From Model T to the 1051

The 10-key universal computing machines FACIT

"Aldrig någonsin kan en elektronisk räknemaskin ersätta Facits högkvalitativa mekaniska räknemaskiner." (Testimony of a Facit Development Chefs)

The early models Facit

Facit Original (Photo: Timo Leipälä)

The first calculators named "Facit" (Swedish for "Conclusion", "solution") were designed by Karl Viktor Rudin and manufactured in the company of Axel weevil in Stockholm. Weevil, which has mainly produced office furniture, also had a representative office machines (including Burroughs, Brunsviga) and a repair shop for calculating machines in the Klara Norra Kyrkogata in Stockholm. There Rudin began developing its own four-operation machine after Sprossenradprinzip, which is known as the "Original Facit" today. When assembled, the machines were in Wibels subsidiary Facit AB, founded in 1918, and the delivery was carried out from 1920 - starting with the serial number 100 (Info Timo Leipälä). The early Facit models were essentially based on the plans of Willgodt T. Odhner in St. Petersburg designed (patent DE7393 or DE64925). However, to be found in the "original Facit" already some special features and improvements as compared to the Sprossenradmaschinen other manufacturers. The revolution counter, which still had no apparatus for tens transmission is mounted not in the carriage next to the result work, but firmly in the machine body via the setting dial. This allowed the carriage carrying only the result of work, are correspondingly short, and this arrangement allowed a relatively high number of posts of 9 x 10 x 15 in the counters. Moreover Rudin developed new locking devices, namely a blocking device for the dials, which operates without springs and so the course of abacus facilitated (patent DE345070), and a reverse lock that prevents reverse rotation of the crank to a specific deflection (patent DE355198). Also noteworthy is that the "original Facit" no indicator for the set number has, though Rudin has a patent DE339121 registered for such a display device. Another distinguishing feature of the early models Facit is the fifth pillar that you otherwise not found in any other brand.

Axel weevil was involved in the AB Åtvidabergs Förenade Industrier, a manufactory for office furniture, which went bankrupt 1922nd This resulted in the same year, the new AB Åtvidabergs Industrier headed by the former furniture factory Elof Ericsson. At the same time took you also Wibels subsidiary Facit AB, and the production facilities were relocated from Stockholm to Åtvidaberg. There the development of Facit calculators continued from 1923rd The Facit original (1918-1924) initially followed the model "Facit Standard" (1924-1931), also a crank machine from Odhner-type with fixed revolution counter without numeric transmission. However, this machine has a novel Tabuliermechanismus consisting of two taboo Furnished keys to gradual displacement of the carriage, a Tabulierdrehknopf on the left side for the free positioning of the result and work ten tab keys with which a decimal point can be preset. From 1928 to 1931, finally, the Facit was 10 built with tens transmission in all arithmetic units, said Tabuliereinrichtung was changed again. The quick shift and step circuit the result work is now carried out by a single lever, which is mounted on the front of carriage. Another feature of the Facit 10 was the "automatic ratio selection", ie, the auto-changeover of the direction of rotation in the quotient structure (patent DE477002 of Karl Rudin). If the first crank revolution takes place in negative direction, then the revolution counter is set so that it counts subtractions in a positive sense. In this way, is always displayed with the correct sign when dividing the quotient, obtained by subtracting the continuing revolution counter. When the ratio is changed, the shaft with the quotient single tooth is after deleting the Umdrehungszählwerks, depending on the sense of rotation of the first crank rotation and until the next zeroing quotient work, rigidly coupled to one of two gears, which are both connected to the crankshaft, but by means of a idle gear rotate in the opposite direction. Such a device for automatic switching of the quotient plant can be found again in later Facit machines.

Facit Standard

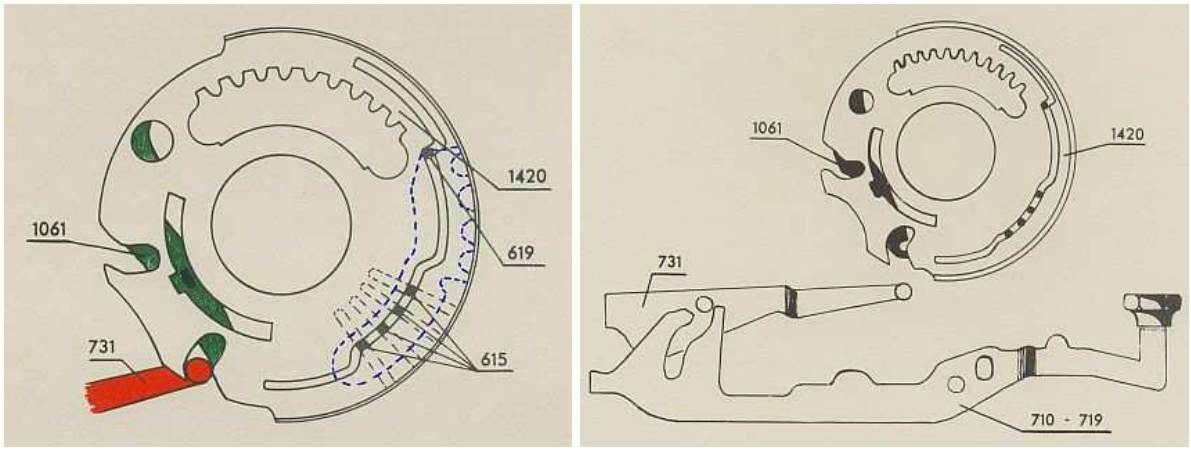
Facit 10

model S

The ten-key crank machines

The Model T (1932-1939). In the early Facit machines and also during later from 1935 to 1954 produced Model S (a crank machine identical to the model Odhner 7) the entry of the digits even in the classical manner, and by means of small levers which are attached to each sprocket. This type of value adjustment is not practical, and therefore they were looking for some time for a way to equip Sprossenradmaschinen with a numeric keypad - with adding machines such a keyboard was introduced ("Witness" Adding Machine, 1902) at the beginning of the 20th century. However, there was to overcome some technical difficulties. Thus, in the classical Odhner machine for setting the number 9 is the sprocket to rotate about 90 degrees, while the number 0 the sprocket remains in its basic position. The adjustment path and force to rotate the sprocket wheel is therefore very different for the numbers 1 to 9. Karl Viktor Rudin was around 1929 a solution to this "ten key problem" (Swedish Patent SE74358). His adjustment mechanism, later called "Facit" principle, was first used during the Model T, which came to market in 1932 and was manufactured until 1939 ("T" stands for "Tangent", the Swedish word for "key") , The patent DE535576 for Facit T there are three major innovations compared to Odhners construction which should ultimately allow the installation of keypad:

- With results and the quotient works are stationary in the machine on a common shaft. In contrast, the setting dial, so the Sprossenradrotor, mounted displaceably in the axial direction in front of these two counters on a carriage. The Sprossenradschlitten glides on a ball bearing tube and is in keying the digit values gradually moved from right to left.
- The "split sprocket": The scion wheels are rotatable in both directions, the rotation in one direction causes the adjustment of the four lowest digits values while setting the remaining digits by rotation occurs in the opposite sense. In such a split sprocket wheel, the adjustment movements can be reduced to about half of the usual rotation angle. Each pinwheel turn carries nine adjustable teeth, but only four of which are arranged in the usual way, ie in the form of short rods, which can be moved along the radial channels in Sprossenradkörper. The five remaining teeth of each sprocket wheel, however, are firmly joined together. When entering the numbers 1 to 4, the sprocket wheel is rotated upward and an appropriate number of individual teeth forced out while the keying of paragraphs 5 to 9 takes a rotation of the sprocket wheel down and also next to the corresponding number of individual rungs of the sector with the five teeth is pivoted.
- The adjustment mechanism (see drawing): Upon pressing a numeric key is a key lever pivoted on the 710-719, whose rear part is provided with a cam, two adjustment arms 731st The positioning arm engages in a corresponding cutout of the dial 1420 and rotates it until the digit that is indicated on the button. If a key is pressed with the digits 1 to 4, the left adjustment arm in downward direction continuous working while being pivoted when a button with paragraphs 5 to 9 of the right adjustment arm in upward continuous direction. The curves at the end of the key levers are shaped differently and different lengths, namely the longer, the higher the numeric value within a key group. In this way, the angle of rotation of the associated adjustment arm is set, and by the specific curvature of the curve, you have a soft keystroke even at higher numeric values. After pressing a button also is the carriage on which the Sprossenradtrommel sitting to move one step to the left. By pressing the 0 key, so there is only a step circuit of the regis- ter one position to the left - without rotation of the dial.

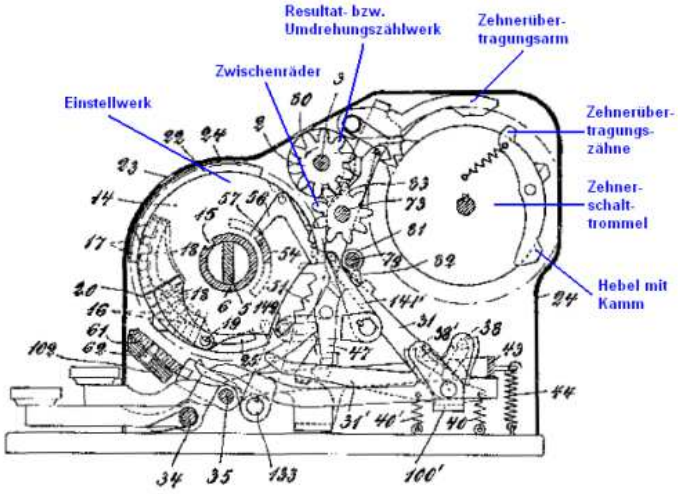


The split sprocket (left) and the key adjustment mechanism (right)

The adjustment had to split sprout wheels using a numeric keypad type "Dalton" result, in the top row, the numbers 2-4-5-7-9 and in the bottom row the numbers 1-3-0-6 -8 lie. In this arrangement, the group of group numbers 5 to 9 is with the numbers 1 to 4 on the left, right of the keyboard, and any Ziffengruppe is assigned one of the two adjustment arms. (In Patent DE535576, Fig. 34, an alternate embodiment is provided for the adjustment mechanism that operates independently of the arrangement of the keys, but never came to be used in a Facit model.) In addition to the numeric keys are postponing the Sprossenradschlittens at multiplication and division three tab keys provided and are located on the sides of the machine three levers that are used to zero the arithmetic units. The counters themselves have a capacity of 9 points in the setting dial, 8 points in the quotient work and 13 points in the result works.

Even with the number transfer chose Rudin a new way. In the Sprossenradmaschinen the time the tens circuit was made even with the help of the side swing-Ten sprouts that are directly attached to the sprocket. However, in order to keep the width of Sprossenradschlittens as small as possible, the mechanism for transmission of Ten was completely removed from the setting dial and relocated behind the results-or revolution counter in Facit T. On a shaft that rotates in synchronization by means of a gear transmission for setting dial, a numeric shift drum is fixed for each arithmetic unit, which consists of several discs. At the discs are mounted lever with tens transmission teeth. These are, as usual, slightly offset, ie are arranged helically to ensure a continuous numeric transmission in the higher places. The tens switching device is described in the Swiss patent CH151383 the Model T as follows: If the visible point from zero to nine or changes reversed in a decimal, a Zehnerübertragungsarm is a small cam on

Zählwerksrad moved toward the opposite transmitting plate and locked in this position. During circulation, the number of shift drum Zehnerübertragungsarm presses on the lever with the tens transmission gear. This is swung out, acts on the intermediate wheel of the next higher decimal place and so rotates forward or backward the Zählwerksrad the subsequent location by one digit. The transfer is then pushed by a cam on the transfer disc back to its original position, and the number transfer is complete.



Ten switching device of Facit T (from the patent DE535576)

The ten-key adding machine of Rudin had several advantages over other Sprossenradmaschinen from that period. With the number keys you can adjust the numeric values relatively safe and convenient as in typewriters. The machine can even be blind with just one hand ("left buttons - write right"). It was also possible, the entire mechanism to accommodate compact and dust in a closed housing. This successful design made the winch machine Facit T for starting point of a whole Abacus generation - up to fully automatic CA1-13. The concept has not changed significantly in the following years, only extended.

Baldwin's Calculator 1875

Historical tour. The idea to store the Sprossenradrotor movable on a carriage, was not new. It goes back to the American Frank Stephen Baldwin, who almost simultaneously and independently from Sweden Willgodt T. Odhner developed the Sprossenradmechanismus. The Sprossenradsystem itself was the polymath Gottfried Wilhelm Leibniz (1646-1716) invented, which is best known as the designer of the first season rolling machine. In his papers we find the note "... the wheels representing the multiplicand, are each provided with 10 teeth, but these are movable so that soon 5, 6 soon teeth protrude, etc., depending on whether one namely to be multiplied wants to represent the number 5 or 6 times. " However Leibniz has never built a calculating machine, based on the Sprossenradmechanismus. The first Sprossenradmaschine 1709, developed by Giovanni Polenius, an astronomer and mathematician from Italy. However, this machine was due to fine mechanical problems still very imperfect, and according to tradition it was destroyed by its builders themselves again. Only 1727 succeeded the Swabian instrument maker Anthony Brown d. Elderly to develop a functioning Sprossenradmaschine for the four basic arithmetic operations. This can-shaped abacus the Sprossenradelement and the crank drive were still centrally located. In 1843 then the French doctor Didier Roth has designed a calculating machine after Sprossenradprinzip again, and in 1866 another Sprossenradmaschine by Swedish mechanic C. Petterson was presented at the Art and Industrial Exhibition in Stockholm. Baldwin (1873) and Odhner (1874), however, were the first who have developed a useful and practical calculating machine based on the Sprossenradsystems. Both knew probably built by Roth and Petterson machines, and they were probably influenced by an abacus of the Polish watchmaker Abraham Israel Season from the year 1845th However, the proposed by Odhner design with fixed setting dial, which he improved again in 1876, was easier and safer, so that this variant has prevailed in the following years. It played Franz Trinks, engineers and employees of the sewing machine factory Grimme, Natalis & Co., a decisive role: He took over in 1892 Odhners patents and licenses, and in his Brunsviga machines was the construction of Odhner spread worldwide. Only in connection with the production of a compact abacus shows the variant of Baldwin decisive advantages, because the usual wide carriage with with results and the revolution counter is omitted. However, whether Karl Viktor Rudin fell back in the development of the model T to Baldwins design (patent US159244), is not known. Besides this commonality, there are still other parallels between Rudin and Baldwin. While Rudin, the inventor of the ten-key Sprossenradmaschine is Baldwin as a designer of Abacus "Monroe" (ca. 1914), the first commercially successful season rolling machine built with full keyboard. In addition, both have to shorten the adjustment path for the numeric values and more evenly distribute the keys, developed a shared transmission element consists of a complete five piece and four individual segments, which are then 0 to 9 combined suitable to adjust the numbers. The split sprocket by Rudin and Baldwin split stepped drum (patent DE276574) So based on the same principle.

Finally, a few words to Karl Rudin (1882-1939), which itself has an interesting biography. He first graduated from a humanistic studies at the University of Uppsala, his native town, but had to abandon the academic career because of an illness. His interest in calculating machines was awakened by frequent visits to Wibels repair shop, and although he did not have appropriate technical training, he started there with the construction of calculating machines. (In this workshop also Carl Friden to have worked, who later was the first for the American manufacturer Marchant and then developed his own company calculators). After Rudin had already been built in the company Wibels "Facit original", he constructed continue calculators for the new owner, who, although he was there never hired AB Åtvidaberg Facit. His work on the solution of the ten key problem he conducted in Stockholm, regardless of Facit and with the financial support of a friendly banker. His patent, which he received in 1929, he handed over to the AB Åtvidabergs Industrier, in its subsidiary Facit AB then the Model T was produced. Thus Karl Rudin came to fame and some fortune - alone in 1935 to 1939, he received about 192,000 Swedish crowns for his invention (for comparison had a Facit engineer at that time a monthly income of 500 crowns). Yet he lived until his death in 1939 in relatively modest surroundings. "The last time, when I met Rudin, he lived alone in a studio apartment with a single bed, a table, a chair and a safe," said Elof Ericsson, the former Management Board of AB Åtvidabergs Industrier. (Sources and further information: [15], [16]).

Prototype to Model T
(from the book by A. Hennemann)

Facit T from 1932
(Photo: Timo Leipälä)

The models TK (1936-1954), NTK (1954-1957) and C1-13 (1957). If you want to fully utilize the capacity of an abacus in the division, one must add the dividends to the far left in the result of work and the move divisor in setting dial as far to the left that the highest decimal divisor is below or to the right of the decimal point highest of dividends. The Model T has a separate button for this division preparation, with which one can tabulate setting dial to several positions to the left. When Facit T but the Sprossenradschlitten coupled to the eight-digit quotient work, so that the value in the setting dial when the "division" key is shifted by 7 points - the remaining positions must fill via the keyboard with zeroes. This problem was eliminated in 1936 by the hand crank machine TK. When Totaltabulierung left now the setting and revolution counter is conveyed independently in the left end position. The corresponding mechanism, known as "sliding quotient circuit" called (Swedish "Kvotkoppling", hence the "K" in the model name), is described in the patent DE719718 Rolf Erik Annerén and Bengt Carlström. From 1943 the model TK was delivered in a green livery, and sold from 1954 to 1957 in a new Preßgußgehäuse with better sound insulation as Facit NTK. 1957 was finally introduced the term C1-13, and delivered the model with a designed by Sigvard Bernadotte housing.

model TK

Facit NTK

C1-13

The LX models (1938-1954), NLX (1954-1956) and C1-19 (1956-1960). In the Facit T and its successor models with results and the revolution counter are built into the machine. The size of the machine body is thus dependent on the dimension of the two arithmetic units. To limit the width of the machine, a relatively small, but sufficient for commercial applications capacity of 9 points in the quotient work and 13 points has been selected in the results business. In 1938 it has developed parallel to the Facit TK a winch machine with much larger computing devices - the model LX with 10 points in the quotient work and 19 points in the result works. Here are a few technical changes with respect to the Series TK were required: Because of the high number of posts are in Facit LX with results and the revolution counter in a movable carriage located above the setting dial, while the Sprossenradrotor maximum of 10 points (= capacity of the regis- ter) can be moved. Furthermore, a two-part numeric shift drum had for tens transfer the result works are used (patent DE703464 and DE735954 Bengt Carlström). The model Facit LX allows calculating with multiple-digit numbers, and it was thus interesting to use in the field of science or engineering. After several design changes you have sold this machine from 1954 to 1956 under the name NLX, and it was then until 1960 as a model C1-19 in the program. The C1-19 was also the first crank Abacus Facit with the Bernadotte case.

Facit LX

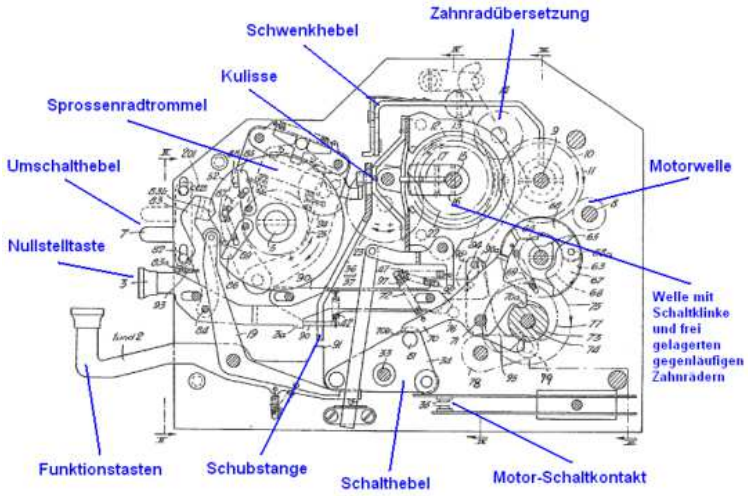
model C1-19

Motorization of Facit machines

"The Sprossenradsystem has several advantages. It is easy and trouble-safe design, occupies a small space a, so it possible to build smaller and cheaper machines. The ability to add by right and left rotation of the hand crank and subtract, so multiply also and divide, saves a special switching between these two basic arithmetic. Significant difficulties but prepared the questions, to motorize the machines and to automate and provided with a keyboard for setting values. of the repeatedly made attempts to motorize the Sprossenradmaschinen and to give them a button setting, only the construction of the Facit abacus has been able to prevail in the long. " (from Priebe [8])

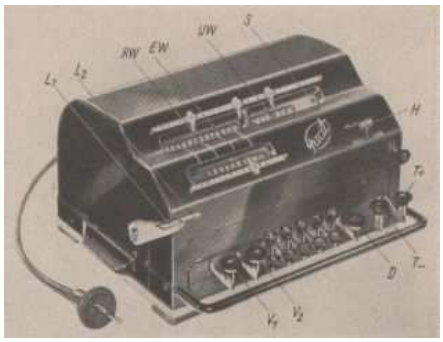
Facit E (1934-1939). Running an arithmetic operations is still entered manually in Facit T by turning a crank. In 1934 also appeared already the electrified version of the model T, the Facit E in which the Sprossenradtrommel is rotated by an electric motor, with a speed of about 400 revolutions per minute. This machine has in addition to the ten setting buttons for sprout wheels and the three tab keys for the carriage circuit nor a function key + for addition (multiplication) and a function key - for subtraction

(Division). Also located on the front of a movable lever which can be adjusted in two layers, wherein the lower layer is referred to as addition / subtraction and the upper layer with multiplication / division. When this lever is set in the lower position, the scion wheels are reset after each machine gear; otherwise, the zeroing is done only after pressing the reset button 0 so that for example, multiplication, ie the continued addition, is possible. The reset button, with the setting dial is deleted, was also new and replaced the extinguishing lever on the right side, while the erasing apparatus for the results and the nature quotient work was maintained.



Motor switching device of Facit E (from the patent DE656737)

The installation of the electric motor and the connection with the mechanism was to be conducted with relative ease at the Facit E: After depressing a function key of the motor contact on a triangular lever is closed, the is kept in this position until the arithmetic operation is finished. A much more serious problem was the control of the Sprossenradtrommel. Since the Sprossenradrotor for the arithmetic operations of addition and subtraction, must be rotated in different directions, but the motor rotates in one direction only, one has designed the following clutch mechanism: a gear ratio initially transmits the engine rotation to two gear wheels which are loosely mounted on a shaft and in rotate the opposite direction. When you press the plus or minus button, a push rod is in the path of a constantly back and brought herschwenkenden lever and so moved to the left or right either. At the push rod a setting is secured on the drive shaft with the appropriate (floating bearings) gear combines a ratchet so that the shaft, depending on the button pressed rotates upward or downward. The rotation of the shaft will eventually be passed by means of a gear transmission to the Sprossenradtrommel. This construction as well as the zero-setting mechanism for the setting dial of Facit E are described in the patent DE656737 and DE682246 Rolf Erik Annerén and Bengt Carlström. The Model E is also equipped with Stop Division (semiautomatic Division): If it falls below when executing the division, ie the continued subtraction, the capacity of the plant result, the machine stops automatically. the drive drum is then rotated once and thus corrects the underflow by pressing the + button. By means of the Tabuliertaste Sprossenradrotor is then shifted to the right, and the division can be continued in the next place. the division process was much easier compared to the winch machine Facit T through this facility.



Facit E
(From the book by F. Willers)

Model EK
(Photo: Timo Leipälä)

Facit NEK

The models EK (1936-1943) and NEK (1943-1948). Like the Model T, the electric variant E was in 1936 with the "sliding quotient circuit" and sold under the name EK. Outwardly there were hardly any differences to its predecessor. In 1943 Facit AB has the color of the case changed from black to "Halda-green", built an improved drive unit and changed the name in NEK. A little later, the curved and silver printed Facit logo was replaced by a black shield. Furthermore, it has further postponed the lever for the setting of multiplication / division and addition / subtraction down. In the Division of the lever can now be taken immediately to the division position, and to transfer the dividends in the result of work of adjustment is only slightly depressed along with the plus button. This so-called "combined control" reduces the computation time, especially when several divisions are carried out in sequence.

The models NE (1953-1956) and CE1-13 (1956-1960). The production of electric abacus NEK was set 1948th It was only in 1953, when already were the semiautomatic model NEA and the fully automatic ESA-0 on the market, Facit has again offered a non-automatic machine, the model NE, where many of these machines were manufactured in Facit office machine work in Dusseldorf. The Swedish version of Facit NE differs from NEK on the function keys for addition and subtraction. Instead the + and - buttons (simple addition) ÷ (combined Div / Sub-key) × (Plus Duration button) and the SUB-STOP lever with the respective functions of the Facit NEA were taken over the ADD button. In contrast to the model, the model NEA NE, however, only equipped with Stop Division, and the device for semi-automatic multiplication missing. At the Düsseldorf variant of Facit NE has additionally incorporated a control lever, which the "short-Division", so the Stop Division with alternating positive and negative operations possible. This version was sold from 1956 with the new, designed by Sigvard Bernadotte disguise as model CE1-13 until 1960th

model NE

CE1-13 (Photo: Peter Haertel)

The semiautomatic Facit models

Facit EA (1939-1943). In 1939, the model EA appeared - a semi-automatic calculating machine with automatic division and automatic step circuit to the left or to the right in the multiplication. Compared to Facit EK some new controls have been added. In addition to the ADD button for easy addition followed by cancellation of the regis- ter, there is a multiplication or increase duration button × for multiple addition and a combined division and minus duration button ÷. Further, a main control lever is mounted, which can be adjusted in three positions: In the left and middle position (multiplication layer) have with results and the quotient work the same direction, the division pulse lever is ineffective, and the Sprossenradtrommel is switched to left or right gear. In the right position (division position) with results and the quotient working in opposite directions, the division pulse lever is effective, and the Sprossenradrotor set to legal procedure. In addition, the machine has a stop lever, the center position in the main control lever, the automatic carriage circuit shut off in his left position to the right, so that arithmetic operations can be performed without self transition of Sprossenradtrommel. In the semi-automatic multiplying the duration Plus button × is pressed until the corresponding number appears on the revolution counter for each point in the multiplier. When you release the button the duration Sprossenradschlitten is automatically shifted depending on the position of the control lever one position to the left or to the right so that the multiplication can be continued the same in the following decimal place. With the main control lever and the stop lever can thereby set to be processed in the order of the multiplicand: from the lowest to the highest point (at the left position of the main control lever) or vice versa (at central position of the main control lever and merits of the Abstellhebels).

The substantial progress in Facit EA, however, was the automatic Division. For this purpose, the main control lever is moved to the right position and transferred the dividend left in the result of work. Then the divisor is keyed to the setting dial and very tabulated left, so compared with the highest point of the dividend. After pressing the minus button ÷ duration then runs the following mechanism: The divisor is first so many times on the value in the result Factory subtracted until there an underflow occurs. This triggers a continuous numeric transfer which is registered with a numeric switch hook (Division impulse lever) and causes a step circuit of the regis- ter to the right. In addition, the Sprossenradtrommel a shift lever during braking (!) Is actuated which switches the direction of rotation of Sprossenradrotors to "Plus". Then the divisor is often added to turn an overflow of the result work the machine stops, surrounded the direction of rotation to "negative" and the Sprossenradtrommel moved one step to the right. The whole process will be continued with alternating negative and positive rotations with intermediate step occurring circuits of the carriage, from the second highest point to the lowest point. The machine is controlled so that it is always stopped at the end in the plus position. In revolution counter then is the quotient, and in the result work always remains a positive residual (or no residue). The fully automatic Division was mostly already in the models of other calculators manufacturers exist, but it has generally used a division algorithm, which differs from the above mechanism is different: The divisor initially repeatedly subtracted until an underflow occurs in the result work; then the divisor is added back to correct the lower reaches, and is only made the step circuit. This generally used procedure in average less efficient than the alternating Division of Facit EA, which came at the time only in the Mercedes-Euclid apply. By alternating negative and positive rotations of a rotation Sprossenradtrommel one hand for each decimal of dividends saved since the underflow in the result work is not reversed, and on the other hand appear less continuous numeric transmissions. One can therefore speak of a "shortened Divison", although in some cases the execution of the arithmetic operation takes longer (approximately in the calculation of 1000000: 999).

The model EA Facit was also the first sprocket wheel that could automatically perform a division not only subtractive, but also in the positive sense. The patent DE871079 which underlies the Facit EA, it says: *"There has been described a calculating machine, in which the shift direction of the carriage is determined by an adjusting lever and the selbstätige granted after releasing the duration button Executing divisions happens after. Transfer of another lever in the operative position, the remaining settings and calculations done automatically. with this known machine can be in setting of the control lever on automatically only one bill, and although only perform a division calculation, which automatically ends with the returning of the lever to its original position. "* (this is the model EMKZ Walther. see patent DE480805). The advantage of this Division Plus is that three calculations can be executed in one operation automatically, and also the reciprocal of a number can be determined particularly advantageously so. Even an automatic multiplication can be realized in this way (as described in DE871079). Similarly, in the Facit EA multiplications in negative sense is possible, with which one can calculate fast and convenient product differences of the form a × bc × d. For the plus or minus Divison multiplying the small lever is turned over on the left side of the engine and so manually switched the revolution counter either the same direction or the opposite direction to result works. A detailed description of the automatic processes in the model EA can be found in the patent DE871079 Bengt Carlström, Erik Konrad Grip and Sture Toorell. Originally probably a dedicated button planned for subtraction (Fig. 1 in DE871079). A modified version was built but then with a combined division subtraction key, though you should also press the lever SUB STOP for simple subtraction. This construction is already mentioned as an alternative in the patent DE871079.

model EA

Facit NEA

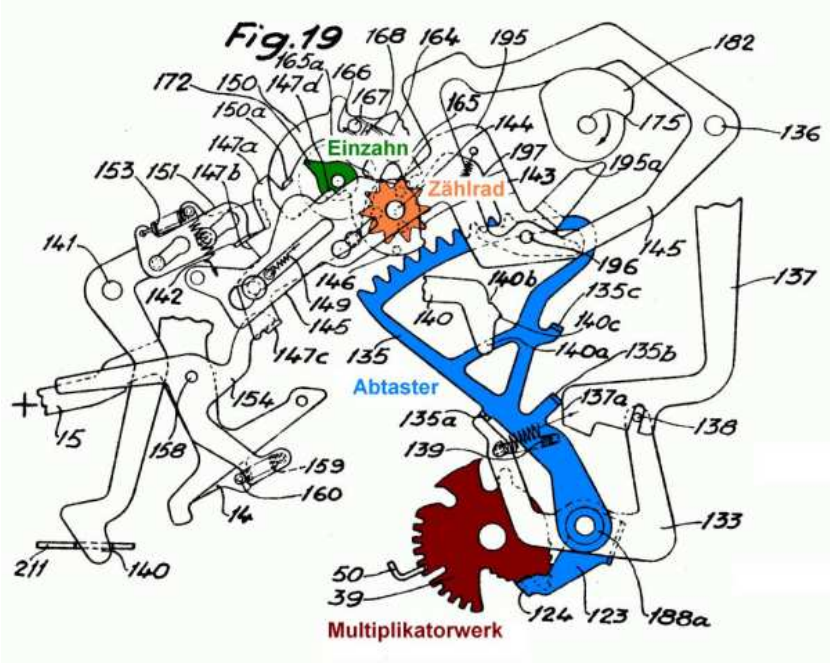
CS1-13

The models NEA (1943-1956) and CS1-13 (1956-1965). Similar to the Facit EK has delivered from 1943 the model EA in a green or beige painted housing, and shortly thereafter the elegant lettering by a sign with the Facit logo replaced. Furthermore, an improved electric drive has been installed, the less sensitive to fluctuations in

the mains voltage, and the indexing means and the intercept mechanism for the setting dial been modified (patent DE914792 and DE923749 Erik Konrad Grip and Sture Toorell). Furthermore, it has improved the Division Preparation: When transferring the dividends in the result of working the quotient work is not adjusted, so that no delete the one in the revolution counter is necessary (patent DE887419 Erik Konrad Grip). The model designation was in NEA thereby changed (= Nya Elektriska machines). From 1956 these machines were the Bernadotte-housing with improved sound insulation and zeroing keys to clear the counters, and the release button for the direction of rotation quotient plant has replaced by a button NEG. Under the new model name CS1-13 the semiautomatic machine was sold until 1965th Perhaps planned, but probably never built was a mechanism for rapid calculation of reciprocal values, which is described in patent DE1096652 or CH342385 Erik Konrad Grip and Lars Gustav Hellström. (The idea: the machine is in the division position, so when slaked result works the setting dial is not tread shown after the first underflow; the zeros in the result works are complemented by an invisible foreign one, ie the dividend 1 need not be keyed, and one gains an additional decimal place in the result.)

The fully automatic machines from Facit

Facit ESA (1945-1949). In 1945, the first calculating machine from Facit came on the market that could automatically perform alongside the Division also multiplying - the model ESA (= Elektriska Super machines). These four species machine was also the first fully automated Sprossenradmaschine or the first ten-key fully automatic world. Unlike the table calculating machines from other manufacturers of this period, in which the factors are either adjacent typed into a keypad (eg Mercedes Euclid 38ms) or its own numeric keypad for the multiplicand have (eg Rheinmetall SASL), is multiplying on the Facit- machine comparatively comfortable and comparable to the multiplying process on today's desktop computers: Once the multiplier is keyed, pressing the product key ×. Then the multiplicand is typed in the usual way (from left to right) in the numeric keypad and start the multiplication process with the button =. For the multiplication particular therefore only one keyboard is required.



Multiplier of Facit ESA (the patent DE922553)

The model is a further development of ESA Facit NEA, which was also equipped with an eight-digit multiplier unit and a scanning mechanism. The multiplier works is similar to the Sprossenradrotor in setting dial. It consists of scanning disc for each value digit of the multiplier, which are rotatably supported on an axis and have different depths notches for the numbers 1 to 9. When keying in the multiplier, the scanning disc will be just like the sprout wheels rotated by an angle corresponding to the numbers. This value is later scanned by a small bracket that is rotated until it abuts against the scanning disc. The multiplier station is initially connected in parallel with the Sprossenradschlitten, so that the multiplier can be read for control purposes in the setting dial. If you press the × button the setting dial is deleted, disconnected from the multiplier works and instead connected to the scanning mechanism. After keying in the multiplicand and pressing = expires following procedure: A digit in the multiplier is first determined by the scanner. This is connected with a gearwheel segment, which is now also pivoted, and a counting wheel by as many steps moves forward, as indicated in the multiplier digit. Thereafter, the counting wheel is disengaged from the scanning segment and contacted with a Zählzahn engaged, the forward or backward to rotate the counter wheel to zero, namely by one step for each revolution of Sprossenradtrommel. The Zählzahn in turn is connected to the quotient unit that shows the number of revolutions and thus the corresponding multiplier digit. After the counting wheel has reached the zero position, the Sprossenradrotor is stopped and continues to move along with the pickup by one step to the next decimal. The scanning operation and the turning wheels of the rung is performed in the same manner in the subsequent value points. If the entire multiplier has been performed with the sensing mechanism, can be found in the result working the product, the quotient work shows the multiplier, and the setting dial, the multiplicand is to be seen.

The model ESA has already been equipped with a mechanism for fully automatic abbreviated multiplication, which minimizes the number of drum rotations in each decimal of the multiplier. If the current paragraph in multiplying a 0, so there is only a step circuit of Sprossenradschlittens. If the multiplier digit is a 1, 2, 3, 4 or 5, then the counting wheel is turned back to zero. Here the Sprossenradrotor rotates accordingly often in the plus direction, and in each cycle, the multiplicand is added in the setting dial to the value in the result works. If, however, the multiplier number between 6 and 9 takes place the circulation of Sprossenradtrommel in minus direction. Here also the Zählzahn is rotated in the opposite direction and at the same time the counting wheel to the complementary value of the sampled number (ie 10 minus the multiplier digit) advanced to the zero position. According often so the multiplicand is subtracted from the value in the result works. Then, the sector gear is returned to an initial position corresponding to the digit first After the step circuit the digit in the next higher decimal place of the multiplier is then scanned and the toothed segment by the corresponding angle is further rotated so that the next multiplier digit is set plus 1 there because of the changed position of the sector gear. Consequently, ten times the multiplicand is added from the perspective of the preceding decimal place again and the bill by the complement compensated (according to the formula 7 = -3 + 10). Overall, our with this method of multiplying considerably shortened, and it saves about 40% of the computing time. In order to determine the different directions of rotation of Sprossenradtrommel, a cam or cam plate is mounted with three surveys on the above-mentioned counter wheel. This cam operates a slider which determines the direction in which the setting dial to rotate.

It is amazing at first glance that the Division can be automated easily in a machine than the multiplication. However, a calculating machine, the numeric transmission in the highest point, which occurs in a subtraction below zero during the division, very good to use to control the mechanical operations. There are computing machines, such as the Hamann Selecta or Hamann machine, in which there is a corresponding method for the automatic multiplication used (the multiplier is set in the revolution counter; this will be automatically rotated back to zero, thereby controlling the number of revolutions of the regis- ter in each location). However, the fully automatic Facit machines operate on a different principle. The method for automatically shortened multiplication in Facit ESA, which is documented in the patent DE922553 goes back to the

designers Erik Konrad Grip and Sture Efraim Toorell. Through the installation of an additional multiplier plant the proven mechanism of Facit NEA was relatively simple and space saving to be extended (in fact, the models NEA and ESA are housed in a housing having approximately the same dimensions; the Facit ESA is due to the multiplier works slightly higher). In addition, the squaring can be due to the coupling of adjustment and multiplier works perform very fast: If you press after keying in a number immediately press =, so the number is multiplied by itself. Finally, a number can be easily multiplied with several factors as a value remains stored in the multiplier works until either the setting dial is deleted or lever SUB STOP is pressed. The model ESA is, incidentally, the first calculating machine Facit, having the wheels on the bottom, which can be the machine to move easily on a desk.

model ESA

Facit ESA-0

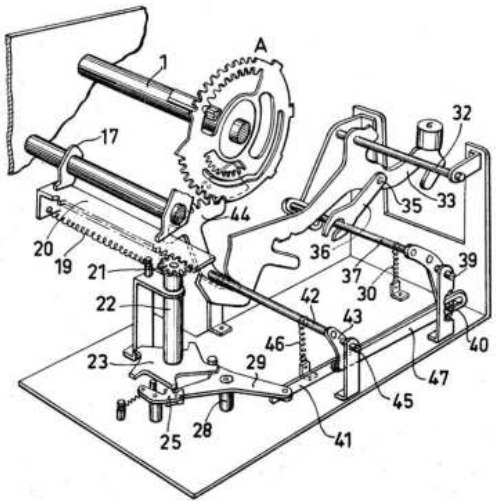
CA1-13

The models ESA-0 (1949-1956) and CA1-13 (1956-1973). From 1949 the model ESA-0 was produced (referred to in the German operating instructions as ESA-O). This is an evolution of the Facit ESA, which also addresses the roots of the results and the nature Umdrehungszählwerks via buttons (electric central deletion), so that all functions are controlled by electric-mechanical processes for the first time. Instead of the two levers on the left side of the machine and the 0 button this machine has three fire buttons I, II and III to the zero position of the respective works. In the early version, the Facit ESA-0 was equipped with only one control lever which could be brought into the positions MULT-ADD-DIV. In later models, in addition to this main control lever, a second control lever has been incorporated which has the same function as the stop lever in the Facit EA. In 1956, the appearance of this series also changed. The panel has been replaced by the new, sophisticated housing of Bernadotte, and renamed the model itself in CA1-13. After that followed a few minor design changes: the rounded corners you went on from about 1964 an angular shape, and the name given to the arithmetic units I and III was reversed. Technical amendments have been but no longer made.

Production of Facit ESA-0 (around 1954) - This model consists of about 2200 items!

The Serie C2 and the model 1051

Until the early 1950s the Facit calculators with her ten-key adjustment mechanism were almost unrivaled. By 1950, however, the situation changed: After patent expiration for the model TK other manufacturers could use the Facit principle to construct own Sprossenradmaschinen with numeric keypad. So even relatively soon further ten-key Sprossenradmaschinen appeared, such as the models Everest Z4 or Precisa 117. Another problem of Facit machines was the comparatively low computational facilities. The Sprossenradmaschinen the competition, including Brunsviga 13RK or Walther WSR16, had a device to retransfer the results-the setting dial. This mechanism allows for repeated multiplication, where you do not have to re-by keying the interim results. When Facit TK the installation of such a retransmission due to the split sprocket wheel would have been possible only with great technical effort. In the late 1950s we were finally able to Abacus manufacturers SCM (formerly DeTeWe) and Olympia, to develop even fully automatic machines with numeric block keyboard and retransmission. Their models, SCM Hamann Automatic 500 and Olympia RA-16 were also only marginally more expensive than the Facit fully automatic CA1-13. All this may be reasons that Facit late 1950s alongside the Serie C1 a completely new design, the C2 series, brought larger capacity and retransfer to the market.



Key mechanism of Facit CM2-16 (from patent DE1082754)

Facit CM2-16 / 1004 (1959 to 1972). The model CM2-16, built from 1959 to 1967 and then renamed with a new design and with a plastic case in Facit 1004 was the world's first crank abacus with double transmission (Info Timo Leipälä) , that both the value from the result of work as well as the contents of the quotient plant can be brought back into the setting dial. This is not only a product, but also the result of a division can be directly processed further. In addition, the CM2-16 received a completely new housing with a ten-block keyboard in the usual form today, and compared with the C1-13, the machine with a larger capacity in the arithmetic units (11-digit setting dial, 9-digit quotient work was, 16 -ary result factory) equipped. To implement these technical facilities had to be extensively revise the established Facit mechanism, wherein the retransmission even the divided Sprossenrad was abandoned (Patent DE1051539 and DE1082754 Erik Konrad Grip). Also noteworthy is the soft, uniform keystroke the model CM2-16 that has been achieved by a novel adjusting mechanism: When a button on the Sprossenradrotor is automatically tabulated one place to the left, and one uses the released spring force of Tabuliereinrichtung to the sprocket by bringing a brief initial rotation in the desired final position. Besides CM2-16 Facit still offered a simplified version CM2-16S without transmission to, and there was a short time also a variant CM2-13S the smaller capacity 9 × 8 × 13 (see [18]).

model CM2-16

CM2-16S

Facit 1004

Facit CA2-16 / 1007 (1962-1972) and CA2-16SX / 1006 (1965-1968). From 1962 the model was manufactured CA2-16 - a highly-developed electro-mechanical "ten-key Superautomat" with fully automatic abbreviated multiplication and division, retransmitted from the results and the nature revolution counter, central deletion of the arithmetic units and Stellenabstreichung in repossessing. Furthermore, the model CA2-16 has a storage device: The revolution counter can be set via the key "Reg II" off, and the keys A + and A-, the values from the result work on the content of Umdrehungszählwerks be added or subtracted. With this construction, it is possible to store items and subtotals, and by combining all means of CA2-16 can also be demanding computing tasks in a short time and with only a few buttons accomplish - as well as the calculation of higher powers, in which one to potentiating the value only once has by keying. For clarity, the keyboard has been divided into different color ranges: dark buttons for basic arithmetic and light buttons for complicated calculations. Despite the variety of ways the model CA2-16 operates at a speed of 420 revolutions per minute. Besides CA2-16 Facit had from 1965, a simplified, cheaper alternative on offer: the model CA2-16SX without memory device and a simple retransmission (only from the results-the setting dial). These two types were in 1967 under the name 1007 or 1006 in the catalog and delivered in an aluminum housing. For further information, reference is made to Lange [12] referenced, covering in particular the technical details of the C2 series in detail.

CA2-16

CA2-16SX

Facit 1051 (1967-1972). In 1967, finally came the Model 1051 to the market, the first and only fully automatic four-operation machine Facit who owns a printing unit. The Facit 1051 as an ordinary adding machine appears at first glance, and actually the digit values by means of racks are transferred to the individual registers. However, the model 1051 is equipped with a 13-digit actuation roller cooperating to perform a fast multiplication and division by a multiplication mechanism, and a product register, so that a processing speed of 430 revolutions per minute is reached (the 1051 is thus even slightly faster than the model CA2-16). The Mechanism is only noted here that

the actuating cylinder is rotated in contrast to Sprossenradtrommel only by a certain angle (depending on the set value), and that the actuating cylinder also works only subtractive - the addition is performed as subtracting the corresponding complementary value. The control of complex computing processes by means of a mechanical unit program consisting of program elements and samplers (see Anthes [11]). The model 1051, built according to the patents DE1524033 or US3451617 and US3484041 Erik Konrad Grip, was also the last new development Facit in the field of electro-mechanical calculators. The company was taken over in 1973 by the Electrolux Group, which has production of mechanical calculating machines set.

There are also a number of design proposals that were long ago applied for a patent, but (in modified form) came only in the Model 1051 for use. Such a mechanism is specified in patent CH308315 Erik Konrad grip from 1951, in which the Sprossenradtrommel rotates both addition and subtraction in the same direction. The subtraction is performed as an addition of Komplementwertes the number set. The scion wheels are therefore equipped with axially adjustable pins that represent the value or the complement value of a number, depending on the position. Further, the Sprossenradrotor and the result works can assume one of two relative to each other computing layers, so that depending on the location, the set number is added to the value in the result works or subtracted to this. Another concept which also goes back to Erik Grip is to be found in patent CH328487 of 1953rd There is a setting dial is described, not only for transmitting Ziffen but also entering a function type, for example, the multiplication is used. Here, the two factors are keyed together with the mark of succession and the executed arithmetic operation "×" displayed in a window. Simultaneously, the function key × that the two factors are transferred into separate calculator (multiplier and revolution counter). After triggering the multiplication the setting dial can be used immediately, while the machine is still busy calculating the product. A similar device can also be found only in the Model 1051st

Last are electrical-mechanical model:
The printing fully automatic machine 1051

Adding machine Facit 1218
= MX 11 C from Odhner
(Photo: Alexander Traxel)

First electronic Facit desk calculator:
Model 1121

The company Facit

"Such is the tale of an old Swedish 'bruk' which wurde a world-famous industry, a tale of a strange legend and reality." ([4])

AB Åtvidabergs Förenade Industrier (1922)

Facit AB in Åtvidaberg (1934)

As already mentioned, the Facit Group had its origin in the AB Åtvidabergs Industrier Förenade founded in 1906, a production of office and shop facilities. After this company in 1922 went bankrupt, it was built with the help of Sydsvenska banks again and as AB Åtvidabergs Industrier continued under the direction of Elof Ericsson. At the same time it took the company Facit AB Axel weevil, a small computing machinery factory in Stockholm that has produced since about 1918 Sprossenradmaschinen. At the new location Åtvidaberg this type were then in 1923 more calculators developed and continuously improved, to the model Facit 10 with numeric transmission in all arithmetic units. The market for calculators from Odhner-type, however, was dominated by the Brunsviga works from Braunschweig, and so until 1932 breakthrough with the ten-key adding machine Facit T, an invention of Karl Rudin, which is very well sold and the one in the following decades has evolved into an electric-super machines. During this time the AB Åtvidabergs Industrier strengthened its market position through clever purchases. After they had been in 1938 bought the typewriter manufacturer Halda-Norden, the company Original Odhner was taken to calculating and adding machines, together with their range in 1942nd Thus, the product range covered all types of office machines from which many of these units were sold under the names Facit and with the Odhner logo (eg the Saldiermaschine E11c that three species Machine MX11C, and later as the models CA1-13 or CM2 -16). In subsidiaries Odhner AB also Saldiermaschinen called FACTA were developed for Facit, including the model FE10CX, probably the only three species Abacus with Dalton keyboard. She was meant to complement the non-printing four-function machines from Facit and should provide customers with the same key arrangement. Approximately in 1950 has changed the name of the subsidiary Facit AB in AB Atvidaberg-Facit, and in 1957, after 35 years in the management team, Elof Ericsson was succeeded by his son Gunnar Ericsson, who until 1970 headed again the company (the AB Åtvidabergs Industrier was referred to as "family Ericsson"). It is also noteworthy that the Facit-Odhner Group has built not only office machinery and furniture, but also some large computer systems: first the Facit EDB, more or less a copy of the former fastest mainframe BESK (Binary Elektronisk Sekvens Kalkylator), followed by the EDB -3, which was put into operation 1959th Until the 1960s, the group eventually developed into a global company with thousands of employees and offices in over one hundred countries. Here, the subsidiary AB Åtvidaberg Facit became increasingly important, so that the entire group became Facit AB in 1966th That same year saw the merger with the Swedish competitor Addo, and has brought the first electronic Facit-desktop calculator, the Model 1121 to the market. However, this computer was not its own design, but was produced by the Japanese manufacturer Sharp for Facit (the Model 1121 is identical to the Sharp model Compet 20). In subsequent years it has sold some such electronic calculating machines from other manufacturers under the name "Facit", but the company management failed to timely enter into the development of its own electronic desktop calculator - too were convinced of the superiority of the electric-mechanical calculators. In the early 1970s, finally broke the sales, and it came to an end for the Facit Group. The company was acquired in 1973 by Electrolux and acquired in 1983 by Ericsson. From 1973 Facit had then only electronic office equipment (desktop computers, dot matrix printers, storage media) and later personal computers (eg the model DTC with a Z80 CPU) in the range. The company Facit AB was founded in 1997 again taken over by Telekom Advanced Systems, a manufacturer of, inter alia, CNC machines and finally disbanded in 1999th The brand name "Facit" can be found, however, still at the table calculators and typewriters.

Facit company building (postcard around 1960)

The Facit-house in Stockholm (left) and the Facit GmbH in Dusseldorf (right)

Facit International. The company Facit was a global company with manufacturing facilities in several countries. About the models that have been produced outside Sweden, however, very little is known. Much of it was made in Germany, from Hans Sabielny in Dresden or in Facit office machine work in Dusseldorf. Sabielny who Facit models originally sold in Germany only and later also made himself the "10-key all-calculators" (advertising slogan of the time) at the International Office Exhibition 1932. discovered Besides some other products, including the rack adding machine Comptator that Facit models TK (own production) and EK were (imported from Sweden), the most important products of "computing Maschinenfabrik Hans Sabielny, Dresden-A.24". Due to the unfavorable manage- union situation in the east founded Sabielny 1951 Facit GmbH in Dusseldorf. There the hand crank machines NTK, C1-13, CM2-16, 1004 were generated while the electric models NE or CE1-13 imported from Sweden and have been adapted for the German market (the Düsseldorf models can be recognized by the Seriennummen starting with "A - "). For more information about Hans Sabielny and Facit machines from Germany can be found in Reese [14]. It should be noted that Sabielny has also written instructions, including the book "Modern machine calculation: Fast and simple methods for every day problems with the Facit Lx".

Mid-1950s Facit has opened a subsidiary in Brazil, the company produced Facit SA, the models in the series C1-13 for the South American region. Another branch was established in Mexico in 1968, and also in Argentina has produced Facit calculators. The Argentine machines carry the model name AA1-13 and are identical to the Facit NTK, in contrast, however, equipped with a gray housing. In addition to South America and Europe, where some part of the Facit machines was built in Turkey (marked with the words "Türk Montaji"), India was an important location for Facit production. In founded in 1962 Facit Asia Ltd., which today still produces electric typewriters branded "Facit", has made Abacus Series models C1-13. During the era of mechanical and electrical calculators in Europe came to an end early 70s, the production in Brazil was probably continue for some time. In India the model C1-13 to have been set even to 1982nd This development makes the ten-key Sprossenradmaschine Facit probably the most built abacus world. In Sweden alone, copies were made of the models T, TK, NTK and C1-13 over half a million.

AA1-13 (Argentina)

C1-13 (India)

C1-13 (Brazil)

"Facit machines" from other manufacturers. A testament to the success, in addition to sales, the many manufacturers who built world Sprossenradmaschinen after Facit principle, sometimes even the entire building was acquired by the model Facit. In VEB Madix (DDR) has initially produced its own version of Facit TK to 1955th Starting from 1958 the successor HM was developed: a hand abacus with the internal structure of the TK and a casing which is based on the modern design of Facit NTK. These machines were also manufactured under the name "Allrema". The model KR-13 or 3201 from Predom-Mesko (Poland) is up to small deviations outside a copy of Facit C1-13, and the model-Predom Mesko KR-19S essentially a replica of Facit C1-19. The Soviet calculators BK-1 and BK-2 or BK-3 are replicas of Facit TK models, EA or ESA. Models 10, 30 and 35 of RC Allen (USA) are identical to the Facit machines TK, EK or EA. They were produced under license and probably with original parts. The Sprossenradmaschinen Z3 to Z5 of Everest (Italy) work according to the Facit principle. But they were further developed through its own structures and differ in their structure, design and layout of the buttons (1-2-3-4-5 above 0-6-7-8-9 below) only. The model Z5R is also equipped with a device for retransmission, the Facit has incorporated in the model CM2-16 later. The model 117 of Precisa (Switzerland) is also based on the Facit mechanism, but the layout of the controls differs in some respects from the model, the Facit TK. Thus, the keypad was divided into three rows of occupancy 1-3-5-7-9 / 2-4-6-8 / 0, all tab keys located to the left of the numeric keys, and the crank has to comfortable handling of the machine obliquely attached. Finally, there is some Abacus brands, which are constructed similar to the model CM2-16 Facit. The 1968 produced winch machine "RT 4" of Olympia with a capacity of 10/08/13 points and double rear transmission, the built 1955-1958 abacus "Brunsviga 16T" and the model E of Schubert (developed around 1960; cf. Reese [. 14], p.74) are Sprossenradmaschinen with numeric block keyboard that a lot of similarities with the CM2-16 in form and function. More images and information on this can be found in Metzen [13].

Madix HM (DDR)

Predom Mesko KR-13 (Poland)

BK-1 (Soviet Union)

Allen 30 (USA) Allen 35 (USA)

Precisa 117 (Switzerland) Everest Z4 (Italy) Olympia RT 4

Publications about Facit calculators

[1] Ernst Martin, "The calculators and their development history", Volume 1, Verlagsbuchhandlung B. Köntopp, Pappenheim 1925 Supplement 1936, p 317/318 (Facit Standard) and S. 412-414 (models X, TK, and S "EK for motor operation").

[2] VA Jansson, "Räknemaskinen Facits senaste model together till jämförelse några utdrag ur räknemaskinernas utvecklingshistoria" Teknisk Tidskrift 1932. Mekanik, S. 137-144.

[3] P. Foreman, "A new ten-key adding machine," Z. Instrumentenkunde 53 (1933), pp 177-179. The author, who presents the Facit T in this article mentions a pen with which you can change the direction of rotation of the results and the nature Umdrehungszählwerks on the same or opposite directions. This device is however not present in any known model T.

[4] "The Bishop's ring: Fact and fiction about a world-famous Swedish industry", Gumaelius / Victor Petterson Bokindustri, Stockholm 1946th

[5] Friedrich A. Willers, "Mathematical Machines and Instruments", 3rd edition, Akademie-Verlag, Berlin 1951, section II.C.2.l: "Electrical equipment keys".

[6] A. Hennemann, "The technical development of the abacus", Verlag Peter Basten, Aachen in 1954, Chapter IV: "calculators split sprocket (Facit system)".

[7] William Lind, "office machines", CF Winter'sche publishing firm, feet in 1954, section C.3.b): "Machines with shared Sprossenrad".

[8th] Otto Priebe, "calculating machines in the office", Part 1, Robert Göller Verlag, Baden Baden 1955, pp 38-40.

[9] FACIT reporter: Information for the office equipment specialized trade, 1957-1973, with four issues per year.

[10] facet: business journal of FACIT GmbH Office mechanic Dusseldorf, 1963-1965, with four issues per year.

[11] Erhard Anthes, "print end abacus: Facit 10-51" Historical Office World 13 (1986), pp 17-18.

[12] Werner Lange, "The Facit, one of the world-famous Swedish calculators" Office Business 3 (1988), pp 21-24. The focus of the article is enclosed in the CM2-16 and CA2-16.

[13] Heinz Metzen, "Block of 10 keyboard for manual Sprossenrad-calculators" Historical Office World 62 (2002), pp 13-14.
The article is available as PDF document before (from Heinz Metzen, courtesy of IFHB).

[14] Martin Reese: "New views of old machines", Verlag Dr. Kovac, Hamburg 2002, pp 92-94: "Facit Germany and Hans Sabielny".

[15] Svante Kolsgärd, "Världskoncernen Facit och industriköpingen Åtvidaberg" http://www.atvidaberg.se/brukskultur/brukshistoria/faciten/facit/facit.htm

[16] Göran Arvidsson: "Facits räknesnurra som blev en världsartikel", http://www.atvidaberg.se/brukskultur/brukshistoria/faciten/reknesnurra/reknesnurra.htm

[17] Christofer Nörings Swedish Typewriter Page contains a lot of information on the historical development of the Facit calculators, including a family tree of the FACIT-calculators .

[18] The page "Facit" Calculators in John Wolff's Web Museum shows many Facit models of the early machines to the fully automated, with some interesting variations.

[19] Harald Schmid, "The 10-key universal computing machines FACIT", Proceedings of the 3rd Symposium (published by WH Schmidt and W. Girbardt) to the development of computer technology, University of Greifswald 2006, pp 13-32.