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A. RAIMONDI
CALCULATING MACHINES
Filed March 17, 1939

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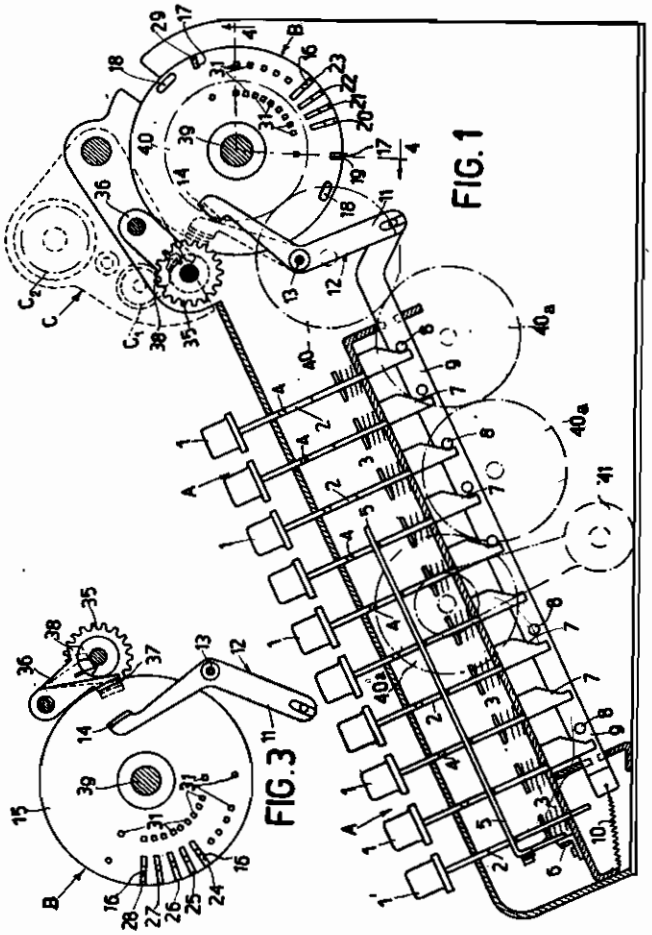

FIG. 1

FIG. 3

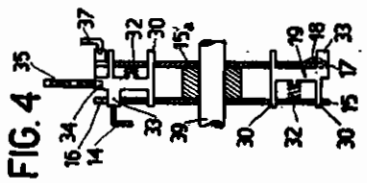

FIG. 4

Inventor,
A. Raimondi

By: Glascock Downing & Seibold
Attys.

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FIG. 5

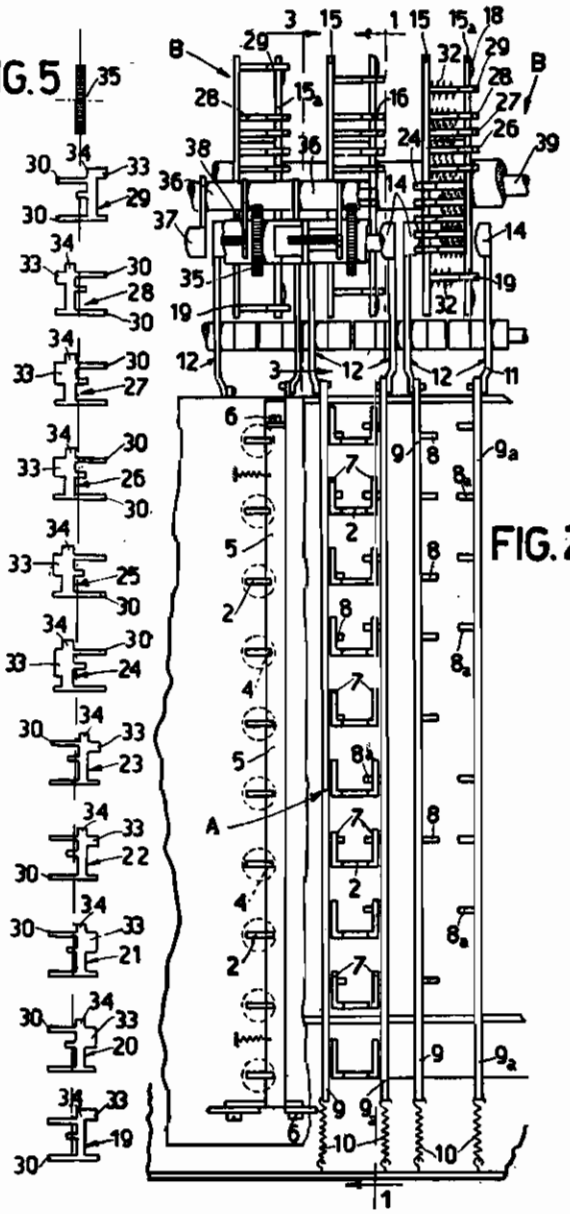

FIG. 2

Inventor,
A. Raimondi
By: Glascock Downing & Seebold
Attys.

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ALIEN PROPERTY CUSTODIAN

CALCULATING MACHINES

Angelo Raimondi, Milan, Italy; vested in the Alien Property Custodian

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This invention relates to improvements in calculating machines, and has for its object to improve their operation, to simplifying their construction and to increase their life.

The principal feature according to the invention consists in that the controlling gear combined with each row of keys is actuated by means of a pinion provided with teeth which are freely movable in a direction parallel to the axis of the controlling shaft, the movement of a selected tooth to operating position being obtained by operating the corresponding key.

A further feature consists in this that, with each row of keys, means are combined which are adapted to be displaced axially, on depressing any of the keys, the mechanism transmitting the motion from each key to the aforesaid means being so designed so as to take into account the distance of each key from the position of connection of said means with the members controlled by them and controlling, in their turn, the movement of the movable teeth of the pinion.

A further feature of the invention consists in that the pinion provided with the movable teeth is formed by two disks having notches therein for accommodating the members forming the movable teeth, so that said members, which are retained in the rest position by resilient means, can be selectively moved axially by the controlling means actuated by the said keys.

A still further feature of the invention consists in that the means which are displaced axially and which are associated with each row of keys, consists of carriage bars provided with pins subject to the action of inclined projections formed integral with said keys, said bars being adapted to move a cam provided on a pivoted lever into the circular path on or a number of counter-cams which are arranged laterally of the movable teeth of the pinion, so that, according to the angular position of the cam on the pivoted lever and of the length and radial position of the counter-cams, the selected movable teeth are moved sideways, rotating at the same time, so as to cause the desired angular rotation of the dials of the counting and registering mechanism.

Reference will now be made to the accompanying drawings, which illustrate by way of example, a constructional form of one of the embodiments of the calculating machine according to the invention in which:

Figure 1 is a cross section along line 1—1 of Figure 2;

Figure 2 is a partial top view, with cover off, the selecting members being shown, conventionally, in cylindrical projection developed in a plane,

Figure 3 is a partial cross-section along line 3—3 of Figure 2;

Figure 4 is a section of a selecting pinion along line 4—4 of Figure 1, and

Figure 5 shows the different shapes of movable teeth belonging to each single selecting pinion.

With reference to Figures 1 and 2, A is the key-board, B are the groups of selecting pinions, and C is the carriage accommodating the digit drums for indicating and registering the various operations. The carriage can be shifted in different positions; namely C^1 are the total or product drums and C^2 are the drums adapted to indicate counting or quotient. The said carriage is provided with means for returning the drums C^1 and C^2 back to zero. The key-board A is provided with a number of rows of keys, each row having 10 keys of which key 1^1 is the column corrector.

The keys are carried on stems 2, which are influenced by return springs 3. Said stems are provided with notches 4, into which can be inserted the edge of a lever 5, which is pivoted at 6 and serves the purpose of maintaining a single key in the depressed position, and at the same time releasing the other keys of the same row, which have already been depressed.

The release of the depressed keys, can be obtained either partially per row, by depressing key 1^1, acting directly on lever 5 of the respective row, in which case the key need not be kept in the depressed position, or for all rows at the same time, by means of a general correcting key, (not shown) acting simultaneously on the levers 5 of each row, the latter being suitably connected to each other.

The lower end of each stem 2 carries two projections 7 each of which is provided with an inclined portion capable of acting on pins 8 and 8^a, fixed on carriage bars 9 and 9^a respectively, the latter being arranged in pairs for each row of keys. The pins 8 and 8^a are suitably kept apart by the inclined edges of the projections 7, so that, on depressing a key, a corresponding movement of the bars 9 and 9^a is obtained. The bars are designed so as to slide in guides, and their amount of movement will be proportional to the succession of the digits, as will be disclosed hereafter.

Said bars are under the action of return springs 10.

The upper end of each bar (see Figure 1) is

adapted to engage with an arm 11 of a lever 12 which is pivoted at 13, whilst the other arm of said lever is shaped at its end 14, in form of a cam, so as to act on the movable teeth in a manner hereafter described.

The selector group B (see Figures 1, 2, 3 and 4) comprises a number of pinions, each formed by two disks or flanges 15 and 15ª; keyed to a controlling shaft and kept apart by suitable distance pieces. The number of pinion, forming the group of selectors, may vary according to the numbers of rows of keys and therefore according to the capacity of the machine.

The disks are provided with radial notches or cuts; namely disk 15 is provided with five notches 16 and disk 15a has instead only four notches, said notches being all at equal angular distances one from another.

Disk 15ª of each pinion (except on the first selector I of the "units") is provided with two additional notches 17, of a different depth than the former notches 16, placed respectively before, and after notches 16, and at an angular distance which is a multiple of the single spaces between the notches 16, namely, disk 15ª of the IInd selector (selector of "tens") has the notches 17 angularly displaced a distance equal to two single spaces relatively to the last notch 16, of disk 15 or 15ª. In the IIIrd selector (selector of "hundreds") the notches 17 are angularly displaced a distance equal to three single spaces and so on, for the further selectors.

Furthermore the disk 15ª is provided with two cam-like projections 18, placed near the periphery of said disk and in proximity of notches 17: said projections being all equally spaced from said notches 17. Within the notches 16 and 17 are placed movable teeth 19, 20, 21 . . . 29 (see Figure 5) provided with gulding wings 30, engaging in the corresponding pairs of holes 31 in the flanges, so that the movable teeth are free to move in a direction parallel to the axis of the controlling shaft. Each tooth is influenced by a spring 32 retaining it in the rest position.

The movable teeth are also provided with counter-cams or actuating feet 33 of varying height; for instance teeth 20 and 21 arranged in the slots 16 of flange 15ª are higher than the counter-cams 33 of the following pair of teeth 22 and 23. In slots 16 of the other flange 15 are arranged slide teeth 24 maximum height, then follow the three teeth 25, 26, 27 all of same height, having the counter-cams 33 lower than those preceding and finally tooth 28 with counter-cam 33 of least height.

These movable teeth have also, in their upper part, projections or noses 34, which are adapted to mesh with the teeth of a gear-wheel 35, arranged on the centre-line of the pinion, said gear wheel in turn being adapted to drive a gear wheel of the totals indicator C^1.

In the same way the movable teeth for the carry-over 19 and 29, are provided with their own counter-cams 33, suitably staggered towards the outside, so as not to interfere with cam 14 of lever 12.

The teeth in the carry-overs 19 and 29, of each pinion, are actuated by a lever 36 having two angular positions, said lever being provided with a cam 37, which is brought to act upon one or the other of said teeth by means of a projection or tooth 38, (according to the arithmetical operation to be performed). Said tooth is actuated by means of a pin placed on the wheel of every single drum of totals C^1; that is, a drum C^1 having made a complete revolution, causes the operation of lever 36, and thus advances one of the teeth 19 or 29 of the selector following drum C^1, which drum has caused the operation of said lever. Lever 36 is restored to its initial position, or position of rest, by the cams 18, after having operated the carry-over.

The series of the digit drums of the indicating-counters or of the quotients C^2 are operated in a known manner by a resilient ratchet controlled by an eccentric not shown keyed on a shaft 39, on which the group of selectors B is fixed. Thus, at each revolution of the group of selectors B, the drum C^2 will move a step forwards or backwards according to the operation fulfilled. Preferably with this object in view, the drums have 19 teeth which correspond the step by step sequence of digits in increasing and in decreasing order, namely from zero to nine; and from nine back to zero. These two series of digits are painted a different colour so as to show at a glance whether the operation made is a positive (sum, multiplication, etc.) or negative (subtraction, quotient, etc.).

The shaft 39 carrying the selectors B is rotated in bearings arranged in the frame of the machine and at one end is keyed a gear wheel 40, to which motion is imparted, either directly, or through other gears 40ª, from a crank 41, or alternatively from an electric motor arranged inside the frame.

The group of selectors B, as stated above, can rotate in both directions, for achieving either negative or positive operations and is further provided with suitable locking systems, for the purpose of preventing mishandling.

The operation of the machine is as follows:

On depressing any one of the keys 1, one or the other or both bars 9 will be moved. Said bars actuate the levers 12 coupled to each bar, so that their cams 14 will move through an angle proportional to the number depressed. The cams will therefore move into the path (circumference) of the counter-cams 33 relative thereto, and on rotation of the groups of selectors B, the counter-cams 33 will be moved by cams 14 towards the centre of the pinion. Thus the projections 34 will engage with the teeth of wheel 35 (see Figure 4) and the latter will be rotated by a number of teeth equal to the number of movable teeth with which they engage. This number will be registered by the digit drum C^1, of the total, whilst the number of revolutions of the selector group B, will be registered by the numeral digit drums C^2.

Let us now consider one of any of the rows of keys in the keyboard: the formation of the numbers is obtained as follows: (the same process being followed for the other rows of keys).

Number one

Key 1 is depressed and bar 9 at the left (Figure 2) moves its corresponding cam 14 to the first position. On rotation of the selector group B, the movable tooth 24 will be moved sideways to mesh with wheel 35, thus moving on drum C^1 by one step.

Number two

The corresponding key is depressed and bar 9 at the right moves its cam 14 corresponding to the first position and, on rotation of the selector group B, teeth 20 and 21 will engage the wheel 35 and as stated above move the drum C^1.

Number three

The corresponding key on being depressed, acts on both right hand and left hand cams **14** moving them both to the first position. Teeth **20**, **21** and **24** will be moved into engagement of wheel **35**.

Number four

Only the right hand cam **14** is moved to second position, thus moving into engagement teeth **20**, **21**, **22** and **23**. It is however possible to combine this number by acting on the left hand cam **14**, moving it to the second position, and thus moving teeth **24**, **25**, **26** and **27**.

Number five

The left hand cam **14** is moved to the third position, thus acting on teeth **24**, **25**, **26**, **27** and **28**. As in the preceding case, number 5 can be combined likewise by moving the right hand cam **14** to the second position and the left hand cam **14** to the first position; thus teeth **20**, **21**, **22**, **23** and **24** will be moved.

Number six

The left hand cam **14** is moved to the second position, the right hand cam **14** moving to the first; thus teeth **20**, **21**, **24**, **25**, **26** and **27** will be moved.

Number seven

The left hand cam **14** is moved to the third position and the right hand cam to the second, thus moving teeth **20**, **21**, **24**, **25**, **26**, **27** and **26**.

Number eight

Both cams **14** are moved to the second position thus moving teeth **20**, **21** . . . **26** and **27**.

Number nine

The left hand cam **14** is moved to the third position and the right hand one to the second, thus moving sideways all nine teeth.

The carry-over levers **36**, move the carry-over teeth **16** and **29** in the manner previously described and therefore at every complete revolution of any drum C^1, the following drum will be advanced by one unit, whilst cams **18** will return the levers **36** to their original position.

The arrangement of the movable teeth, as specified and illustrated, is designed with a view to obtaining a better stress repartition both on the keys and on shaft **39**, thus causing an almost uniform wear of the operating members.

It is to be understood that other arrangements of the movable teeth might be designed, as for instance by arranging them all on one side of flanges **15** or **15a**, or else by placing six teeth on one side and three on the other, either in immediate sequence or alternating, and so on.

Alternatively, the movable teeth could be made so as to obtain an angular displacement instead of a rectilinear shift. In this case it would be sufficient for instance to fulcrum the lower end of said teeth on the ring placed between the flanges **15** and **15a**.

It is also to be understood that these and other details of design and construction may be varied without thereby departing from the nature of the invention.

ANGELO RAIMONDI.