here the machine does not offer any extra advantages. The machine is not suitable for division.

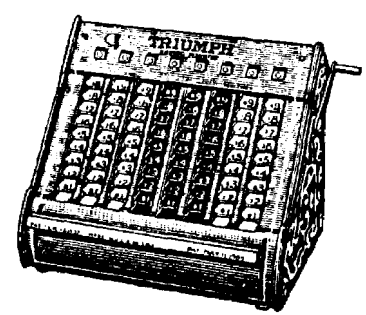


Figure 190

Model A	eight places, for decimal currency	$50.00
Model B	ten places, for decimal currency	$60.00
Model C	twelve places, for decimal currency	$70.00
Model D	eight places, for inches, fractions, or English currency	$60.00
Model E	ten places, for inches, fractions, or English currency	$70.00
Model F	twelve places, for inches, fractions, or English currency	$80.00

Manufacturer: Triumph Precision Machine Co., 74 Wall St., New York.

Teetor (1910)

This is a nine-place, full-keyboard adding machine without complementary digits and with wide carriage. The amount printed is hidden, as in the Burroughs, although the result is visible in windows above the keyboard. The machine is equipped for electric drive. Repeat, nonprinting, subtotal, total, addition, and subtraction keys are all on the right side of the keyboard so that the left hand always remains free. The machine has only a single-color ribbon. It was originally made by the Teetor Adding Machine Company in Des Moines, and later in Pomona, California. Production has stopped for the time being.

International (1910)

This is a nine-place, full-keyboard adding machine that was supplied with a narrow and a 30-cm-wide carriage. It had self-correcting keys and visible addition and printing. Repeat, correction, total. subtotal, nonaddition, and nonprinting keys were on the right side. It was available with manual and electric drive. The price was $225.00 for roll paper, $250.00 with 30-cm-wide carriage.

This machine was also supplied connected to a payment machine. It was possible with this combination to write wage sheets at the same time as pay envelopes, to count up the necessary coins, and finally to put them in the envelopes. The manufacturer was the International Money Machine Company, Reading, Penn., but the factory is no longer in existence.

Addall (1910)

This is a single-row adding machine from the Addall Company, Temple Courts, Temple Row, Birmingham. This machine disappeared from the market a number of years ago.

Kollektor (1910)

This small machine was brought out by the Wurttemburgische Uhrenfabrik Bürk Sohne in Schwenningen on the Neckar. It never gained a really wide distribution and today is no longer being manufactured.

Only the left hand is needed to operate this machine. The setting of numbers is carried out by so-called control areas instead of keys. There are four of these control areas, one for each of the numbers 1, 3. 4, and 5. Of these, 1 is controlled by the small finger. 3 by the ring finger, 4 by the middle finger, and 5 by the index finger. The other digits are done by double movements in rapid succession: 2 = 1 and 1; 6 = 3 and 3; 7 = 3 and 4; 9 = 4 and 5.

Addition of Columns: The calculating mechanism must be set up on the viewing window corresponding to the column by being raised, shifted sideways, and let down again so that the stationary indicator points to the correct viewing window. The single digits are then added one after another by the fingers lightly pressing and pulling on the control surfaces. At the end of entering a column of digits, the control mechanism is simply moved to the next digit place and the process is repeated.

Figure 191

Addition of Single Coupons, Etc.: After entering each digit, the calculating mechanism must be moved over to the next digit place; otherwise the procedure is the same as addition, Since with this mode of operation the right hand does not have to follow the numbers, it can be used to move the mechanism very quickly.

subtraction: In order to use the apparatus for subtraction, all that is required is to pull out the knob on the left side (which prevents it from turning), which causes the machine to operate in the opposite direction. The procedure is then exactly the same as addition. For resetting to zero, the calculating mechanism must be raised by means of the knob protruding on the right. This is pressed in and very slowly and gently turned forward until it snaps into place again. To change any number. for example in making a correction, the knob on the left side is used as in subtraction. It is turned forward or backward but may not be moved axially.

The *Zeitschrift fur Vermessungswesen* (1910, vol. 3I) described the machine as follows:[69]

This is surely the first adding machine one can operate without having to look at the machine. As figure I shows, only four fingers of the left hand are used. and this is in a comfortable and fixed position—the little finger for the key (or rather cylinder) 1, the ring finger for 3. the middle finger for 4, and the index finger (which can be moved further and more easily than the little finger) for **5**. There are not nine elements but rather only the four that have been named. The four fingers are only required to gently press and pull in order to add each of the respective numbers I. 3, **4.** and **5**. On the other hand, 2 is done by two pulls of the little finger. 6 by two pulls of the ring finger, 7 by the ring and index fingers, and 9 by the middle and index fingers. There is of course no objection in attaching nine instead of only four elements, and at first sight it may even seem strange that with this machine a part of the addition has to be calculated in the head. even if it is only a small part. But it is, in fact, much simpler to design the machine as compactly as this inventor has done; that is, by equipping it with only four elements, since one then has the advantage that the calculating hand can remain at "rest position." As long as the correct position of each finger is clear in one's mind (that is. without having to think), the calculation is in fact carried out much more quickly. reliably. and smoothly than if one's hand had to move around to search for the right key among a great number of different keys. Because of the way the Kollektor is designed, one's eyes can remain on the written numbers to be added. Another advantage of this new machine is that these digits are transferred to the machine, not in groups that must he remembered, but rather digit by digit. The machine takes care of everything else with only a simple movement of the fingers needed. In addition. it is possible to relax one's attention somewhat, since one does not have lo keep looking from the machine to what is written down.

69. *Journal for Surveying*

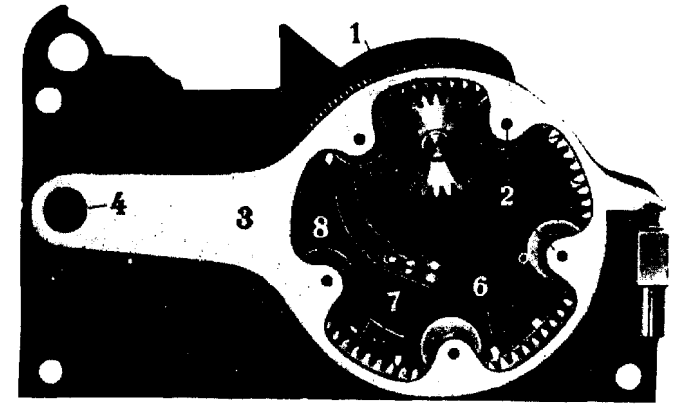


Figure 192

What the size of the four numbers 1, *3*, **4,** and 5 signifies is superfluous for the practical use of the machine in that one must know the number mechanism with the fingers without thinking and without looking at each number. The four "keys." which are each worked by one finger on the left hand, are corrugated cylindrical rollers that one's finger must lightly press and turn by pulling gently as far as the mechanism allows. Each of the rollers (marked 1 in figure 192) has two inner gearings and, with the help of five small rollers (2), is positioned on the arm (3), which can swing around the pivot point **(4).** The arm *is* moved by gentle pressure from the finger until it strikes against stop (5). With this action, the gearing belonging to (1) is meshed into wheel (9). and at the same time the locking teeth **(6)** are taken out of the stationary block (7), which had, until this time, prevented the roller from turning. The small wheel (9) is carried along with the rotation of the roller that is now possible. Each rotation is restricted by the stop lever (8); that is, whenever the next locking point position **(6)** is positioned exactly under block (7). Only in this position can the arm (3) return to its rest position, and roller (1) can only be turned exactly within that arch between the two locking points **(6).** The small wheel (9) (visible in figure 193 with **roller** (1) removed), which has been carried along with the rotation, now drives cog (11) positioned on the same axle (10), which by means of (12) carries the movement further over to wheels (13) and (14).

The calculating mechanism is positioned above these arms and wheels. It is shown in Figure 1931194, taken out of and placed next to the machine. By means of wheels (14), wheels (16) and the digit cylinders of the calculating

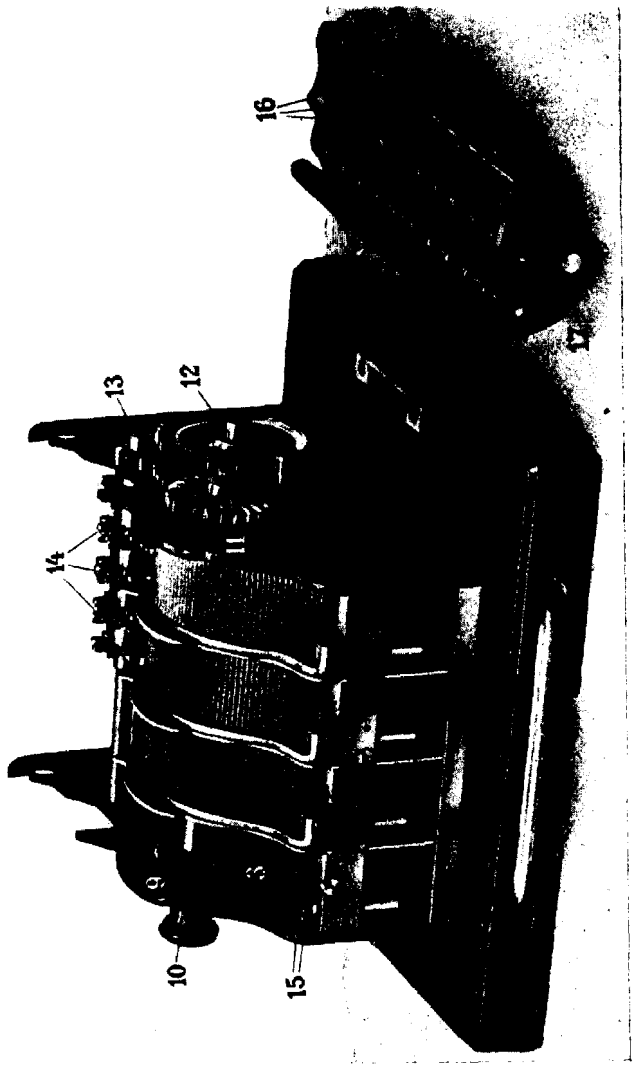


Figure 193/194

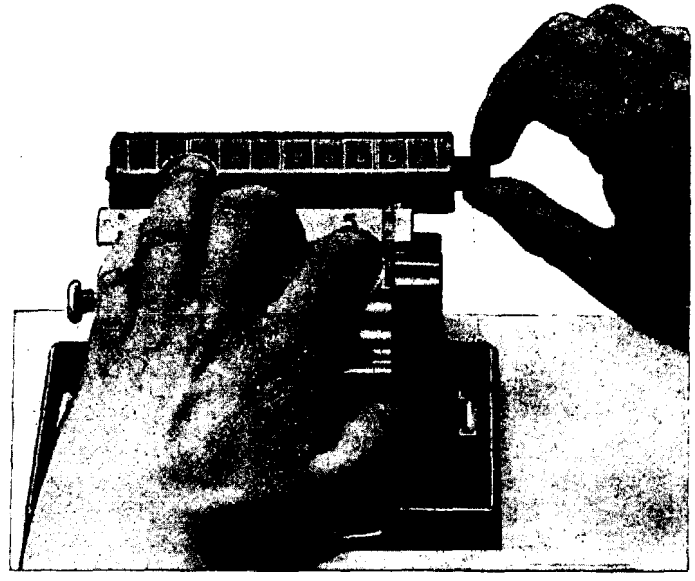


Figure 195

mechanism are moved. As is usual, it is possible to read from these digit cylinders in the viewing windows. The four mechanisms, which are placed together in the machine, operate differently only in the fact that the cogs within each of them are placed far away from each other. The first cylinder from the left transfers 1, the second 3, the third 4, and the fourth 5 units. Any error in the calculation caused by two keys (rollers) being pressed down at the same time is prevented since it is not possible to simultaneously move two rollers. As soon as a roller has been pressed down, all others are locked by a lever (15). After adding up a column, the calculating mechanism must, as usual, be shifted one position.

Figure 195 shows the resetting to zero of the calculating mechanism. The adding machine Kollektor subtracts in exactly the same way as it adds. All that is required is to pull out knob (10). Any changes to the total are as possible during subtraction as they were for addition. The whole machine is really one of the simplest imaginable, on account of the small number of movable parts. In spite of its handiness and the small size, the good materials which make up the machine guarantee unlimited durability.

The price of the machine is 150 marks.

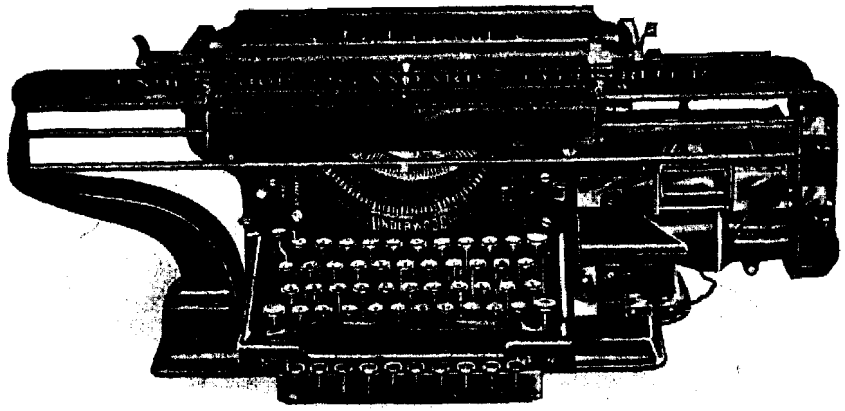


Figure 196
Model A.

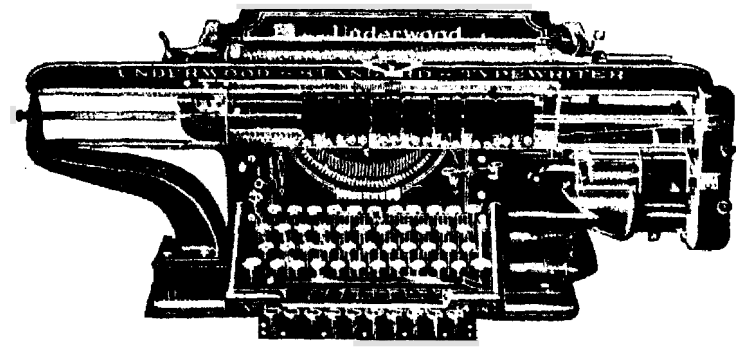
Underwood (1910)

Since 1910, the well-known Underwood Typewriter has been equipped with an adding and subtracting device. This was originally the design **of** John T. Howieson of New York, who earlier had designed a similar device for the Fay-Sholes Typewriter (see the 1904 entry for the Arithmograph). However even the Underwood Company never produced the machine on a large scale. Later there appeared almost the same adding and subtracting machine with the name Typewriter Calculating Attachment. Even with the new name it remained relatively unknown.

In 1911, the Underwood company brought out the Underwood Computing Machine illustrated in figure **196.** It has a number of small calculating mechanisms mounted on top. **or** attached to the side, of the Underwood Typewriter. Virtually the same work can be carried out with this machine as with the Wahl Adding and Subtracting Device but with the difference that with the Underwood addition and subtraction is done via an electric drive. This means that the keys are always struck evenly, whether it be a *2* or a 9 that is pressed. The following models are available:

Model A: with one 12-place calculating mechanism attached on the side, vertical and horizontal adding and subtracting.

Model B: with two 12-place calculating mechanisms attached on the side,



igure 197
lodel D.

vertical and horizontal adding and subtracting. In preparing statements **of** current accounts, this machine looks after not only the addition of individual columns but **also** always records the balance amount.

Model C: with any number of small calculating mechanisms attached. The calculating mechanisms can be **4, 5,** 6, **7, 8, 9, or** 11 places for monetary values and **4, 5, 6,** 7,[70] **8, 9,** or 12 places **for** quantities.

Model D: with any number **of** small calculating mechanisms attached, in addition to a cross or control adding mechanism attached on the side. The uses of this machine are many and versatile. For example, a number of columns can be added vertically; simultaneously a number of columns can be added horizontally and the total subtracted from another column.

Apparently, the electric drive has not proven a success when a very large number of columns are involved, and for this reason production of the machine was given up once again in 1917.

In 1912 there emerged the Underwood adding or bookkeeping machine, as illustrated in figures **I98** and 199. It can also be electrically driven although that model is constructed quite differently. Here the typewriter stands on a base, approximately 12 cm high, containing one or more calculating mechanisms. The machine is very simple to operate. It is only necessary to set up the tabulator stops in accordance with the work to **be** carried out (exactly the same as with the standard typewriter) and to attach either adding or subtract-

70. At this point Martin actually has "4" rather than "7"—we presume it is simply a typographic error.

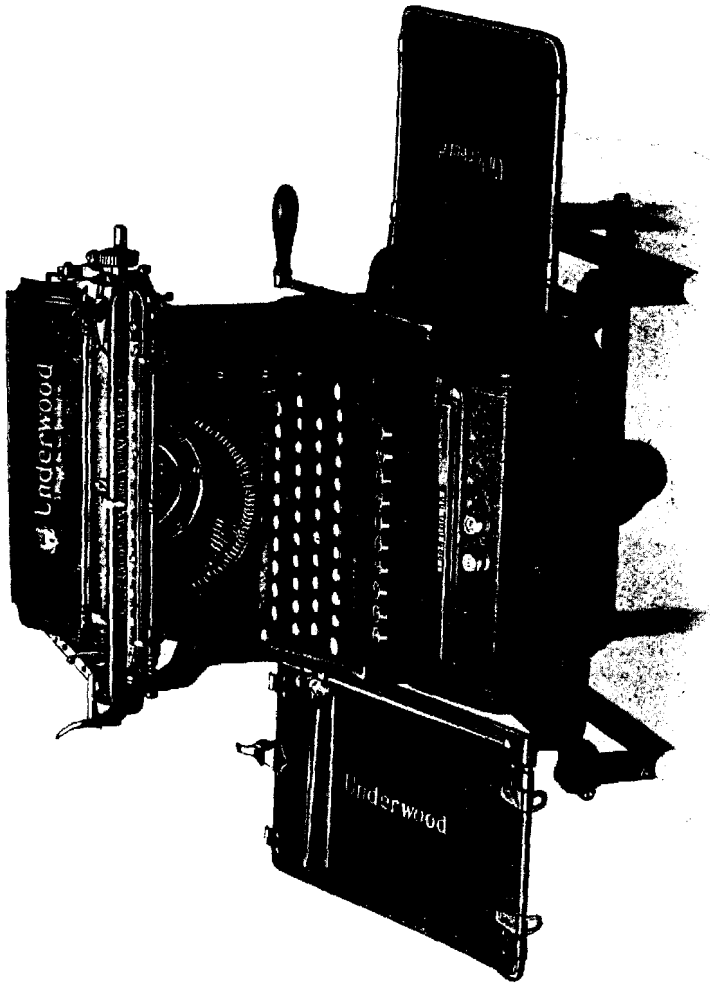


Figure 198
Machine with one calculating mechanism.

ing stops—the adding stops differ in shape from the subtracting stops. In order to add up a column with a calculating mechanism, it is necessary to use an adding stop behind it and in order to subtract in another calculating mechanism a subtracting stop must be used. The machine is now ready, and as long as the same column setting is used, it is not necessary to make any sort of changes to the setting in preparation for addition or subtraction.

The numbers are entered by means of the number keys of the typewriter. If an incorrect key has been struck, the error can be corrected by simply pressing the E key next to the respective calculating mechanism If a number has been skipped over or pressed too lightly so that it does not come out clearly in the print, then by pressing the backspace key, it may be struck again.

The amount typed can be automatically added (or subtracted) and registered in two ways: automatically by means of the stop already mentioned, which operates the motor after the last digit, or by lightly touching a key on the right side. If the electric motor is not used, then the hand crank, which is attached to the right side of the machine, is used instead. This simply requires a light, quick pull. In this way, one amount after the other is typed and added. If the typist forgets to pull the crank, a locking device, which falls across the number keys, automatically prevents typing further amounts before the previous amount has been added or subtracted. If one wants to know the sum totals, then one only has to copy down the last figure in the calculating mechanism. Before this is done, it is advisable to set the machine on subtraction—this is carried out by simply pushing in the subtraction key on the left side of the machine, or by setting up automatic subtraction. If the typing of this total is correct, it sets all calculating gears to zero, and the machine is then free for the next task. This also proves that the sum total has been correctly copied. Subtotals can be taken at any time by pushing the nonaddition key.

Next to the E key is another zeroing key. If this is pressed at the beginning of a new operation, it prints a star on the paper as proof that the respective calculating mechanism previously stood on zero. If the sum total has been typed during simultaneous subtraction, and if the star can be typed next to it, then this is further assurance that the sum has been correctly copied. Subtraction is just as easy to do as addition. All that must be done is to push in the subtraction key or set up automatic subtraction. Once an amount has been subtracted, the machine automatically changes back to addition if one does not want to do several subtractions. Sums and subtractions automatically appear in red, or in another color different from that of the amounts to be added.

Moreover, there is always a signal at the front of the machine indicating addition or subtraction, so there can hardly be any confusion. It is possible to add or subtract rows of figures vertically and even horizontally in one or several calculating mechanisms simultaneously. If horizontal rows of figures are added up, the sum total of all end sums can be registered in a second calculating mechanism. For work involving invoices, etc., the machine can be used so that credit items are automatically subtracted from debit items and the balance always given.

With other adding typewriters (an exception being the Calculating Mercedes-Elektra), the gears must be turned by pressing keys. It is easy to understand (insofar as the digit keys run 1 to 9) that the striking action must be uneven. A one key will be easier to hit than a nine key since the latter does more work. Since all tasks such as turning the various gears (driving gear, transmission gears, number pears, etc.) as well as the movement of all other parts are done by finger pressure, it is only natural that such machines are more difficult to operate. Moreover it is necessary to make an apparatus

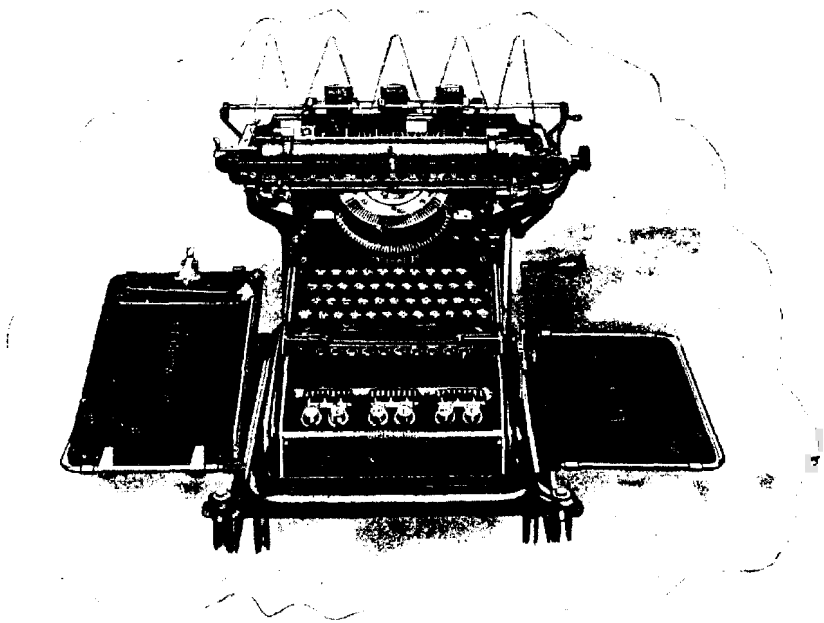


Figure 199
Machine with three calculating mechanisms.

such as this small and light. It is, therefore, often extremely difficult to read the numbers of the number gears, which, by necessity, must be kept small.

As was mentioned earlier, for their first models the Underwood Company followed the same principles but very soon changed them over to direct striking action. which will now be briefly described. In these machines, only one pin is set up when a key is struck, and only when the whote amount has been typed in will a common driving mechanism (itself either operated automatically by an electric motor or by a hand crank) perform the necessary rotations and movements in order to carry the figures over into the calculating mechanism. The digit keys of the typewriter therefore work just as easily and quickly as for a standard typewriter.

With such a machine there are many different kinds of tasks that can be performed. Each machine is equipped with automatic carriage return and line feed and. furthermore, bas all the modern supplements of the Underwood bookkeeping machines. The numbers on the base denote the number of calculating mechanisms as well as the width of the carriage in inches.

For example, figure 199 shows a machine with three calculating mechanisms and a 14-inch or 35-cm-wide carriage. Machines are available with 1, 2, 3, 4, and 5 calculating mechanisms, and each machine can be supplied with 30-, 35-, 40-, 45-, 50-, and 66-cm-wide carriages. Prices range between $575.00 and $1,225.00. There are also machines built without shift, which therefore print only capital letters.

Distribution is done through the Underwood Typewriter Company, New York.

Autarit (1910)

Designer: Alexander Rechnitzer. of Vienna. Manufacturer: the Autarit Company, Ltd., of Vienna I, Fuehrichgasse No. 10. Production has been discontinued since the beginning of the war; the firm is no longer in existence.

This is a stepped drum machine, with motor drive for completely automatic multiplication and division. The machine has two rows of setting slots: one on the lower part of the machine and a second one on the movable carriage underneath the result windows. For addition, the first item is entered in the lower slots in the customary manner, the machine is set to addition by means of the button located to left of the setting slots, the start key for the motor is pressed, and the amount is thus transferred into the result mechanism. For subtraction, the greater item is introduced into the result mechanism as in

addition, the reversing button is set to subtraction, the motor is started, and the remainder may be taken from the result counting mechanism. in multiplication, the value to be multiplied is introduced into the result mechanism in the manner described in connection with addition, the machine is set to multiplication. the multiplier is entered by means of the upper setting slides, and the motor is started; whereupon the machine commences to multiply automatically. With each revolution of the shaft the setting slide, at the first place from the right, moves one digit toward zero; when it arrives at zero, the carriage is automatically shifted by one place, and now the slide set in this place commences to move automaticaiiy towards the zero position, and so on, until multiplication is complete and the result may be read in the result counting mechanism. Division, including ordinal displacement of the carriage, also occurs automatically. In **1913** the Autarit factory maintained a sales office in Frankfurt on the Main; it does not seem likely however, that anything other than experimental models were produced.

Midget (1910)

Manufacturer: Midget Sales Company, 60 Van Buren St., Brooklyn. The machine is only used for addition. The left hand holds the handle, and the small finger on the right hand holds the machine steady (as shown in figure 200).[71] The right hand also holds the calculating stylus. In setting up values, the digits on the right or the left edge plate are used. The tip of the adding stylus must be placed in the hollow of these digits (units, tens, hundreds, etc.), which are to be added and teft there while the handle is turned with the left hand until it hits the calculating stylus. The other numbers are entered or added in the same way. The sum can be read behind the stop rod J. Resetting the machine to zero is done by lifting the stop rod *J* and turning the handle until the small lug of the individual calculating gears presses against the stop rod.

Price: $10.00. It appears that the machine is no longer produced. It was never introduced into Europe.

S and N (1910)

This is a small adding machine with chain drive and stylus entry produced by Seidel and Naumann, Dresden. There are a number of models in production:

71. Martin aclually had figures 200 and 201 reversed; we have corrected the error in this reprint.

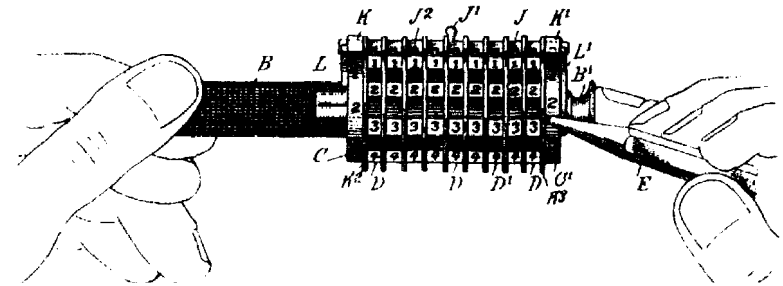


Figure 200
Midget.

nine and thirteen-place machines, a debit and credit machine (always with two six-place calculating mechanisms and seven-place result mechanisms), and three models for English currency.

The machine operates in the same way as described for Small Adding Machines in the introduction. Zero setting of the result mechanism (which is above the entry mechanism) is brought about by turning the crank on the right as far as it can go. The force of the spring will then turn the crank back to the rest position. On the right side there are two keys labeled ***A*** and *M*. The ***A*** key is used to return the chain links to their rest position after the value entered has been checked for accuracy. If, during multiplication and subtraction, the *M* key is pressed, the individual chains spring back to their starting position after the adding stylus has been removed. At the other end of the

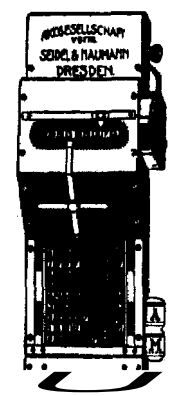


Figure 201

adding stylus there is a three-sided key that, with one turn to the left, operates the bolt attached to the right side panel. With this, the chains, the item cancellation, and the sum cancellation are locked, and the machine can, therefore, not be used by any unauthorized person. The connecting cross piece, as can be seen in figure 201, points from the digits of the chain columns to the digits of the result mechanism. The result mechanism also has a movable decimal point. Subtraction is carried out using scales with complementary digits, which are attached on both sides. To enter units in subtraction, one uses the scale on the right side. For other places (tens, hundreds, etc.), one uses the left scale.

Model	Weight	Price
nine-place	1.4 kg	100 gold marks
thirteen-place	1.8 kg	125 gold marks
for English currency		110 gold marks

Barrett (1910)

Designer: Glen G. Barrett. Manufacturer: originally the Barrett Adding Machine Company, 142 Court St., Grand Rapids; since January 1, 1922, Lanston Monotype Machine Company, Philadelphia.

This machine was introduced into Europe before the war, although up until now it has not been distributed on a large scale. It is a full-keyboard adding machine with visible printing in one color but only on narrow paper strips. The machine has self-correcting keys with complementary keys for subtraction and division. There are repeat, keyboard cancellation. total, and nonaddition keys on the right side of the keyboard so that the left hand is free to turn pages or point to figures. Carryover totals are added and carried forward with the aid of the total or sum and keyboard cancellation keys. By using the nonaddition keys, figures that have been entered can be excluded from addition, provided that this key is pressed before the crank has begun to move back. All values that have not been added are specially marked on the paper. Dimensions of the machine are 25 × 30 cm, and its weight is approximately 11 kg.

Models dating from before the war were supplied with the so-called mezzanine attachment, which is shown in figure 204. With this device, values that have been entered on the keyboard can, in multiplication, be shifted side-

Figure 202
Older, nonprinting machine.

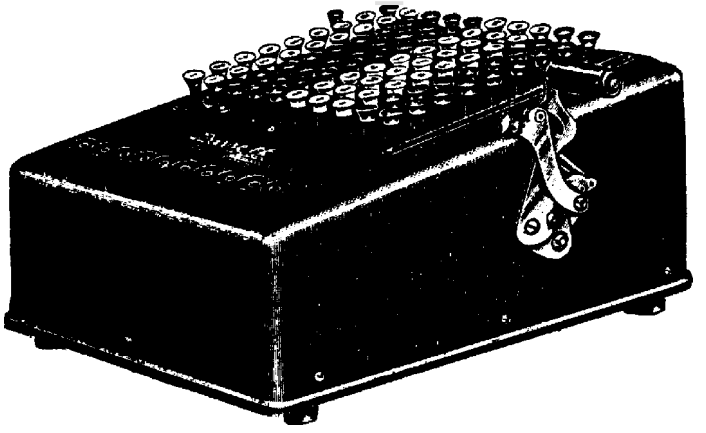


Figure 203
Later model

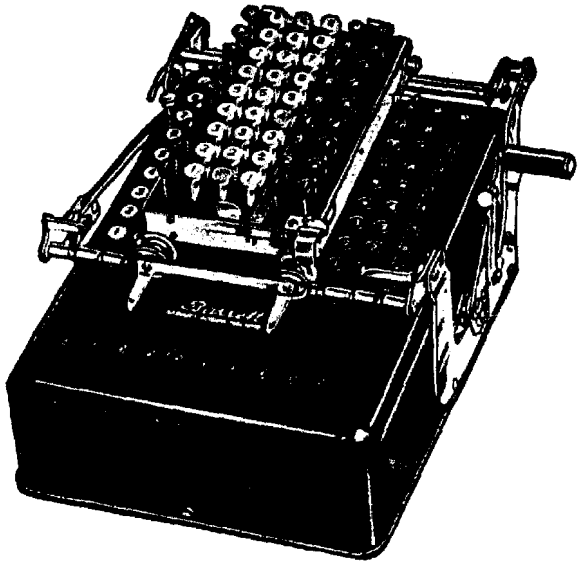


Figure 204

Figure 205

ways into the next column without having to be entered again. Model 12 has been equipped with another device for multiplication; this makes it unnecessary to set up the multiplicand again in transferring to the next multiplication. The adding gears are shifted back and forth by means of a lever, adjustable in notched positions, attached beside the right ribbon spool. This represents, of course, an important saving of time.

Model	Columns of keys	Number of digits in result	Price in $[72]
*7	7	7	175.00
*7¼	7	7	190.00 (Model 7 with ¼, ½, ¾)
9	9	9	225.00
9¼	9	9	240.00 (Model 9 with ¼, ½, ¾)
9⅛	9	9	250.00 (Model 9 with ¼–⅞)
9A	9	10	250.00
9B	9	11	275.00
9C	9	12	300.00
12	9	9	325.00 (with multiplication device)
*5	5	6	125.00
*7A	7	8	*200.00*
*6	Models 6 and 10 were nonprinting models (figures 202, 203).		
*10			
*14	This was the same as model 12, but with a wider carriage.		

Note: Those with * beside the model number are no longer available.

Marchant (1911)

Manufacturer: Marchant Calculating Machine Company of Oakland. The Marchant is a pinwheel machine that operates like the one described in the introduction. Originally two models were manufactured, the Pony and the Standard, which differ from one another in size.

Until 1922 the two models had the small setting levers of the well-known German machines and resembled them in other respects as well. The revo-

72. Martin left the price of models 6, 10, and 14 blank.

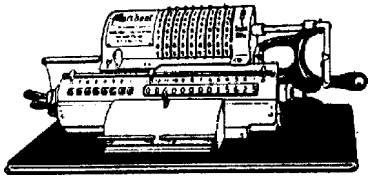


Figure 206

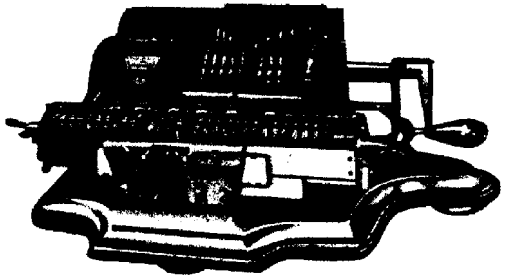


Figure 207

lution counter is equipped with tens-carry; instantaneous zero setting of the entry levers is provided by lifting a bar. Shifting of the carriage and zero setting of the two counting mechanisms occur in the usual way. Since 1915 the machine has been provided with electric drive. as shown in figure 208. in this model, when the motor lever is shifted to the digit 8, the motor will perform exactly eight revolutions. This is very useful in multiplication, etc.

Since 1922 the Pony model has also been provided with large, nonrotating levers. The keyboard model appeared in 1923 (figure 209). It possesses self-correcting keys, column clearing keys, a repeat key, a repeat disabling key, and a keyboard clearing key. The setting windows are at the very top left: a revolution counter is arranged to the right of the setting windows: the result mechanism is located underneath in the movable carriage. This model has no red numerals in the revolution counter—the American literature praises this as a novelty. but in reality this has simply been copied from German products. Aside from these models, they are still selling one with lever setting in which the movable result mechanism is located below the setting slots with the revolution counter located adjacent to it. The counter mechanisms of both models may be set to zero by rotation of a crank.

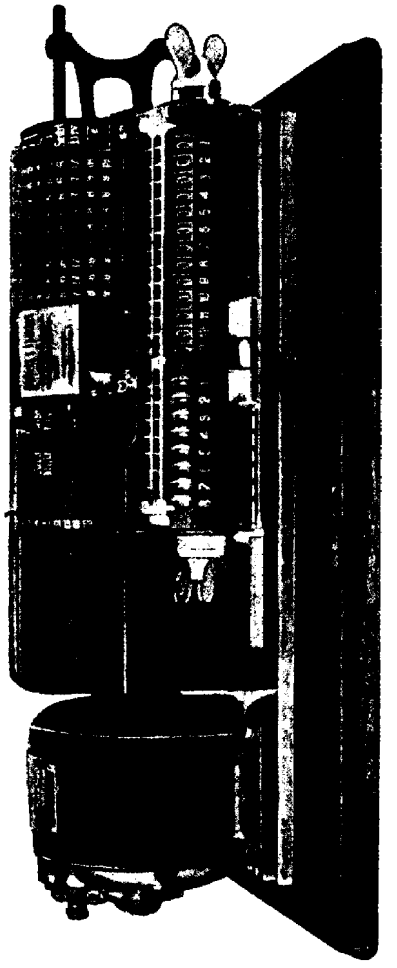


Figure 208
Lever set machine with electric drive.

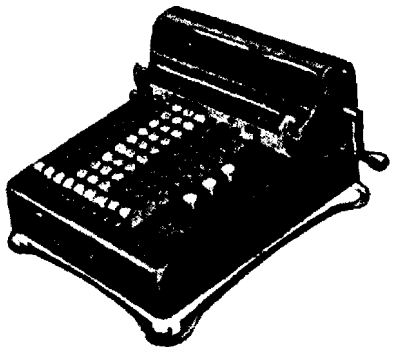


Figure *209*
Keyboard model.

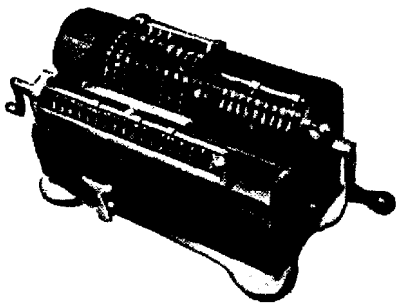


Figure 210
Model X-L.

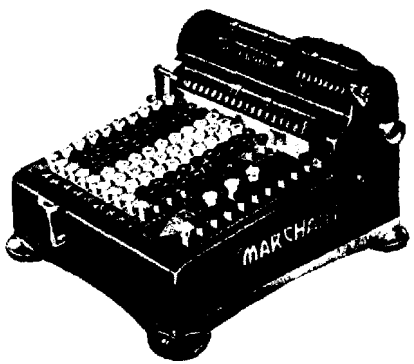


Figure 211

Models and Prices:

Pony **A**	9 × 6 × 13 places	$275.00
Pony B (1917)	9 × **10** × 18 places	**$325.00**
Standard **A**	9 × 8 × 13 places	**$265**.00
Standard B	9 × 10 × 18 places	**$315.00**
X-L Model with lever setting	9 × 9 × 18 places	$350.00
K-A Model with keyboard	6 × 6 × 12 places	$200.00
K-B Model with keyboard	9 × 8 x 16 places	$300.00
K-C Model with keyboard	9 x 9 x 18 places	$350.00

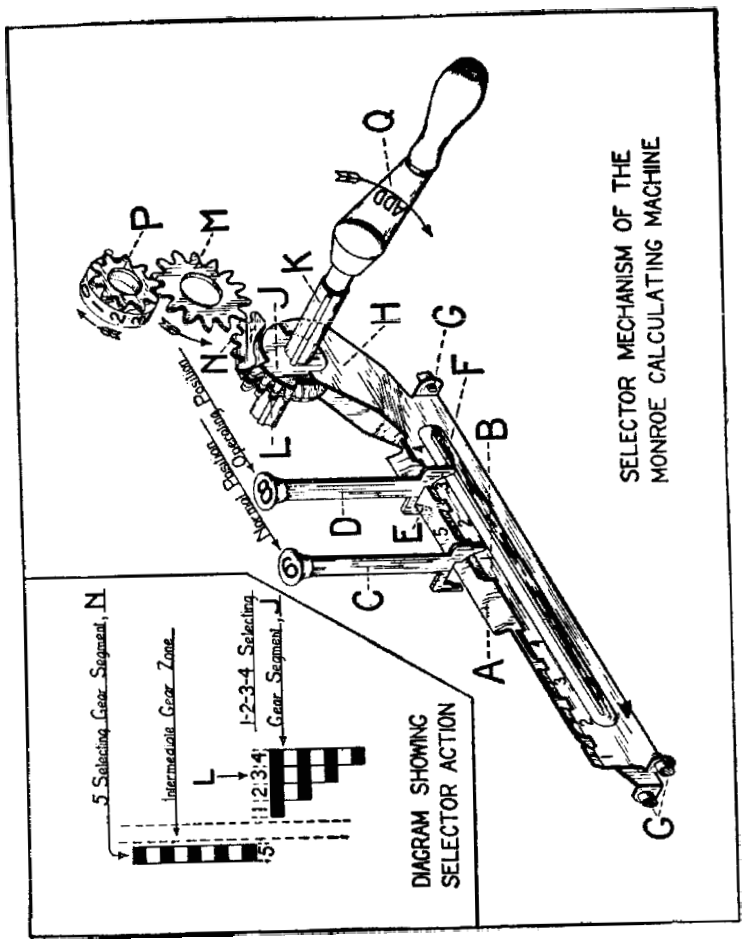
The K-C model may be supplied with electric drive if so desired (figure 211). To the right of the addition keys, and separated from them by two motor keys, are keys numbered 1 to 9. When a value is to be multiplied by 98, the 9 key is pressed, the carriage is shifted one place, then the 8 key is depressed, and the result may then be read from the machine. The additional charge for the electric drive is $150.00. The Marchant has been imported into several countries.

Monroe (1911)

The Monroe emerged, so to speak, from the Baldwin Calculator (see Baldwin 1875). The designer of both machines is Frank Stephen Baldwin who was in his late seventies when he set out on his new job. His work was instigated by J. R. Monroe from whom the machine derived its name and who actively participated in the making of the first machine.

When values are entered **on** a stepped drum or a pinwheel machine by means of the setting levers, the operating hand has to travel a relatively large distance. Moreover, the setting has to be carried out very accurately otherwise the result will be erroneous. Generally speaking, the pinwheel machines and the stepped drum machines with setting levers are not very well suited for addition of long columns of values because the accurate setting of the values takes a long time. Only one such machine having a keyboard was on the market when the Monroe appeared since this system was, at the time, still relatively unknown.

It was ***not*** a great leap to think of providing a machine that combined the advantages of the full-keyboard adding machine (speediest setting of the



Figo e 212

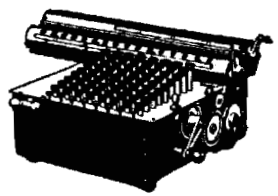


Figure 213

Figure 214

items) with those of the stepped drum and pinwheel machines (direct subtraction by turning the crank in the opposite direction or by special reversing setting, and in any case without the use of complementary digits; fast multiplication and division merely by turning the crank and appropriate ordinal displacement of the carriage). and this the designer succeeded in doing.

The key depression on such a machine must be short, of instantaneous effect, and light; no errors must occur by insufficient depression of the keys or by excessive speed in operating the machine. Because of this, Baldwin conceived the idea of subdividing the setting mechanism into two sections; the left half having five teeth and the right half having a first, second, third. and fourth tooth. One can now have five teeth activated at once and with them one or more of the first four teeth. The setting operation. the dimensions. and the weight of the machine are reduced. resulting in a short key travel no matter whether the first or the ninth key is used. Figure 2 12 shows the whole key and transfer mechanism of the present model.

The first model (as shown in figure 213) dates back **to** the year 1911, from which time these machines have been continuously on the market. Large-scale production was started in 1914. Figure 214 shows the model from 1915, which has a slightly altered design. At that time a banked (or stepped) keyboard was employed, whereas the present model **K** has an oblique keyboard

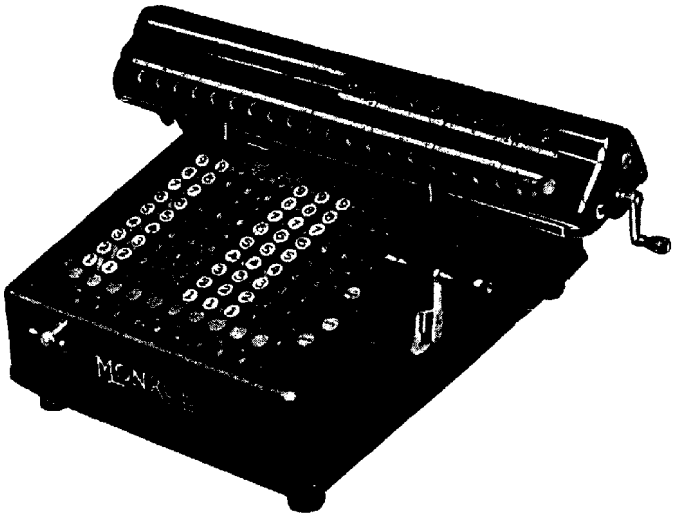


Figure 215
Model K. manual drive

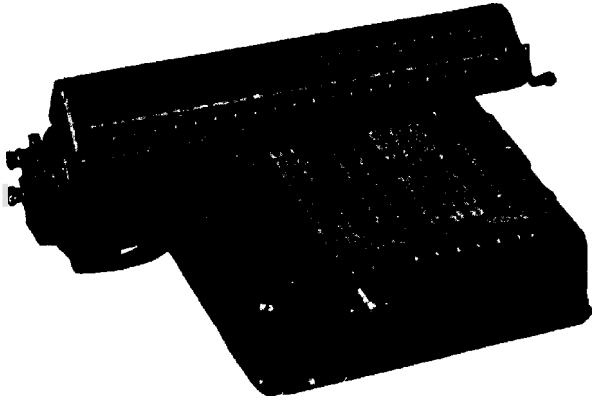


Figure 216
Machine with electric drive

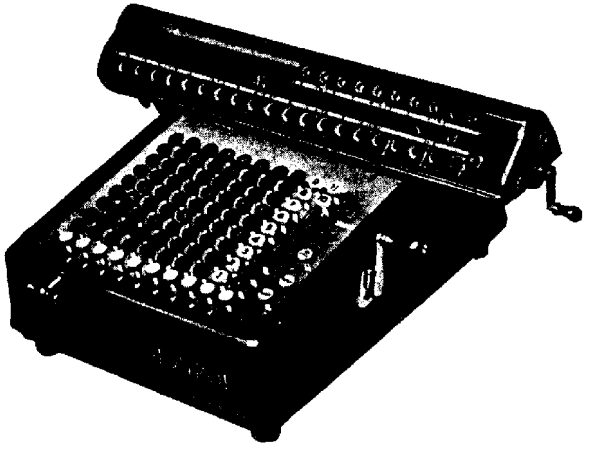


Figure 217
Machine for English currency.

with keys of approximately the same height in all key rows. The carriage is located above the keyboard. Rotation of a manual crank, which may be seen at the front of the machine, provides ordinal displacement of the carriage to the left or to the right, while a button on the right side of the carriage permits speedy shifting over its total path of travel. The keys for clearing of individual columns of the operational keys are located in the lowest row of the keyboard. The two counting mechanisms may be set to zero by a crank: the upper one by a forward movement of the crank and the lower one by a backward rotation of the same device. At the right side of the keyboard there is a repeat key, a repeat disabling key, and also a general clearance key for the keyboard. The keyboard is self-correcting. Addition, subtraction, multiplication, and division occur in the same manner as in the pinwheel machine, except the setting takes place by means of the keys.

No details are available with regard to the first three models, which were only manufactured in small numbers. Model D appeared in 1915, model E in 1916, model F in 1917, model G in 1919; then in 1921 the present model K appeared, which is manufactured in the following sizes:

6 x 6 x 12 places	10.5 kg	$200.00
8 x 3 x 16 places	11.5 kg	$200.00
10 x 10 x 20 places	13.5 kg	$400.00

The two larger models were also furnished with electric drive. The motor is located on the left side of the machine, while the plus and minus operating keys are at the right side of the keyboard. If the electric current should fail, which is known to happen, the hand crank may be slipped on and the machine may be operated manually. Machines for fractions and for English currency are also available.

Manufacturer: Monroe Calculating Machine Company of Orange, New Jersey. (The company took over the facilities and the equipment of the Pike Adding Machine Company in Orange.)

Tourtel (1911)

The Tourtel is a printing adding machine with setting levers just like the pinwheel machines. It is equipped only for English currency. The lever on the right side of the machine is marked F (farthings), followed by D (pence), 1 (shilling), and finally 10 (shillings). The remaining three levers are for pounds—the machine is thus capable of adding up to £999. The setting levers

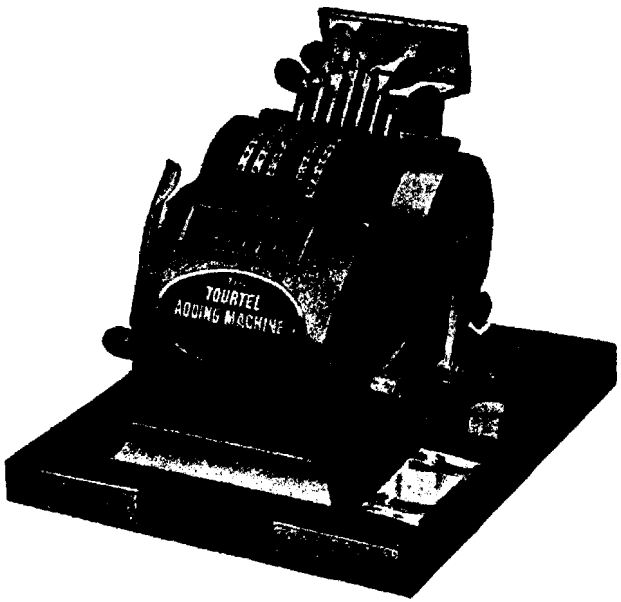


Figure 218

are, as usual, placed next to the setting slots, and the values are entered in the normal way. The result can be read from the wide window at the front of the machine, In order to print and add the value entered, the printing lever (on the left of the entry slots) must be pressed, which then forces the paper platen against the calculating gears. The crank on the right side of the machine must then be turned. This adds the value and brings the setting levers back to their rest position. On the front of the machine are two mirrors by which it is possible to check whether the correct value has been entered. To print the total, the lever next to the result window must be pressed and the zero setting crank on the left side of the machine must be turned—this causes the value in the result mechanism to be printed. To reset the machine to zero, the zero-setting crank must be turned without the total lever being pressed.

The weight of the machine is 5.5 kg. The designer is John Mesny Tourtel, London. and the manufacturer is The Tourtel Adding Machine Syndicate, Ltd.. 57 Chiswell Street, London E.C. In 1912, the German patent was tendered at £2000, although it was later sold by the designer for considerably less. Even in England the machine was not considered to be a significant one, and it has not been manufactured for some time.

Thales (1911)

The Thales is a well-established calculating machine with pinwheel gears (see the section in the introduction on pinwheel machines) that has been produced in four models.

Model A: nine places in the setting mechanism, thirteen in the result mechanism. eight in the revolution counter; weight: 4.5 kg.

Model B: nine places in the setting mechanism, eighteen in the result mechanism. ten in the revolution counter; weight: 5.5 kg.

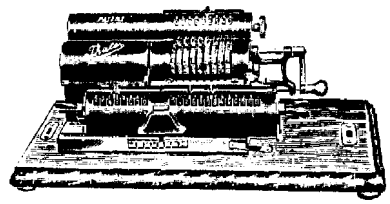


Figure 219