

June 24, 1969

E. K. GRIP

3,451,617

PRINTING CALCULATING MACHINES

Filed April 3, 1967

Sheet 1 of 24

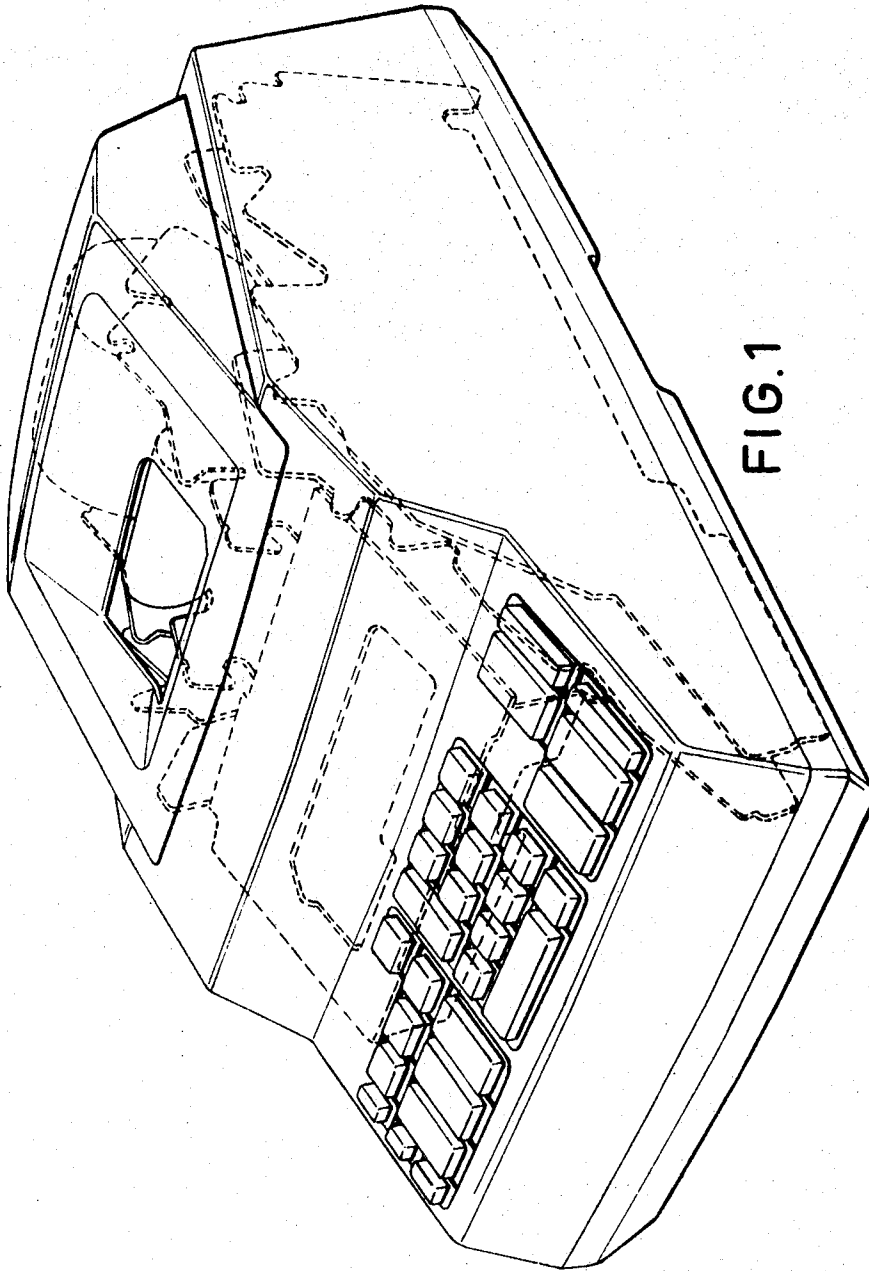


FIG. 1

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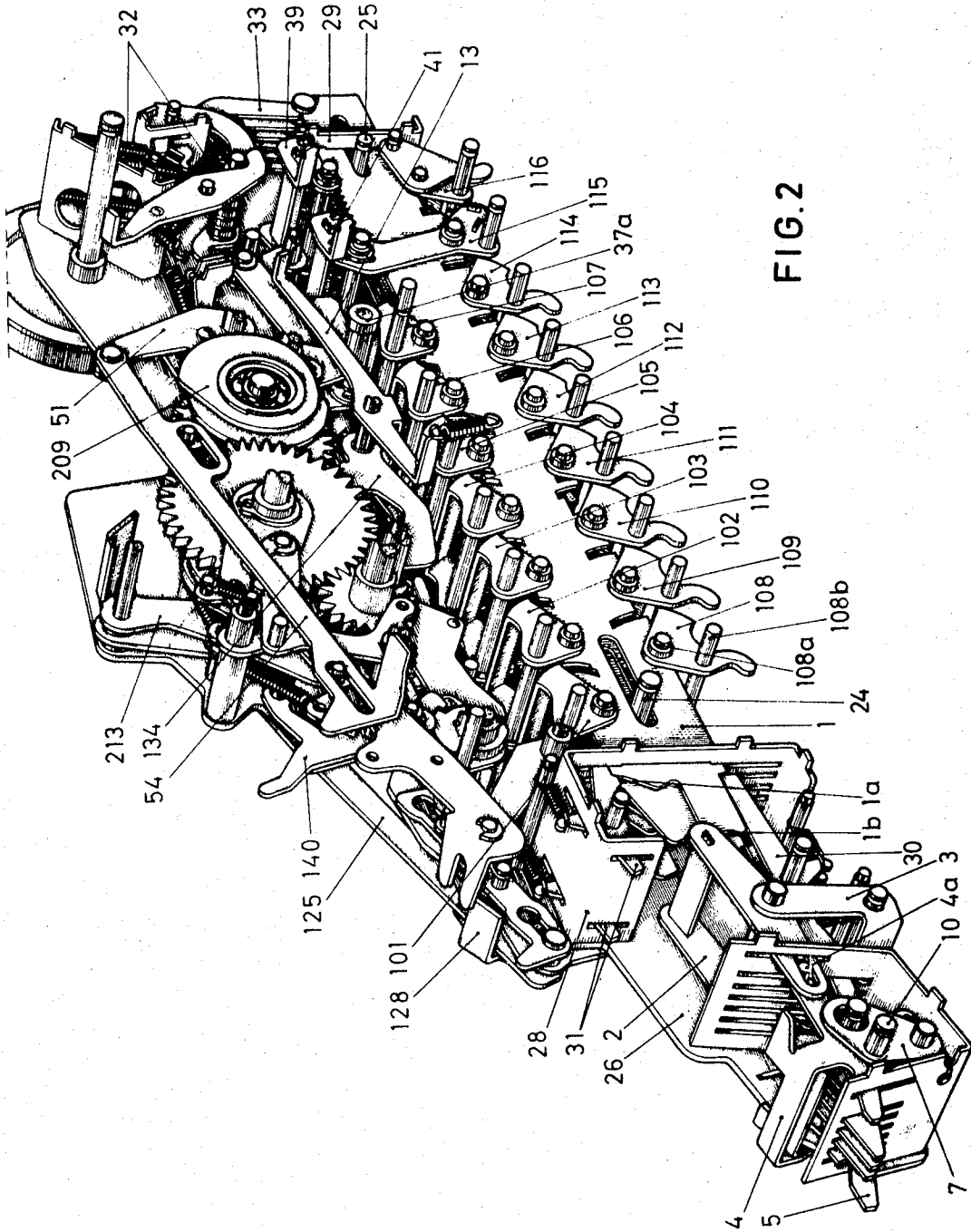


FIG. 2

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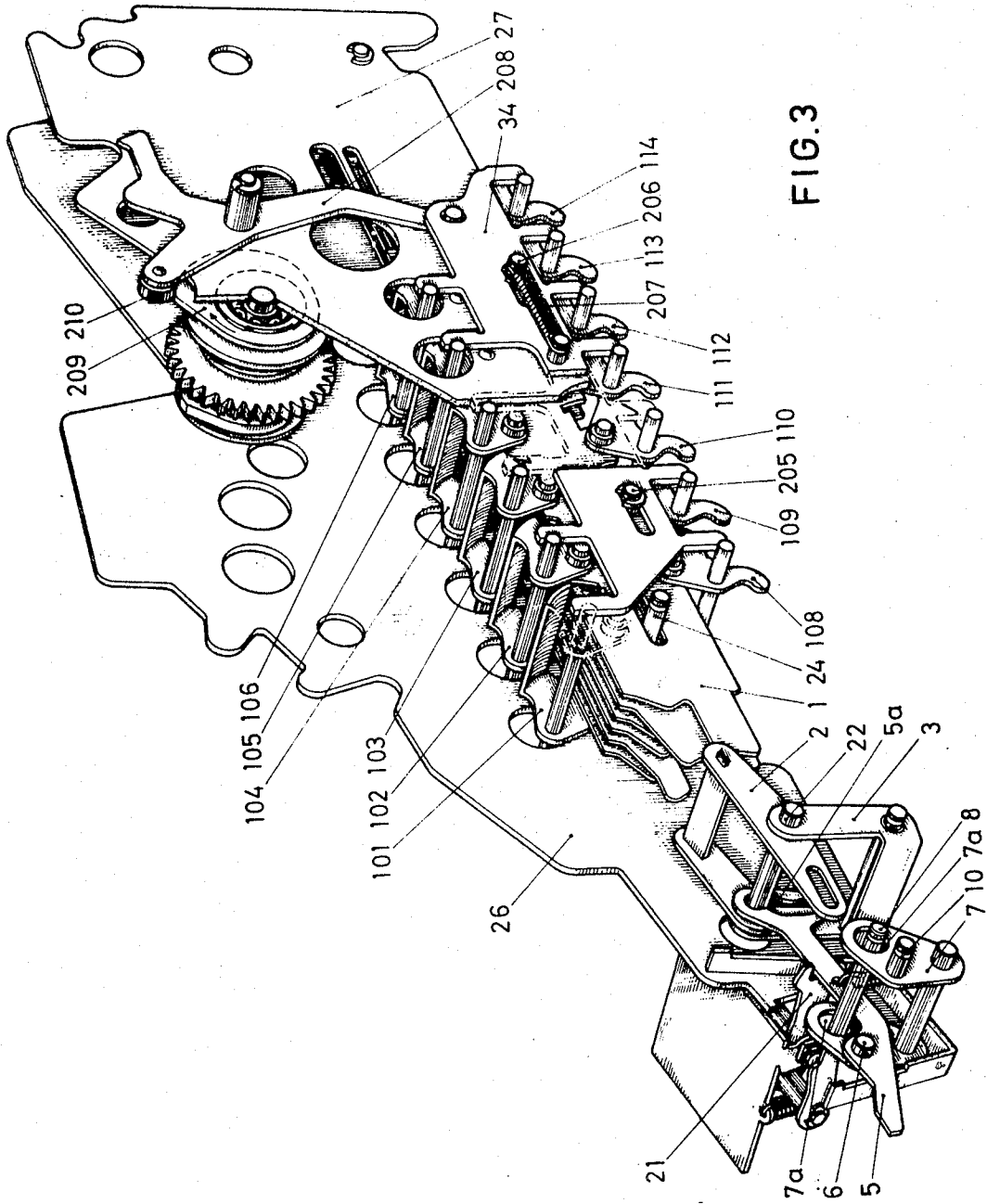
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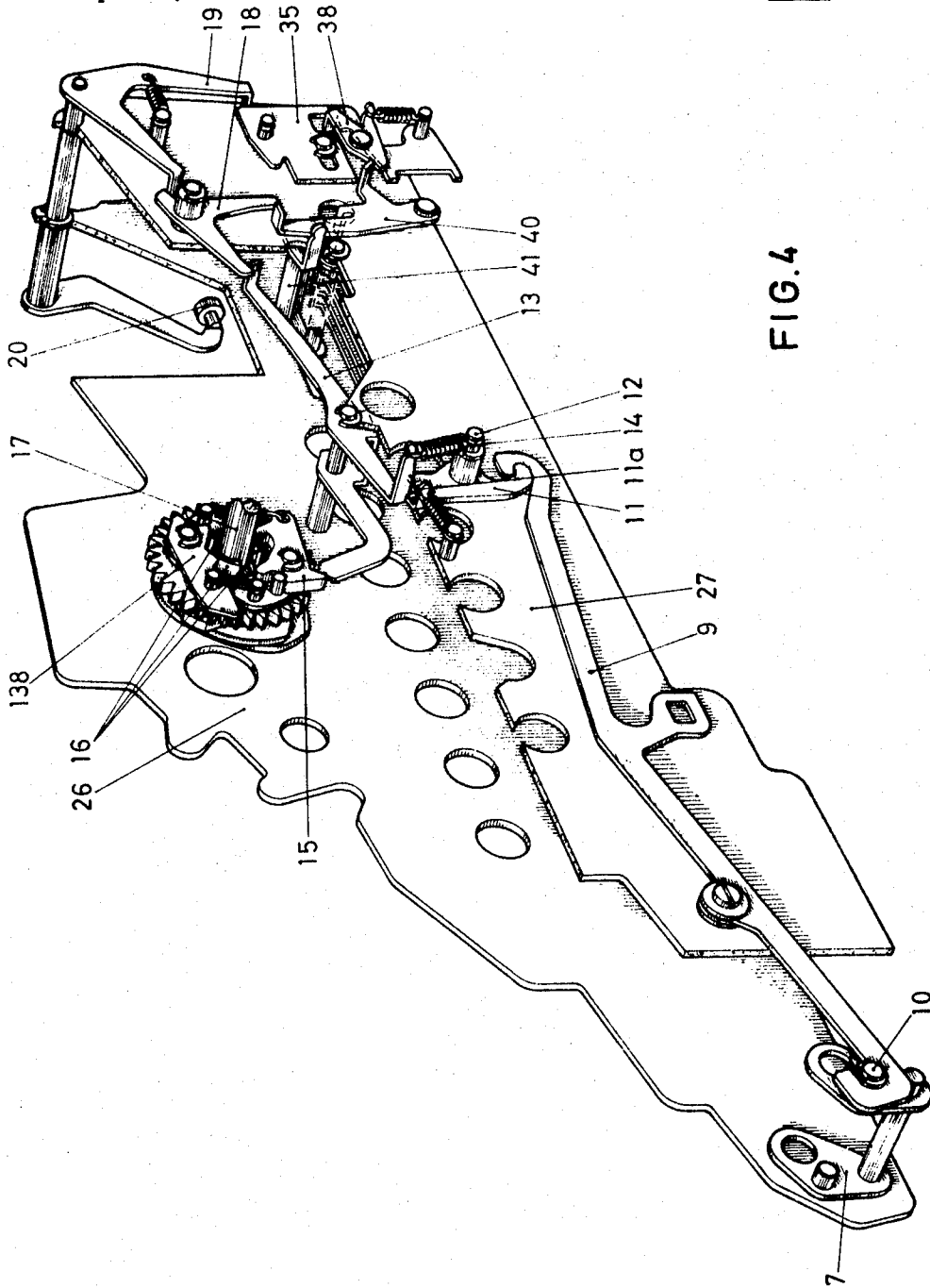
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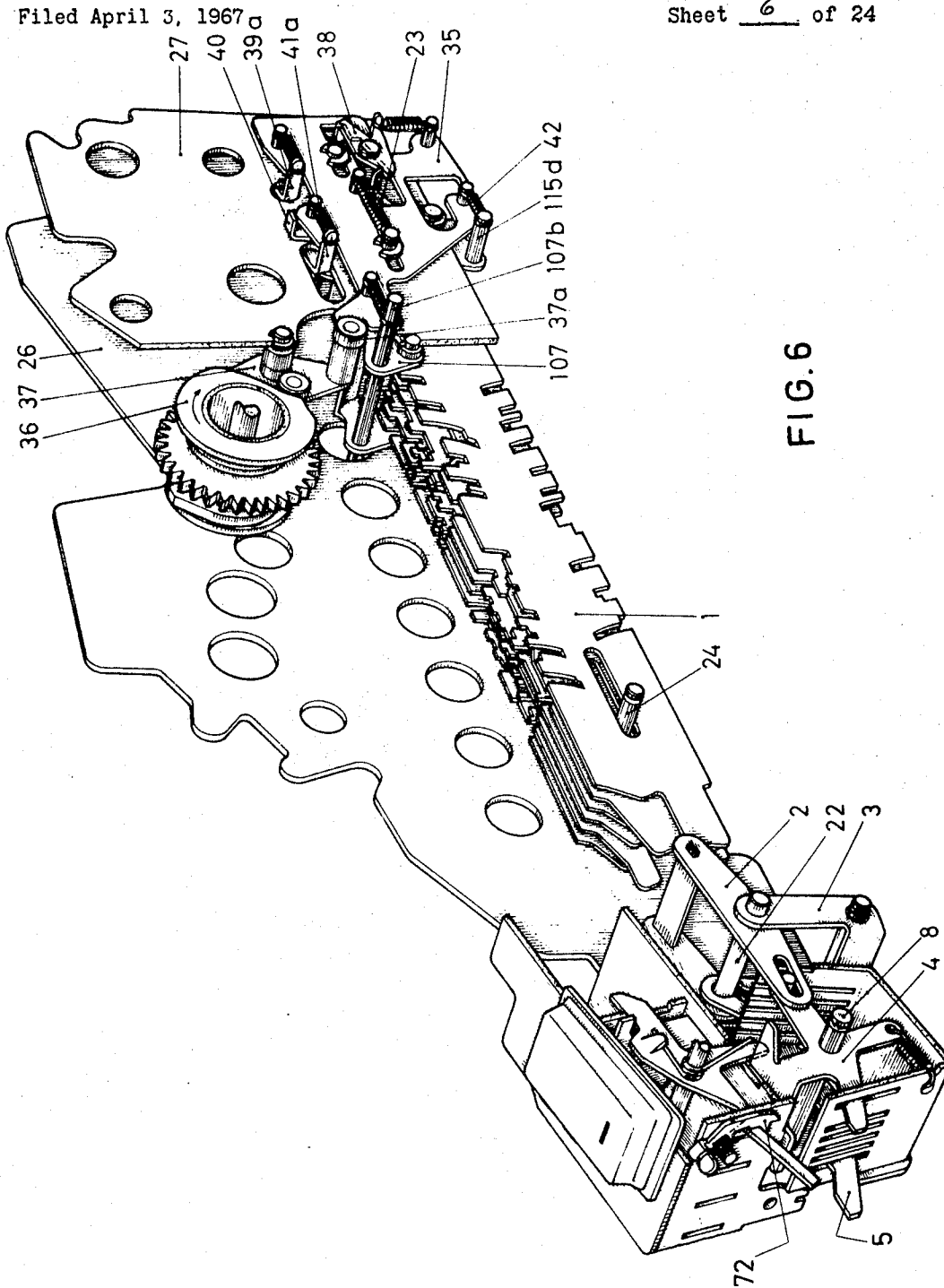
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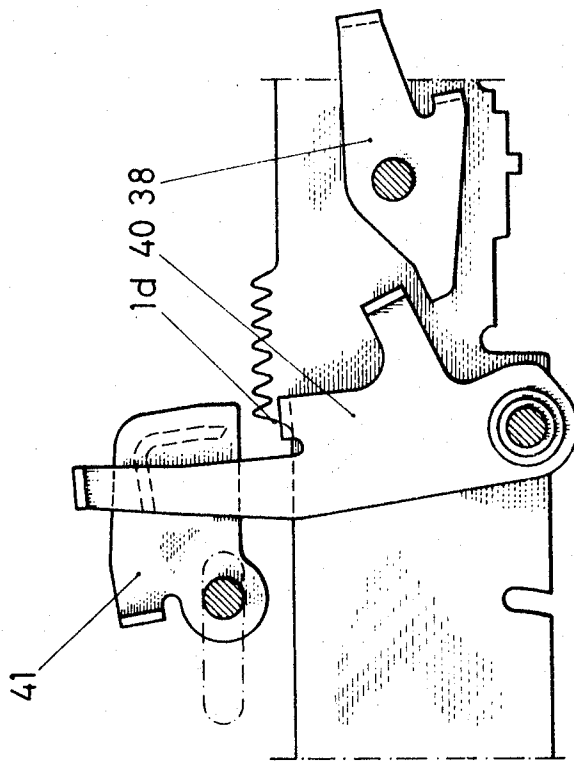


FIG. 7

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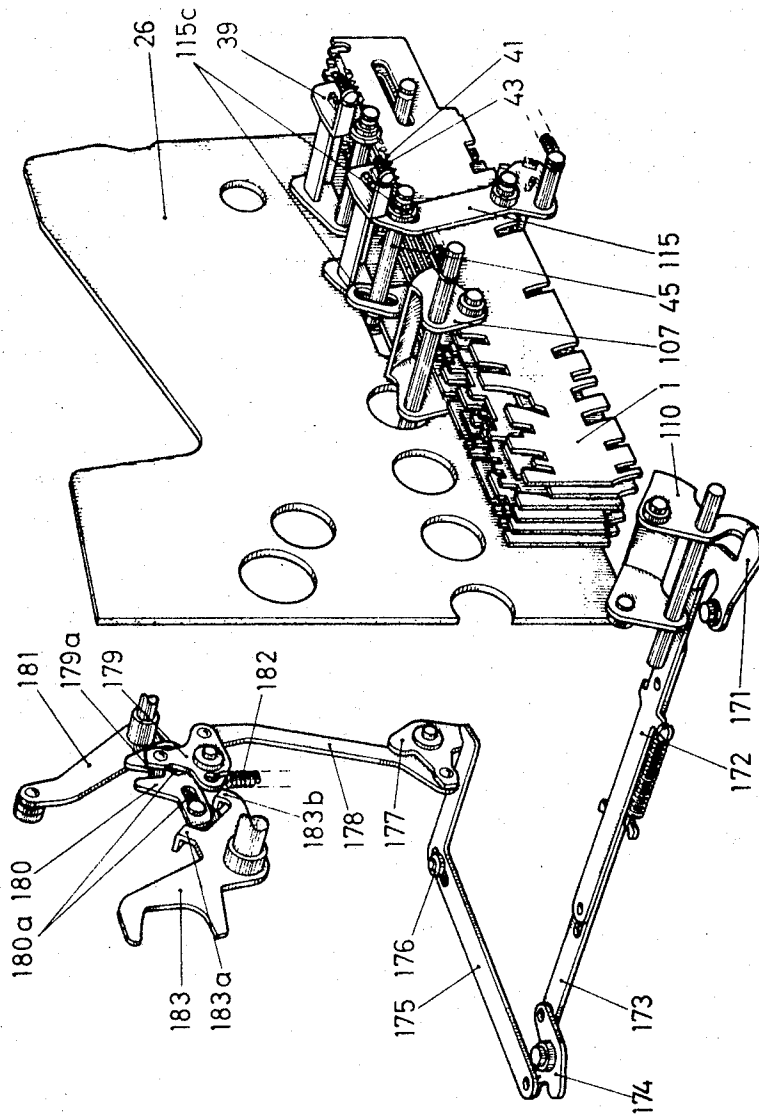


FIG. 8

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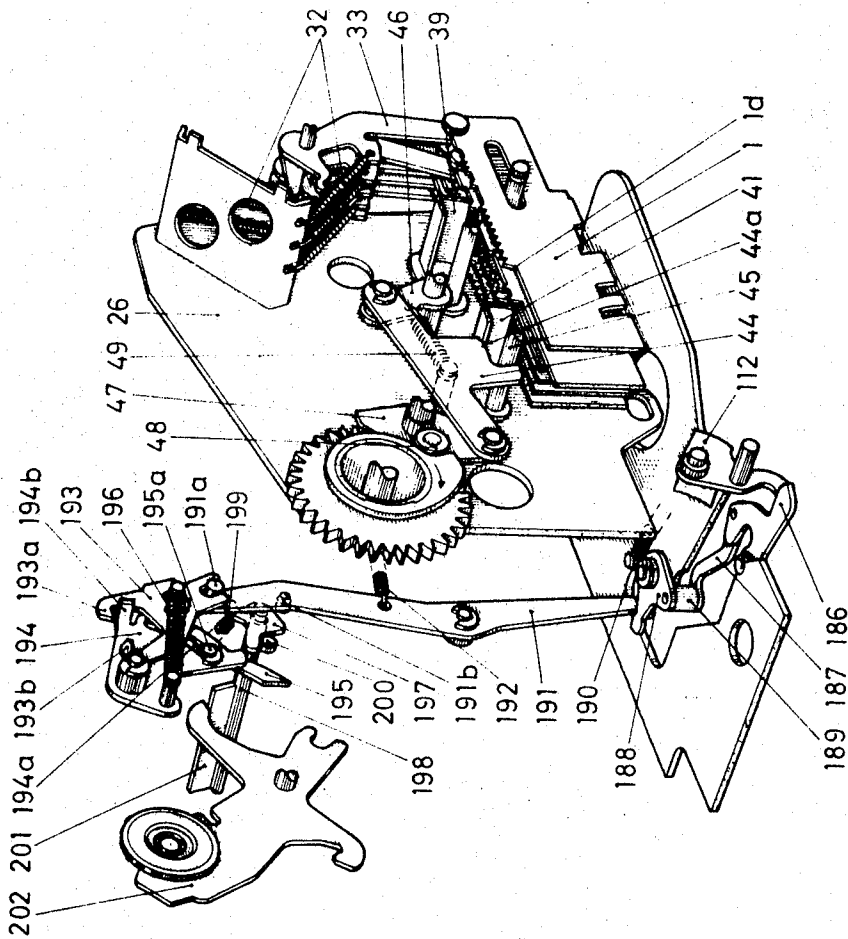


FIG. 9

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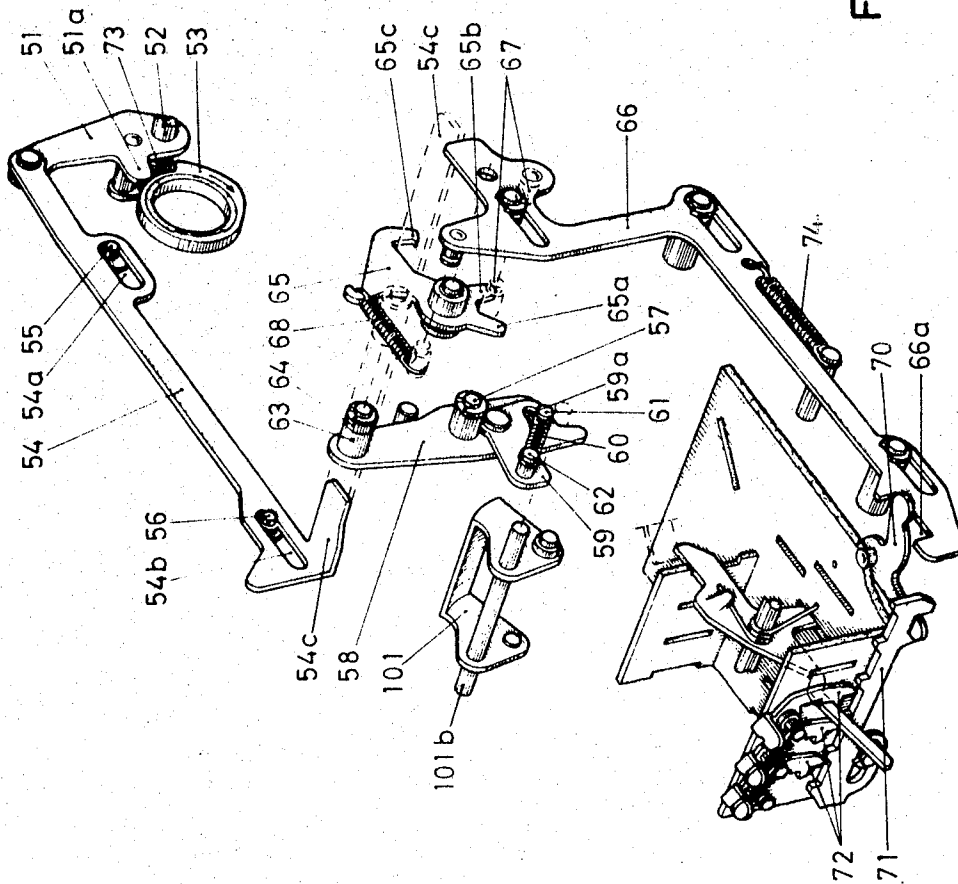


FIG. 10

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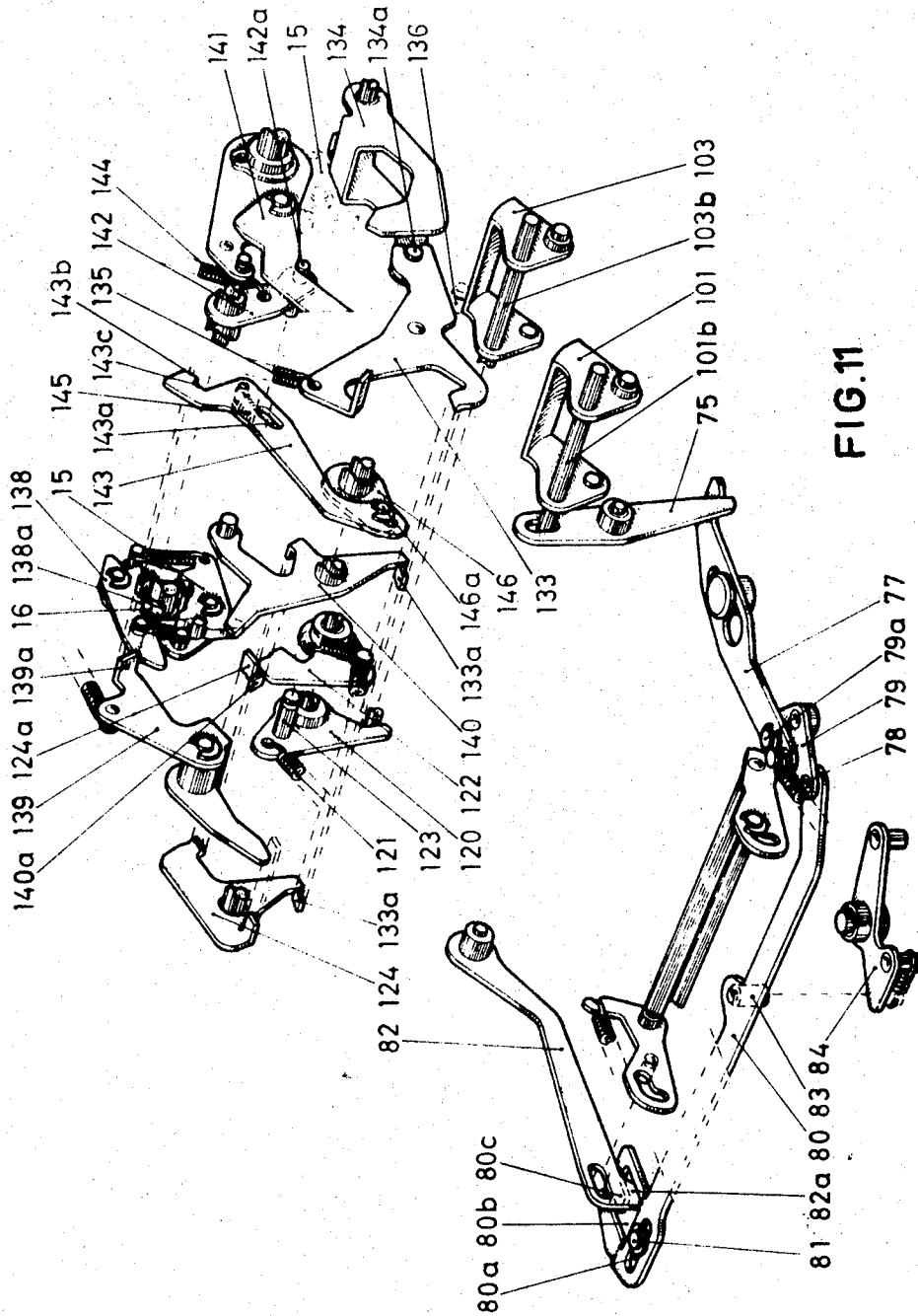


FIG. 11

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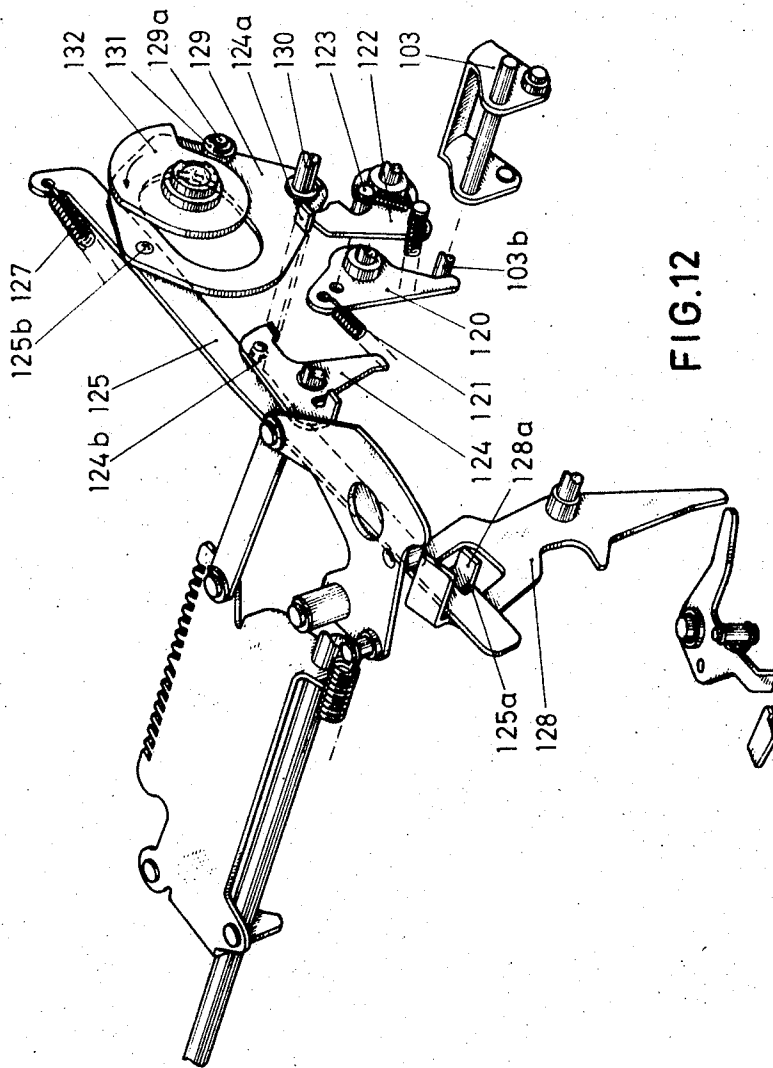


FIG.12

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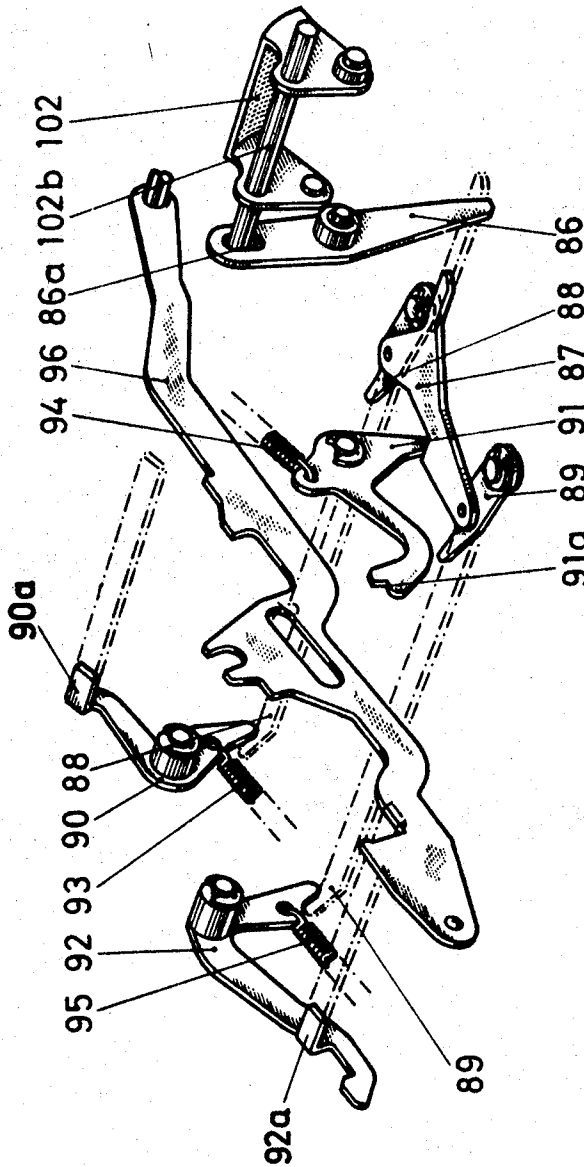


FIG.13

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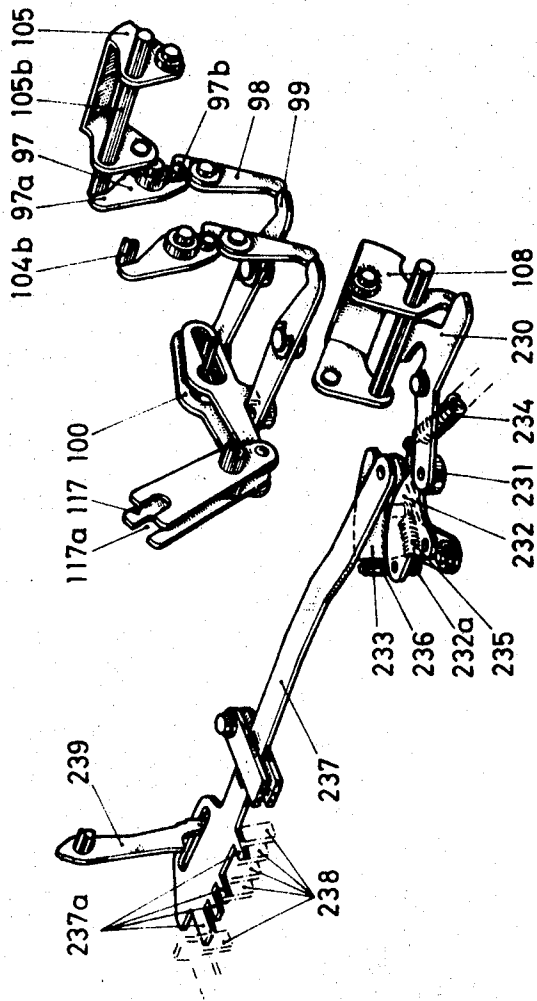


FIG.14

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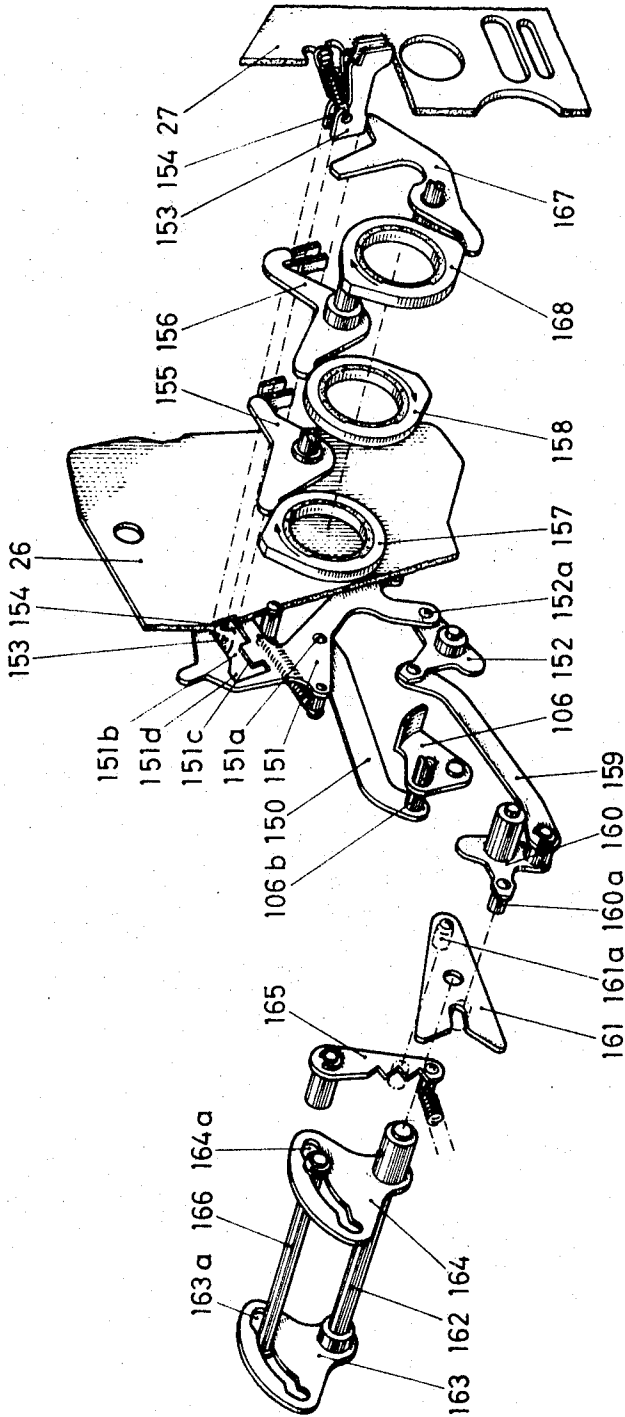


FIG. 15

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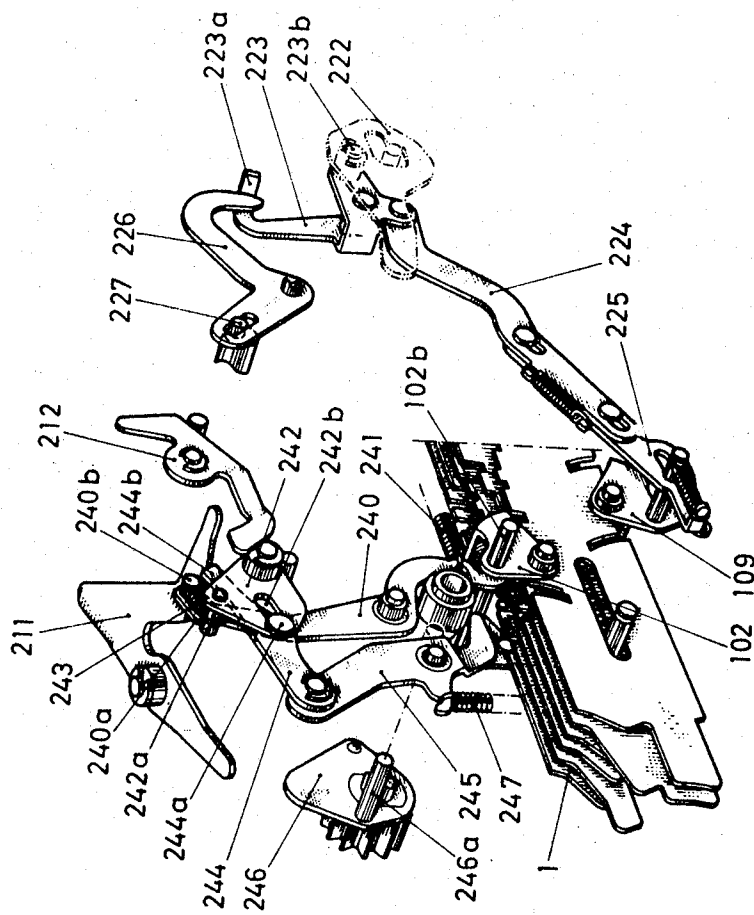


FIG. 16

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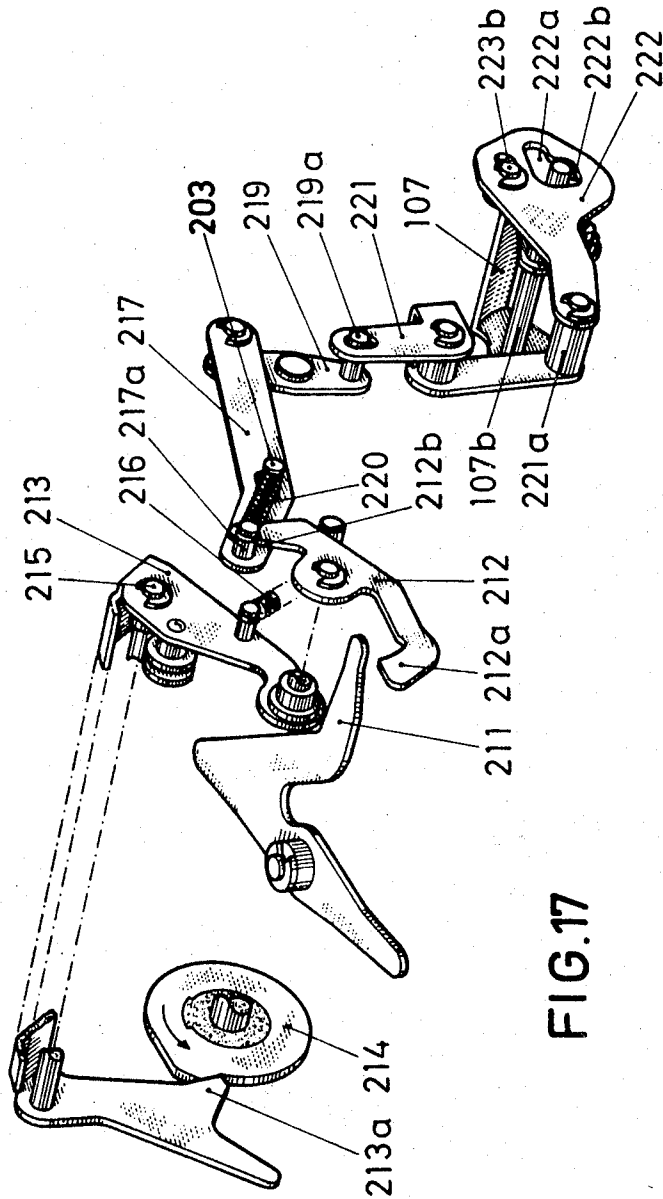


FIG.17

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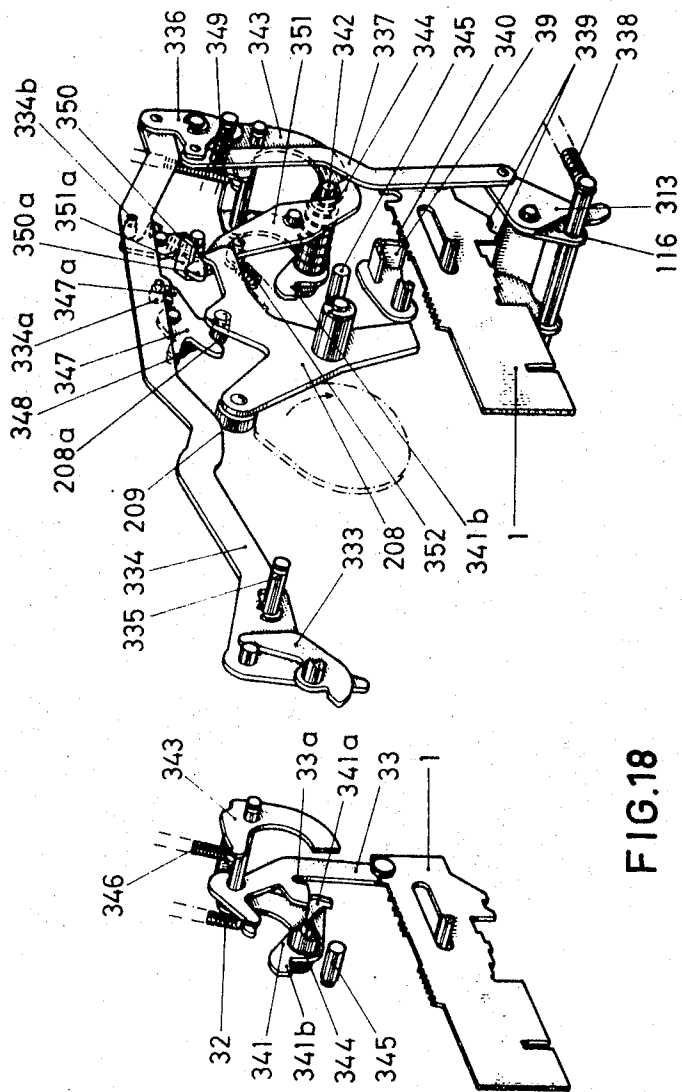


FIG. 18

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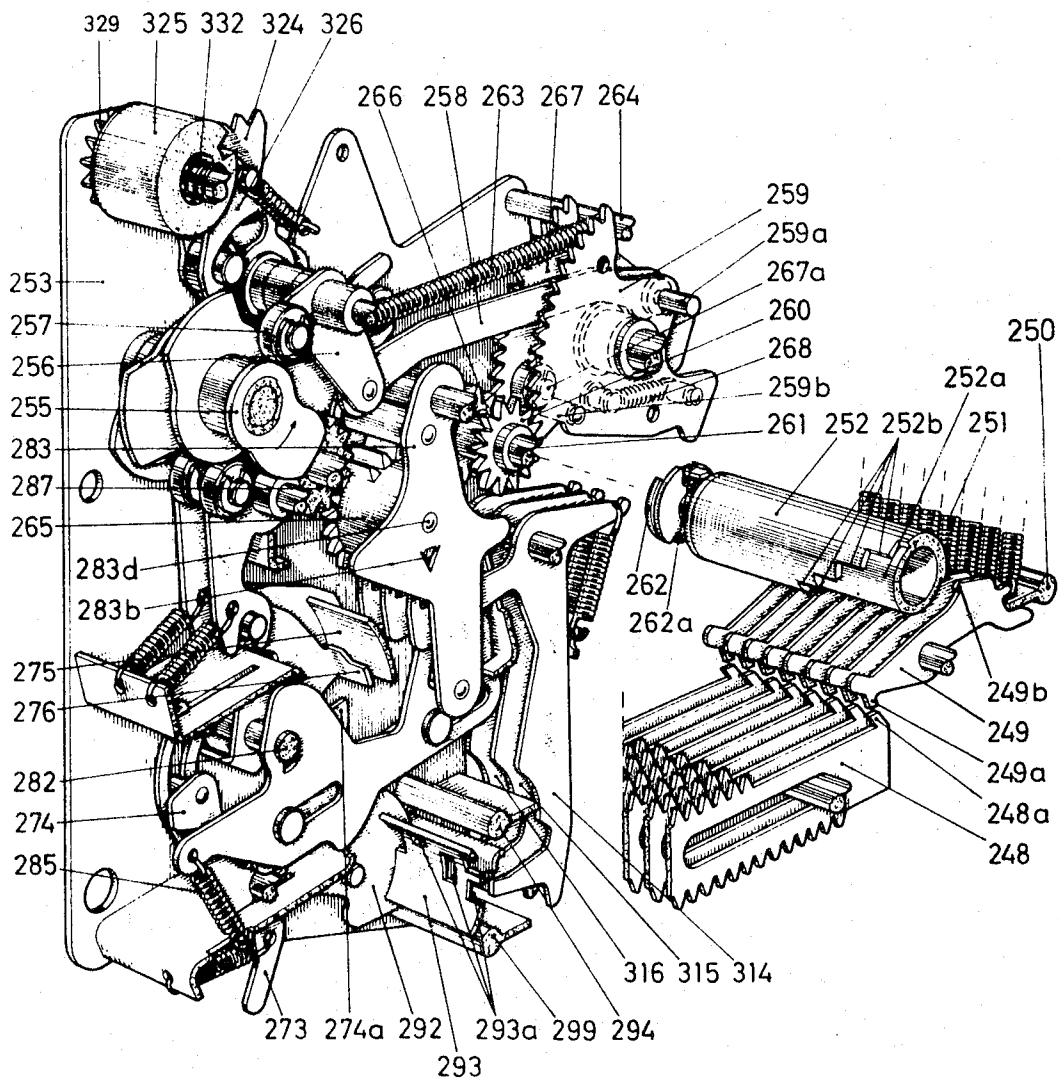


FIG.19

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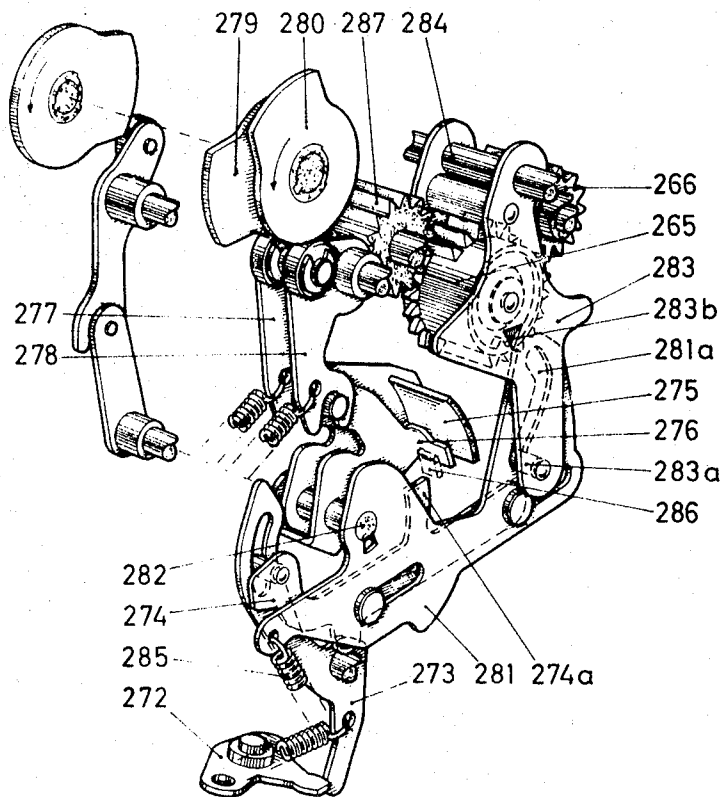


FIG. 20

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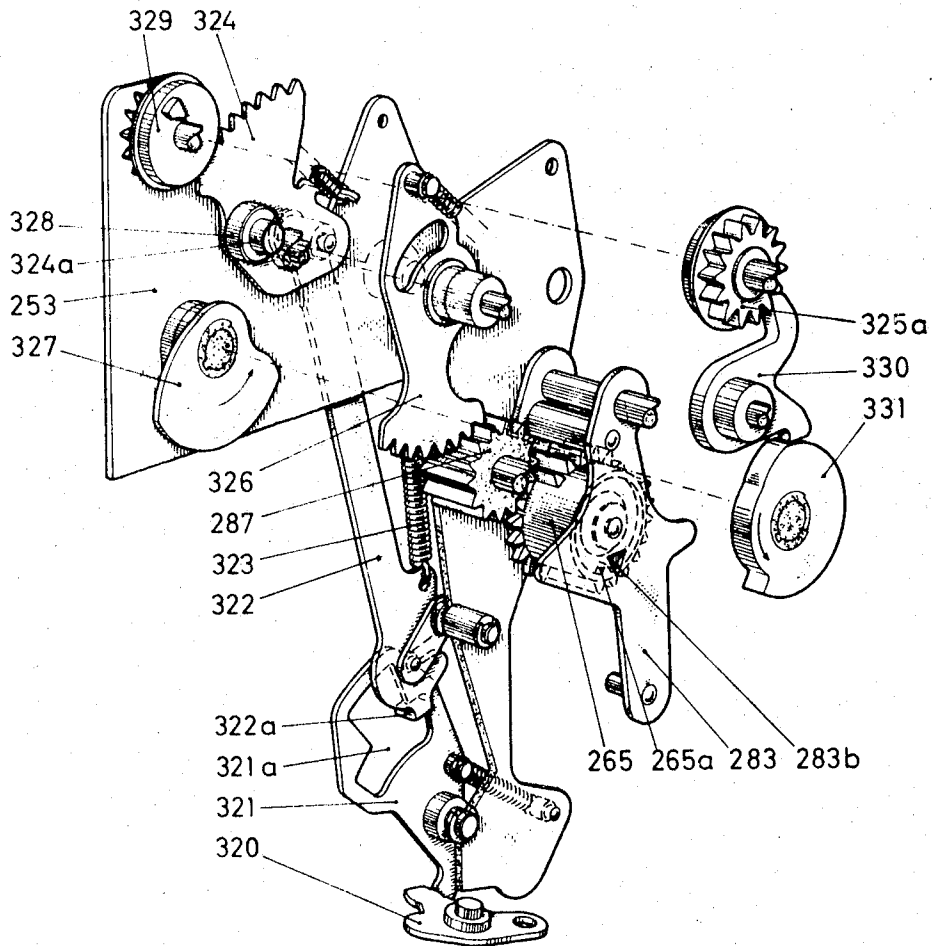


FIG. 21

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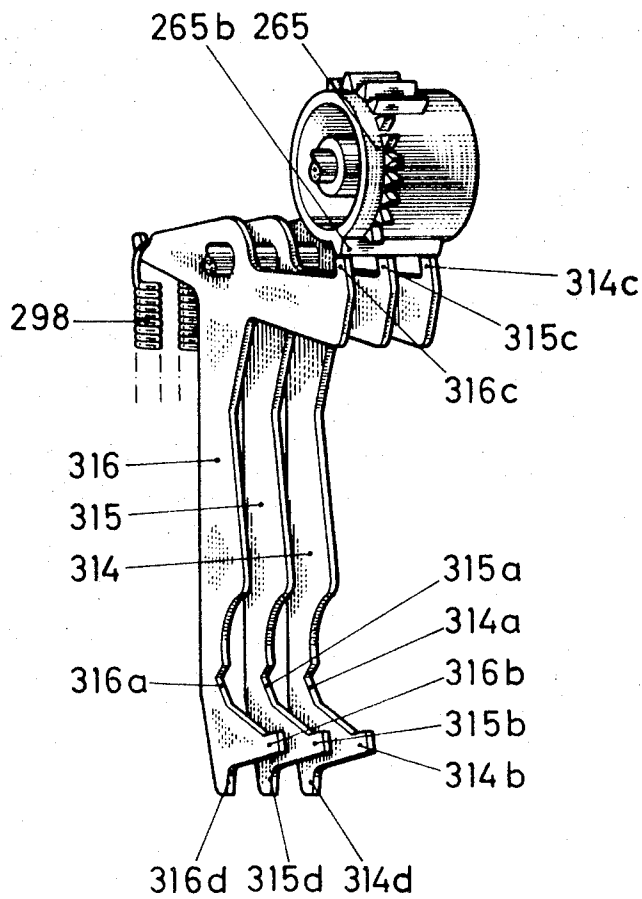


FIG.22

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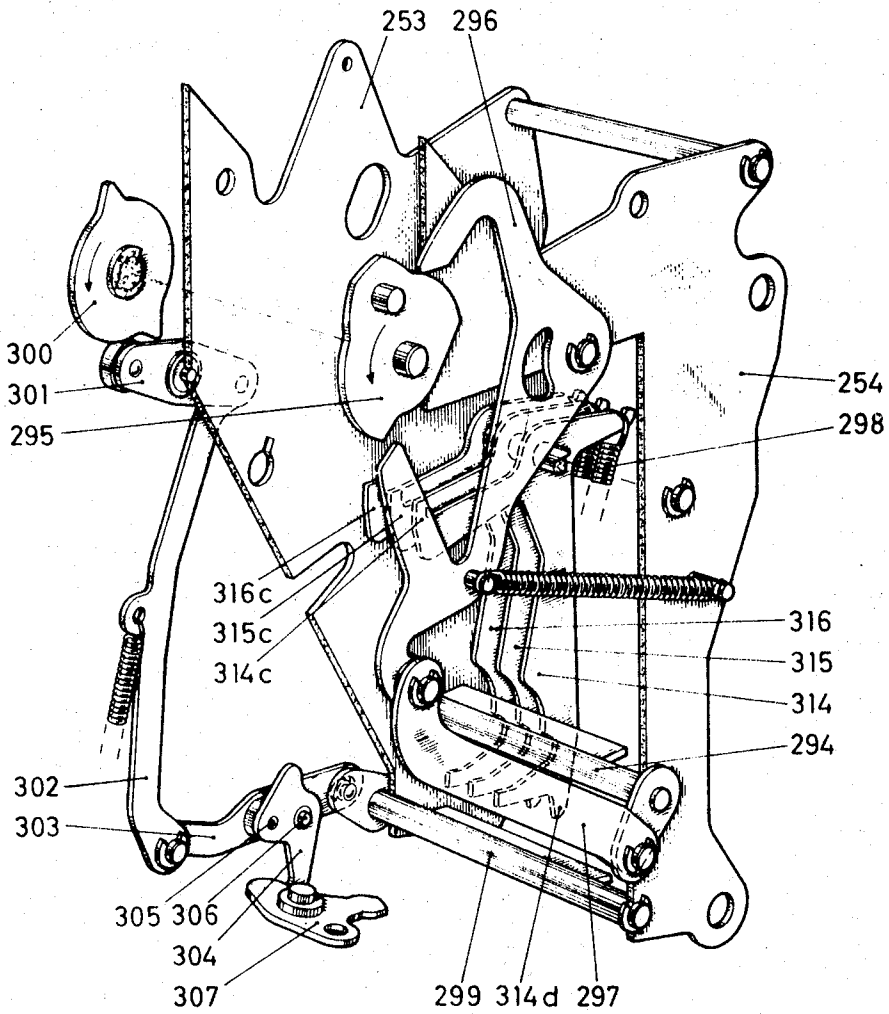


FIG.23

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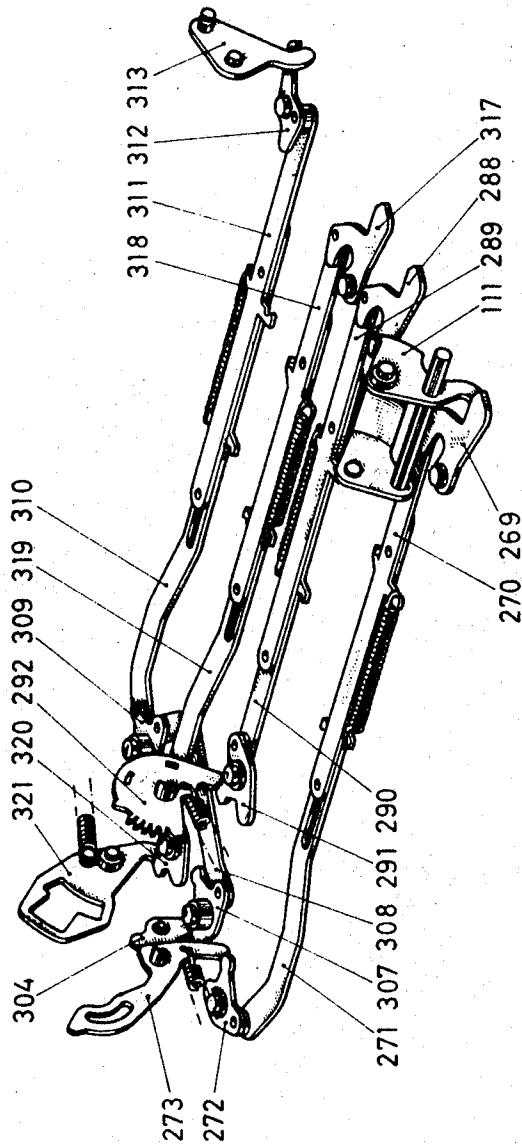


FIG. 24

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**PRINTING CALCULATING MACHINES**

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Filed Apr. 3, 1967, Ser. No. 627,895

Claims priority, application Sweden, Apr. 21, 1966, 5,428/66

Int. Cl. G06c 27/00, 29/00

U.S. Cl. 235—60

7 Claims 10

**ABSTRACT OF THE DISCLOSURE**

The present invention relates to a printing calculator which carries out all four kinds of arithmetic calculation and prints the results as well as the items (set-up numerals), and which can store set-up as well as computed numerals in accumulating registers.

The machine embodying the invention is provided with a variable number (for example 5 to 7) of schedule bars 1 (FIG. 5), in which the operations are scheduled by means of recesses 1c. Sensing members (101 to 116) sense off and set scheduled operations from the said schedule bars. Each schedule bar can be shifted longitudinally into a plurality of sensing positions (at least twelve), and by varying the starting position and causing the schedule bar to pass over non-desired stop positions, several operation schedules may be embodied in each schedule bar. On exceeding capacity, or the like, the sensing members are prevented from moving into their sensing position of engagement with the schedule bars, until the error (such as exceeding the capacity) has been corrected (correction operation and setting up manageable numerals). By the possibility of varying the number of schedule bars and the configuration of the latter, machines for fulfilling any particular need may be constructed in a simple way.

The present invention relates to power-operated calculating machines of the kind destined to carry out, beyond addition and subtraction, also automatic multiplication and division operations, with printing of the numerals set up as well as of the results obtained.

Calculating machines of this kind, i.e. printing calculators, are well known in the art, and many of those have operated satisfactorily. Due to their comparatively complicated construction they are all subject to certain limitations with regard to their versatility, however, and those limitations have particularly affected their flexibility in automatic calculating operations. In that respect electronically operating machines have proved highly useful, but these machines are, on the other hand, several times as expensive as mechanical calculators and are, moreover, more fragile and also heavier and more cumbersome than the latter.

It is therefore a chief object of the invention to provide a versatile mechanical calculating machine having great flexibility in carrying out automatic scheduled operations and combining in itself the good points of both machine species referred to above. It is a further object of the invention to provide a machine construction which may readily be manufactured by conventional methods and comparatively simple workshop technics in efficient production processes, and which will for that reason be inexpensive when its attainments are considered. It is a still further object of the invention to provide a power-operated automatic calculating machine combining compact dimensions with easy, reliable and swift operation.

By the provision of mechanism according to the invention in a mechanical calculating machine automatic

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computing of a complicated kind will be possible to carry out in a simple way, in that the machine may be pre-conditioned not merely for the simple rules of arithmetic, but also for special operations, such as computing (after setting up in the keyboard) the total cost of a plurality of items with a given price of each, deducting a given discount percentage therefrom, adding turnover tax to the sum and adding the latter to an amount already stored in the machine (or subtracting it therefrom).

The same machine may also be provided with scheduling means for the automatic carrying out of, for example, timber calculations, cargo calculations, computing the mean error according to the method of least squares, etc.

The mechanism according to the invention thus readily permits the conditioning of the calculating machine for particular operation schedules, and may also, as mentioned above, be provided with a plurality of mutually independent operation schedules which can be employed alternatively by actuation from the machine keyboard.

The invention may be applied, in principle, to all calculating machines comprising mechanisms of a kind normally provided, such as setting-up mechanism, calculating mechanism, registers, accumulators, printing mechanism and drive means. It provides control mechanism for the automatic cooperation of the said principal mechanisms by virtue of special schedule bars.

According to the invention there is provided in or at a calculating machine control mechanism a plurality of schedule bars which may be activated by the influence of one or more operation keys to be shifted into engagement with abutment means adapted to close the drive motor circuit for transmitting drive to a drive mechanism and to release, with or without assistance from the drive motor, a number of preferably spring-loaded sensing members to be brought into engagement with an activated schedule bar, this bar arresting, according to its configuration, certain sensing members in an active sensing position, that or those sensing members having assumed an active position bringing about, with or without the help of transmitting members, the engagement of the drive mechanism connected to the drive motor with those operation units of the machine which correspond to the activated sensing members and which carry out the operations sensed from the schedule bar, the latter being returned by one or more steps back towards its initial position into a new sensing-off position, in which the sensing members, which are retracted on the stepwise motion of the schedule bar, are urged into a renewed engagement with said bar, to actuate thereby subsequent machine operations corresponding to the configuration of the bar in the new sensing-off position, further stepwise displacement of the bar towards the initial position being carried out after the accomplishment of the last-mentioned operations, means being provided for breaking the drive motor circuit to stop the machine operation upon the initial position of the schedule bar being reassumed.

As a rule it is desirable to have a plurality of different schedules for the machine, and according to a further feature of the invention a plurality of different schedule bars are disposed alongside each other. To further improve the versatility of the machine, several different schedules may be embodied in any single schedule bar. In a preferred embodiment of the invention each schedule bar can be activated by two or more operation keys each of which is adapted to set an abutment member common to all schedule bars in a stop position corresponding to the respective key. The different stop positions for the different keys cause the sensing members to abut the schedule bar in such a manner that different schedules of the bar are selected.

Further, an abutment member common to all schedule bars may be caused, upon activation of a schedule bar, to

take up one of two alternative positions, in dependence of whether digits have been set up from the keyboard in the selecting mechanism of the machine or not (in the latter instance the schedule bar may embody a schedule by which, for example, the transfer of a numeral from an accumulator to the actuator will be actuated).

In a preferred embodiment the abutment member common to all schedule bars is bail-shaped and is brought, upon depression of certain operation keys (e.g. multiplication key, numeral printing key or return key), to assume an upper stop position, and, on depression of certain other operation keys (e.g. division actuating key, addition key, negative multiplication actuating key or correction key), to assume a lower stop position, the bail further being brought into assuming a forward or rearward position, depending on whether the selecting mechanism of the machine (pin carriage or the like) has been set up, or not.

In this embodiment thus four different stop positions are provided for each schedule bar, that which corresponds to four schedules for each bar.

It has further proved advantageous to arrange the bail in such manner that it is carried along through a small distance when it checks the motion of the schedule bar, to make it thereby effect engagement between the drive mechanism of the machine (e.g. one or more cam assemblies) and the power drive shaft of the machine.

In a preferred embodiment of the control mechanism the stop bail also actuates, upon abutment of the schedule bar, a switch which starts up the electric drive motor of the machine.

An advantage derived from making the schedule bar itself actuate the starting of the drive mechanism will be that the schedule bar must have attained its correct position before it is engaged by the sensing members. Otherwise (if, for example the operation key were to actuate the drive mechanism) it would be necessary to provide delaying means to prevent premature sensing. This would add to the complication, and the operation might become somewhat unreliable (for example if a bar should get jammed).

A most significant feature of the control mechanism according to the invention is the provision of means for checking errors of the type caused by the capacity of the machine being exceeded in one way or other, for instance if the capacity of the product register is exceeded, or if a set up multiplication should give as result a numeral having more digits than the machine is designed for.

In that case a non-compliance function is actuated, i.e. the selected schedule is interrupted, and the machine is arrested.

This is a signal to the operator that, for instance, the calculating operation last set up cannot be carried out, that the capacity of the product register has been exceeded, or the like.

Upon depression of a special correction key, one of the schedule bars is now actuated and starts up in its turn a special correction schedule. The latter may, for example, comprise clearing the last set up numerals, to produce from the accumulator the result computed up to the said numerals, to print that result etc., that is to reestablish a desired starting position for the continued calculations.

This non-compliance function is of special importance if the machine is provided with an automatic decimal point position control. In such case numerals which are non-compatible with the capacity of the machine may be set up, or may form quite easily during calculation. The non-compliance and correction functions ensure that if the capacity would have been exceeded in one respect or the other that will not pass by undetected, to give an erroneous final result.

The general operation of a specific embodiment of the invention (which shall be described more in detail below) might be understood from the foregoing description and may be summarized as follows:

The actuation of a specific operation key will release a schedule bar which moves to a stop position.

After that, a number of sensing members move into engagement with said schedule bar, and those sensing members moved into an active position will initiate the corresponding operations. These operations may either be carried out directly (by a cam assembly or the like) during an operating cycle by the intermediary of means controlled by the sensing members. This is the case, for example, when controlling the printing mechanism, accumulator and selecting mechanism etc. Certain sensing members release, instead, an engagement member which connects, for example, the calculating rotor or rotary actuator (of the general type shown in my co-pending application Ser. No. 591,744 or that shown at 32 in U.S. Patent No. 2,611,539) to a shaft driven by the motor, or effects the transfer of a numeral back from the product register to the calculating rotor etc.

When the operations controlled in one position of the sensing members have been accomplished, the main body of the sensing members is lifted out of engagement with the schedule bar. The latter is shifted rearwards some steps controlled by a special sensing member, and the sensing members move subsequently into fresh engagement with the schedule bar and release consecutive scheduled operations etc.

It might also be mentioned that in this embodiment there are six schedule bars, and that each bar may assume four different stop positions. If all sensing positions are employed, eleven different sensing positions may be provided for each bar. The number of different schedule combinations will thus be very great, and may moreover be varied by designing special bars for schedules which are wanted for special purposes. It will thus be possible to provide made-to-measure schedules in a standard type machine with very slight modifications.

The control mechanism embodiment briefly outlined above will now be described in greater detail with reference to the annexed drawings. The drawing figures are all perspective views save FIG. 7, and some of them are exploded views.

In the drawings:

FIG. 1 is a general view of a calculating machine incorporating control mechanism according to the invention at its right-hand portion,

FIG. 2 illustrates the control mechanism with the right-hand side wall removed for clarity,

FIG. 3 is a view of the schedule bars with sensing members and lifting bar,

FIG. 4 illustrates the mechanism for closing the drive circuit and for transmitting drive to the drive mechanism (cam assemblies),

FIG. 5 is a view of the mechanism for zero position stop and the forward feed mechanism for the schedule bars,

FIG. 6 is a view showing the arrangement of a spring tensioning plate,

FIG. 7 is an elevation view of the release mechanism for the spring tensioning plate in FIG. 6,

FIG. 8 is a view of the feed mechanism for the schedule bars with a positioning bail (and ink ribbon shift to red print),

FIG. 9 is a view of the paper feed and printing control mechanism,

FIG. 10 is a view of the key release mechanism,

FIG. 11 is a view of the pin carriage sensing and clearing mechanisms as well as rotor setting for calculation and rotor return travel,

FIG. 12 is a separate view of the rotor return travel mechanism,

FIG. 13 is a view showing engagement of the multiplier mechanism and product register,

FIG. 14 shows mechanism for setting symbols and selecting species of calculation,

FIG. 15 is a view illustrating the engagement and disengagement of the quotient register,

FIGS. 16 and 17 are views illustrating mechanism for reversing complementary numbers,

FIG. 18 is a view of a mechanism for indicating when the capacity is exceeded,

FIG. 19 is a view, partly in section, of the control mechanism and the mechanism for sensing the numerals in the printing mechanism,

FIG. 20 is a view of the engagement and disengagement mechanism for the cipher wheels,

FIG. 21 is a view of the mechanism for setting the rotor abutment,

FIG. 22 is a view of the sensing mechanism for the cipher wheels,

FIG. 23 is a view of the mechanism for setting the non-compliance function, and

FIG. 24 is a view of the transmitting members between the control mechanism and the indicating mechanism.

In the following specification reference is made to different units and mechanisms belonging to calculating machines and not being the object of the present invention. As such units and mechanisms are well known to those skilled in the art a detailed description thereof has not been deemed necessary, and has been dispensed with.

The calculating machine illustrated in outline in FIG. 1 is provided with a control mechanism positioned at the right hand side of the machine. This control mechanism is supported by two side walls 26, 27 (FIGS. 2 and 3). Two cam assemblies are mounted on shafts extending between the side walls 26, 27, and are connected to an electric drive motor (not illustrated). Below the cam assemblies six schedule bars 1 are disposed alongside each other (the shape and number of the bars is subject to variation, if the operations controlled thereby are modified).

The schedule bars 1 are slideably supported by two rods 24, 25 extending through oblong slots in the bars and secured to the side walls 26, 27. The schedule bars 1 are guided towards their ends by slotted vertical guide plates 28, 29. A recess close to the farther end of each schedule bar is engaged by a shouldered pin mounted on a corresponding arm 33.

The arms 33 are supported by an axle extending between the side walls, and are connected to springs 32 which urge the schedule bars forward against abutments 30 and 31 (FIGS. 2 and 5) actuated by the operation keys by means of a lever assembly in such a way that an abutment 30 or 31 is shifted when a key is depressed. A corresponding schedule bar 1 is released thereby and travels forward by the action of the spring 32 upon the arm 33 engaging the end portion of the bar.

#### SETTING AND STARTING-UP MACHINE

As understood from the description above, each schedule bar embodies different schedules represented by step-shaped recesses, and these schedules are selected by arresting the schedule bar in different positions. The mechanism provided for this purpose is common to all schedule bars and comprises a stop bail 2 (FIGS. 2 and 3) which is normally held in an upper position by a spring and is forced upon depression of keys into a lower position by a linkage engaging a setting bail 4 having a pin 4a secured thereto, said pin slidably engaging a slot in the stop bail 2.

The abutment surfaces 1a, 1b of the schedule bars are staggered in such a way that the different positions of the stop bail 2 correspond to different stop positions of the schedule bars. The stop bail 2 is pivotally supported by a further bail-shaped member 3 at right angles thereto in such a manner that when the schedule bar strikes against the stop bail, the latter moves some distance forward (about two millimetres), before the motion of the bar is checked definitively. This is effected through the shifting of a lever 5 (FIG. 3) mounted on a pivot 6 provided at a bail-shaped structure 7. This bail structure 7 is shaped

with a hole 7a in each shank. An axle 8 extends through the holes 7a and is supported by the side walls of the mechanism. The relative dimensions of the axle and the holes are such that on forward motion of the stop bail 2 the lever 5 is shifted as well. The bail structure 7 takes part in this motion and is arrested as the opposite edge portions of the holes 7a abut the axle 8.

During this movement the circuit of the electric motor is closed through the following sequence:

A release lever 9 (FIG. 4) is mounted on a pivot 10 at the bail structure 7 and is shifted when the latter is actuated by a schedule bar. The lever 9 which engages by its other end a latch 11 will tilt about a pivot 12 provided at the right hand side wall 27. A catch 13 is pulled by a spring 14 down into a notch 11a in the latch 11. A hook member 15 is forced by this action against any one of three prongs 16 projecting from a boss mounted on a drive shaft 17 driven from the motor and transmitting its drive to two cam assemblies (not illustrated). The catch 13 simultaneously engages a bell crank 18 that actuates a start bail 19 provided with a contact 20 which closes the circuit.

Making the schedule bars engage the cam drive at the same time as the drive circuit is closed means that the drive is not started up before a schedule has been selected. The complication of a special delaying action in the drive mechanism is avoided, therefore.

As already mentioned a numeral may be entered into the calculating mechanism either from the pin carriage or from a mechanism in which a constant value may be set in a manner known in itself, upon depressing the same operation key. To distinguish automatically between those two different sensing actions which are followed by similar calculating operations, the pin carriage actuates, as soon as a numeral has been set up therein, a shifting arm 21 (FIG. 3) to swing the lever 5 whereby a cam slot 5a formed in the lever 5 will displace an axle 22 extending through the slot rearwards by about two millimetres (as shown in FIG. 3). The stop bail 2 carries by the axle 22 will consequently be shifted an equal distance. Upon the pin carriage being cleared (zeroized) the lever 5 returns to an upper position, and the stop bail 2, by virtue of the pin- and slot-connection 22, 5a, will be moved into its other extreme position. By this arrangement, on setting up numerals in the pin carriage, the shifting arm 21 displaces the stop bail 2, and the numeral set-up is sensed from the pin carriage, whereas, if no numeral has been entered into the pin carriage the numeral is automatically received from the mechanism for setting up a constant value, if such a value has been set up therein.

#### THE SETTING OF OPERATION KEYS

Sensing members 101 to 116 are provided along the top and bottom edges of the schedule bars 1 (FIG. 2). These sensing members are U-shaped and pivoted in the side walls 26, 27 on shouldered pins 108a, fast on the sensing members. Transverse rods or axles 108b are secured to the sensing members and these axles will actuate different operation setting members upon the engagement of sensing members with schedule bars. Said operation setting members will be actuated upon the lifting off of the sensing members, as well.

As already described, the schedule bars 1 are supported by two rods 24, 25 between the side walls 26, 27, and are further guided by two guide plates 28, 29. When the abutments 30 and 31 for a schedule bar 1 (FIG. 5) are moved out of the way upon depression of a key, the schedule bar is pushed forward by the corresponding spring 32 by the intermediary of an arm 33, and during the last two millimeters of this motion the contact 20 is closed, and the drive motor is started (FIG. 4). At the same time the catch 13 for the drive coupling is moved to inactive position, the hook member 15 drops into engagement with the drive wheel, and the rotation of the two cam assemblies is started.

During the first part of the cam rotation a lifting bar 34 (FIG. 3) engaging by elongated slots two studs 205, 206 mounted at the outside of the right-hand side wall 27 will be pulled rearwards by a spring 207 when a cam 209 has turned into an angular position wherein a lever 208 which is connected to the lifting bar and is engaged by a cam follower 210 may be swung counterclockwise to permit the said motion of the lifting bar. The latter will release, upon its travel, the sensing members 101 to 116 disposed above and below the schedule bars which are shaped with arcuate recesses 1c (FIG. 5) of varying depth.

For different functions the recesses have different characteristic depths. As the sensing members are spring-biassed towards the schedule bars, they will, depending on the longitudinal position of the bars, either enter the recesses to be arrested by the bottom edge or by step formations of the recesses, or will have their motion checked by the longitudinal edges of the bars. When arrested by the schedule bars, each sensing member will have actuated an operation mechanism or will have disengaged said mechanism. Disengagement will usually be effected when the sensing member is arrested against the longitudinal outer edge of the schedule bar.

During the remaining part of the cam revolution the operations set according to schedule as well as some non-scheduled operations, which will be carried out for each revolution, are accomplished.

The members which carry through the set operations are the two cam assemblies in the drive mechanism and further cam assemblies in the printing and checking mechanisms. When the operations have been set, and in most cases carried out, the sensing members 101-116 are lifted by the cam 209 which actuates the cam follower 210 to swing the lever 208 clockwise whereby the lifting bar 34 is moved forward to its initial position. The schedule bar may now be moved back to non-actuated position or to another actuated position in which a similar cycle is repeated.

#### KEY LOCK

To prevent more than one schedule bar at a time from assuming actuated position (that is, to prevent the depression of more than a single operation key at a time) a spring tensioning plate 35 (FIG. 6) is provided at the outside of the right-hand side wall 27. During the first revolution of the cam assemblies this spring tensioning plate is moved rearwards by a cam 36 engaging the plate by the intermediary of a lever 37 mounted at the inside of the wall 27 and a roller-supporting pin 37a. The plate thereby engages a catch 38 at the side wall and is kept in this position until the last feed is accomplished. The disengagement of this catch 38 will be described later.

The functions which are influenced by the spring tensioning plate 35 are those which do not prevent the shifting of the schedule bars.

At the rearmost portion of the upper edge of the schedule bars 1 there is provided a positioning bail 39 (FIG. 8) which is actuated by the spring tensioning plate 35. This bail is U-shaped like the sensing members and is assembled of two side members and an intermediate profiled bar member to provide a rigid structure. The intermediate member is machined to engage teeth formed at the schedule bars. The purpose of the positioning bail is to retain the schedule bar in distinct positions during the sensing. After key lock release (which is to be described later) has been effected, the key lock prevents more operation keys than one from remaining in depressed position, and thus it is avoided that more schedule bars than one are fed forward at a time.

#### FEED OF THE SCHEDULE BARS

The engagement and disengagement of the mechanism for the feed of the schedule bars is effected through the

action of the spring tensioning plate 35 and this stepwise displacement is controlled by a sensing bail 115 (FIG 8) which is supported on pivots in the same manner at the sensing members and is adapted to engage the bottom of the schedule bars. At the top of the schedule bars a feed bail 41 is supported by an axle 45 guided by slots 115c in the sensing bail 115 and also by slots in the side walls. When the spring tensioning plate 35 has been shifted to its rearmost position after about three-quarters of the cam revolution to be hooked up on the catch 38 the sensing bail 115 has been moved into sensing the schedule bar in question aided by a spring 42 (FIG. 6). At the same time as the sensing bail is moved into sensing position the feed bail 41 is pulled forward and held in engagement with the schedule bars by a spring 43 exerting light pressure.

When the sensing bail 115 has been arrested by the schedule bar the feed bail 41 has been set for feeding a certain number of steps depending on how far the sensing bail 115 has been permitted to swing into the schedule bar. Since the feed bail is moved thereby to a position determined by the sensing bail 115, a deep recess sensed by the sensing bail 115 corresponds to a more advanced starting point for the feed bail 41, and consequently the schedule bar concerned will be fed a correspondingly increased number of steps.

A feed link 44 (FIG. 9) which is adapted to engage the axle 45 is pivotally connected by one end to an arm 46 which is pivoted on a pin in the right-hand side wall 27. By its opposite end the feed link 44 is hingedly connected to an actuating arm 47 mounted on an axle extending between the side walls. A roller 48 is rotatably mounted at the arm 47, and this roller 48 engages by the action of a spring 49 extending between the arm 46 and a pin mounted at the side wall a cam belonging to the rearward cam assembly. Upon feed movement a heel portion of the feed link 44 is moved towards the axle 45 by the action of the cam on the actuating arm 47, and at the same time a shoulder 44a at the link 44 is brought into such a position above the feed bail 41 that the latter is locked in its engagement with the schedule bars, to prevent the latter from carrying out any additional shifting movement by reason of their momentum when the feed of the sensed number of steps is being effected.

The last tooth 1d (FIG. 7) in the series of feed teeth provided at the schedule bars extends from a lower level than the other teeth, and the feed bail 41 consequently goes down deeper when engaging this tooth. A swing arm 40 will be carried along in this movement and will engage in its turn the catch 38 and move the latter out of engagement with the spring tensioning plate 35. The catch 38 will return subsequently to initial position by the action of a spring 23 (FIG. 6). The sensing bail 115 now will be lifted out of engagement with the schedule bars 1 by means of a pin 115d. Further, the spring tensioning plate 35 will be instrumental in returning the feed bail 41, the positioning bail 39 and a non-compliance bail 107 to their initial positions, the two first-mentioned bails by the intermediary of bent-out ears 41a and 39a, respectively, and the last-mentioned bail by the intermediary of an axle 107b supporting this bail (FIG. 6).

#### KEY LOCK RELEASE

When an operation key has been depressed the other keys shall be locked, as mentioned already, to prevent the release of more schedule bars than one as well as any change of a numeral set-up in the pin carriage. By this reason a key lock mechanism of a kind well known in itself is actuated upon depression of a key. The release of this key lock should be effected as soon as possible so that the setting-up of fresh numerals and operations will not be delayed while the machine carries out those already set. Such key lock release must not ensue, however, before the pin carriage has been sensed and cleared, so

that the numeral already set up will not be changed. These functions are controlled by the sensing member 101 (FIG. 10). In a first position this sensing member controls key release, in a second position key release and pin carriage sensing and clearing, and in a third position only pin carriage sensing.

The mechanism for key lock release comprises a bail 51 supported by an axle 52 extending between the side walls 26, 27. The bail 51 engages by a projection 51a a cam 53 in the rearward cam assembly. A link 54 is hingedly connected to the bail 51 and is shaped with two slots 54a, 54b receiving pins 55, 56 secured to the right-hand side wall 27. The rearmost slot engages its pin with an amount at lateral clearance to avoid jamming. The bail 51 and the link 54 carry out a reciprocating motion for each cam revolution.

Means are provided to control the moment when key lock release shall take place, and these means comprise a lever 58 mounted at the outside of the side wall 27 on a pivot pin 57 (FIG. 10). At the lower portion of the lever 58 an extension 59 is hingedly mounted, and is held in a predetermined position by a spring 60 extending between a first anchor pin 61 provided at the lever 58 and a second anchor pin 62 at the extension 59. The anchor pin 61 engages a recess 59a in the extension 59 and this anchor pin 61 provides an abutment for the bottom edge of the recess 59a.

A shoulder pin 63 at the lever 58 provides an axle for a roller 64, and this roller engages a hook member 65 pivotally mounted on a release bar 66. The hook member 65 is provided with two V-shanks 65a, 65b, and a pin 67 mounted at the release bar 65 extends in between the said shanks to serve as an abutment therefor.

At the beginning of each revolution of the cams and after the rearward displacement of the lifting bar 34, the sensing member 101 is moved by the action of a spring 68, and the intermediary of the resilient lever 58, 59 down into contact with the schedule bar which has been fed forward. On key lock release the sensing member is arrested either against the edge of the bar, or in the first position. The hook member 65 will extend in those positions with a tooth 65c across a transverse arm 54c formed at the link 54 which reciprocates for each revolution of the cams, and will be carried along in this motion. As the key lock release must be effected during the very last fraction of the revolution the sensing member 101 has already been lifted by the lifting bar. The sensed result must remain, therefore, and this is caused by the extension 59 of the lever 58 engaging an axle 101b at the sensing member 101 moving in unison with the sensing member when lifted, while the lever 58 with the roller 64 engages the hook member 65. By reason of the link 54 having moved slightly rearwards, the transverse arm 54c has engaged the tooth 65c of the hook member and retains it in that position by the tooth being shaped as a catch. When the link 54 is moved further rearwards during the last fraction of the revolution the hook member 65 is carried along and will shift the release bar 66 which is mounted at the outside of the right-hand side wall 27. The release bar is shaped at its forward portion with a recess 66a engaged by a bellcrank 70 which is pivotally mounted at the underside of the keyboard bottom plate. When the release bar is pulled rearwards the bellcrank 70 is rocked and thereby actuates a bar 71 in the keyboard. As a consequence, this bar will release latch members 72 corresponding to the keys and of a kind well known in itself. When key lock release has been effected the bail 51 and the link 54 are returned by a torsion spring 73 mounted at the axle 52 back to initial position with the bail 51 engaging the cam 53. The release bar 66 is returned simultaneously by a spring 74. When key lock release shall not be effected, the sensing member 101 is permitted to penetrate more deeply into the schedule bar whereby the upper part of the lever 58 is swung counterclockwise to bring the roller 64 in a position wherein the tooth 65c of the

hook member 65 will be right above the transverse arm 54c, and consequently the hook member 65 cannot take part in the movement of the lever 54.

#### THE SENSING AND CLEARING (ZEROIZING) OF THE PIN CARRIAGE

For sensing and clearing the pin carriage a lever 75 (FIG. 11) is mounted at the outside of the left-hand side wall 26, said lever engaging by a pin-and-slot connection the through-going axle 101b of the sensing member 101. A slide member 77 mounted on the base plate of the machine (not illustrated) is forced by a spring 78 to engage one end of the lever 75. The slide member 77 is hingedly connected at its opposite end by means of a pin 79a to a bellcrank 79 mounted on a pivot in the base plate. The bellcrank 79 is connected by a further pin to a setting link 80 formed at its opposite end with a slot 80a receiving a pin 81 mounted on the base plate. When sensing is carried out the sensing member 101 is shifted by the spring 78, the slide member 77 and the lever 75 into engagement with the schedule bar, and at the same time the link 80 is actuated. At one end the link 80 is formed with a rectangle-shaped aperture 80b with a tongue 80c projecting thereinto. A heel 82a formed at an arm 82, which reciprocates in the longitudinal direction of the tongue 80c for each revolution of the cams, extends into the aperture 80b. When the link 80 is in a position wherein the tongue 80c faces the heel 82a of the arm 82, the latter will strike, upon its reciprocating movement the tongue 80c by the heel 82a. The arm 82 will be raised thereby to bring the heel 82a on top of the tongue whereby the sensing pawls in the printing mechanism (not illustrated) are moved into sensing position. When the tongue 80c faces either side of the heel 82a no sensing of the pin carriage will take place, since the arm 82 is not raised in these positions. By means of a pin 83 mounted at the link 80 a bellcrank 84 is actuated which controls means for clearing the pin carriage (known in themselves and not described).

#### ENGAGEMENT OF MULTIPLICATOR MECH- ANISM AND PRODUCT REGISTER

When a numeral shall be entered in the multiplier mechanism or be sensed therefrom or from the product register a set of tooth wheels shall be interposed between the racks in the printing mechanism of the machine and the respective mechanism. The engagement of these tooth wheel sets is controlled by a sensing member 102 (FIG. 13) which activates in a first sensing position the tooth wheel set of the multiplier mechanism and an abutment in said mechanism, against which its setting wheels are arrested. In a second position only the tooth wheel set of the multiplier mechanism is moved into engagement. In a third position nothing happens, whereas in a fourth position the tooth wheel set of the product register is brought into engagement.

For transferring the sensed position a lever 86 is pivotally mounted at the outside of the left-hand side wall 26 and a slot 86a in this lever is engaged by the through-going axle 102b of the sensing member 102. A link 87 extends at right angles to the lower portion of the lever 86 and is mounted movably on two parallel bars 88, 89 mounted on pivot pins on the base plate of the machine (not illustrated). Three bellcranks 90, 91, 92 mounted in the printing mechanism engage these two parallel bars and a notch in the link 87, respectively. The bellcranks are biased by springs 93, 94, 95 which urge the sensing member into engagement with the schedule bar, the bellcranks assuming thereby different positions depending on the arrested position of the sensing member. The bellcranks 90 and 92 are formed each with a transverse arm 90a, 92a, respectively, and these arms either engage a bar 96 that reciprocates for each revolution and imparts its motion to the bellcranks, the tooth wheel sets thereby

being brought into engagement position with the multiplier mechanism or the product register, or assume a position above the bar so that no setting up will be effected. When a numeral is to be entered in the multiplier mechanism the bellcrank 91 is released and will move with a notch 91a in front of an abutment for the numeral wheel of the multiplier mechanism (not illustrated) to prevent the abutment from engaging the wheel. On the sensing of numerals in the multiplier mechanism the abutment is released, the bellcrank 91 being prevented by the sensing member 102 from swinging into a position in front of the abutment.

#### PRINTING OF SYMBOLS

When a numeral is printed there will always be printed one or two symbols to the right thereof. The symbols in the column closest to the numeral signify either what kind of calculation is concerned, or whether the numeral is a computed result which shall be retained or cleared, or if the numeral is just an item. In the second column, it is marked if the numeral is a remainder, if it is negative, or if an error has occurred, for example exceeding the capacity with accompanying non-compliance.

For the setting up of the symbols to be printed two sensing members 104, 105 (FIG. 14) are provided, one for either symbol column. Both work on an identical principle, and therefore only one will be described.

At the left-hand side wall 26 two levers 97, 98 are pivotally mounted, the lever 97 engaging by an extension 97a the axle 105b of the sensing member 105 and engaging by a pin 97b mounted at its other end the lever 98 that engages in its turn a lever 99, pivotally mounted on the base plate of the machine. The lever 99 actuates an arm 100 by a pin-and-slot connection and the arm 100 being hingedly connected at its other end to a pin mounted at one end of a setting-up lever 117. The opposite end of the lever 117 is formed with an open-ended slot 117a, which receives a pin (not illustrated) mounted at a symbol bar belonging to the printing mechanism (not illustrated). This symbol bar is of equal shape and moves in the same way as the rack bars in the printing mechanism.

The sensing member 105 moves, as already mentioned, down at the beginning of the revolution for sensing the schedule bar. Immediately after that the rack bars as well as the symbol bars in the printing mechanism are released and are pulled rearwards by springs (not illustrated) until they are arrested by the sensing member being forced against the schedule bar through the linkage described above. The sensing member 105 and the linkage cooperating therewith serve as an abutment for the symbol bars. The alignment of the latter and the printing is carried out in a manner well known in itself. On the lifting of the sensing member by the lifting bar 34 the symbol bars will be carried along as this lifting operation is effected before the return of the rack bars.

#### RED INK PRINTING

When a numeral has been reversed and shall be subsequently printed the fact that it is reversed, i.e. negative, is marked by printing the numeral in red. Normally the black zone of the ink ribbon of the machine is disposed opposite the platen, and only when a signal releases a changed setting the ink ribbon is lifted to bring its red zone in printing position. This signal is received from a sensing member 110 (FIG. 8) providing an abutment for a linkage, the adjustment of which is altered when the sensing member plunges into a recess in the bar. The said linkage comprises a bellcrank 171 pivotally mounted on the base plate and engaging an extension of the sensing member. From the bellcrank a resilient link 172, 173 extends to a further bellcrank 174. The link 172, 173 is hingedly connected to both bellcranks 171, 174. An angle-shaped link 175 is hingedly connected to the bellcrank 174 and is formed with a guide slot engaging

a pin 176 mounted on the base plate. A vertically extending bellcrank 177 is pivotally mounted at the printing mechanism side wall and engages that shank of the link 175 remote from the bellcrank 174. The bellcrank 177 is hingedly connected to one end of a link 178 the other end of which is hingedly connected to a setting up bellcrank 179 pivotally mounted at the side wall of the printing mechanism. A pin 179a mounted at the bellcrank 179 extends through an open-ended slot in a setting arm 180. In the latter two further slots 180a are formed receiving corresponding pins mounted at a reversing bellcrank 181. Normally the setting arm 180 takes up a rearward position, and the printing will be effected in black ink, but when the sensing member 110 is swung into a recess in the schedule bar the whole linkage will be pulled by a spring 182 as far as permitted by the sensing member 110 which rests in its stop position against the bottom of the schedule bar recess. Upon this movement the setting arm 180 will be moved by the pin of the bellcrank 179 to a forward position and will be straddled by two bent-out ears 183a, b on a bellcrank 183 which is reciprocated for each revolution. The setting arm 180 and the reversing bellcrank 181 supporting the arm 180 will be carried along, clockwise initially, and counterclockwise subsequently. A roller, mounted for rotation on the reversing bellcrank 181 will actuate thereby the ink ribbon lifting mechanism to shift the red zone of the ribbon into printing position (not illustrated). After printing the ink ribbon is returned into normal position by the lower ear 183b at the bellcrank 183 acting on the setting arm 180 with counterclockwise motion, and the setting arm 180 returns to initial position when the sensing member 110 swings away from the schedule bar.

#### PAPER FEED AND PRINTING

After the printing of a numeral the paper is immediately fed forward, as this is necessary for making the printing visible at once above the ink ribbon, the machine becoming in this respect simultaneously ready for a fresh printing. Paper feed may further be effected upon depression of an operation key which also releases a schedule bar, repeated paper feed motion being caused as long as the key is kept depressed. On a single depression of the key a paper feed comprising six steps is actuated, and if the key is retained in depressed position when this feed is completed a further feed by six steps is actuated etc. The mechanism which determines when paper feed and printing shall be effected comprises a sensing member 112 acting as an abutment for a linkage setting the functions. This linkage is similar in principle to that already described for printing with red ink.

The motion of the sensing member 112 (FIG. 9) will be checked either by the longitudinal edge of the schedule bar, and in that case nothing further will take place, or will be arrested by recesses in the bar of three different depths. A recess of a first depth will actuate paper feed by two steps, a recess of a second depth will actuate paper feed by two steps and printing, and a recess of a third depth will actuate paper feed by one step and printing. On setting up numerals paper feed is effected by one step whereas on printing a result paper feed by two steps is actuated. As mentioned already these different settings are obtained with a sensing member 112 (FIG. 9) acting on a linkage which sets in dependence of the sensing member position members for effecting the operations. A bellcrank 186 mounted underneath the base plate engages an extension of the sensing member 112. From the bellcrank 186 a link 187 extends to another bellcrank 188 mounted on the upper side of the base plate, and a shouldered pin 189 at the bellcrank 188 penetrates through an aperture in the base plate and provides a pivot for the link 187. A spring 190 is connected to an anchor pin on the bellcrank 188 and retains by a comparatively great force the whole linkage in the position determined

by the sensing member. A lever 191 pivotally mounted at the printing mechanism side wall is urged by a weak spring 192 into permanent engagement with the bell-crank 188. Two pins 191a, 191b are mounted on the lever 191. The lowermost pin 191b which extends towards the printing mechanism actuates the printing, and the uppermost pin 191a which extends away from the printing mechanism actuates the paper feed. The uppermost pin 191a extends into an open-ended slot formed in a selector plate 193 which can be set in different positions by the linkage depending on the sensed recess depth. At the printing mechanism a setting rocker arm 194 is mounted and is released for each revolution of the cams of the printing mechanism by an arm 195 provided with a pin 195a engaging a slot 194a in the rocker arm 194, and performs a reciprocating motion urged by a spring 196, whereby a bent lug 194b on the rocker arm will be checked by a tooth 193a on the selector plate 193, if the sensing member 112 engages the edge of the schedule bar, no paper feed being effected in that case. If the sensing member has moved to the first recess depth position the selector plate 193 has turned by the influence of the linkage such an angle that the bent out lug 194b is moved free of the tooth 193a, and the rocker arm 194 is swung into a higher position and will set paper feed by two steps. In the next recess depth position at the schedule bar the selector plate 193 has been turned still farther, but the bent-out lug on the rocker arm 194 will still be unobstructed by the selector plate 193 and thus will set paper feed by two steps. In this position the lowermost pin 191b has actuated setting for printing as will be described later. For the next recess depth the selector plate is turned still further, and the bent-out lug 194b at the rocker arm 194 will now be checked by a tooth 193b on the selector plate, but as this tooth is more distant from the center of rotation than the tooth 193a the rocker arm will be checked in an intermediate position corresponding to paper feed by one step.

As mentioned above the lowermost pin 191b sets printing in the two deepest recess positions. Normally this pin lies some distance away from a cam 197 which is mounted on an axle 198. A lobe of the cam 197 is forced by a spring 199 against a stud 200 at the printing mechanism side wall whereby the motion of the axle 198 is limited in one direction. In this position a fin 201 on the axle 198 provides an abutment for a pivotally mounted symbol plate 202 carrying the symbol wheel, and thereby prevents printing. In the both positions referred to above the pin 191b will, on the rocking movement of the lever 191, rotate the cam 197 and consequently the axle 198 and fin 201, whereby the latter will not form an obstruction for the symbol plate 202 which will be swung to effect printing.

The whole assembly will return to initial position as the lifting bar 34 moves the sensing member 112 back to starting position.

#### ENGAGEMENT OF CALCULATING AND ROTOR POSITIONING MECHANISMS

When calculation shall be carried out a signal must be transmitted to the calculating mechanism, and an abutment (for the calculating position) for the cam assemblies in the control mechanism must be moved into stop position to immobilize the cam assemblies of the control mechanism during calculation. Also during the lateral displacement of the calculating rotor on return movement and filling up a numeral the cam assemblies of the control mechanism have to be immobile.

For controlling these functions a sensing member 103 is provided and sets in a first position the abutment for the cam assemblies of the control mechanism and the lateral positioning of the calculating rotor and in the second position further sets the calculating pawls for calculation.

In FIGS. 11 and 12 the illustrated sensing member

103, when clicking into the first position, will release a lever 120 which will be swung by a spring 121 into engagement with the through-going axle 103a of the sensing member, whereby an interponent 122 will be moved in unison with the lever 120 by a pin 123 mounted on the lever. Thereby a return pawl 124 engaging by a projection 124a the interponent 122 will move out of this engagement, and the return pawl 124 will be rocked clockwise by the action of a lever 125 (FIG. 12) which is mounted on a drive member 129 and is urged by a spring 127 into engagement with a pin 124b. The lever 125 thereby will drop down and engages by a hook portion 125a a projection 128a on a positioning lever 128 which acts on the calculating rotor in the calculating mechanism to make it move towards its left-hand position (not illustrated). The lever 125 receives its reciprocating movement from the drive member 129 supported by the axle 130 and connected to the lever 125 by a pin 125b. The drive member 129 is provided with a stud 129a carrying a roller 131 which engages a cam 132 in the rearward cam assembly. The lever 125 thus has a reciprocating motion imparted thereto by the action of the cam 132 on the drive member 129 through the roller 131 in one sense, and the action of the spring 127 in the opposite sense. During this motion the calculating rotor moves laterally as already mentioned. The cam assemblies must be held up in the calculating position to give the calculating rotor time to move before the next operation is commenced. By this reason the return pawl 124 when rocking in the clockwise sense moves in front of a projection 133a on a transmitting lever 133 to which a counterclockwise rocking movement is imparted for each cam revolution by a pin 136 in the rotor clearing mechanism (not illustrated), said rocking movement being so ample that a check bail 134 is swung by a pin 134a mounted thereon and engaging an open-ended slot in the transmitting lever 133, into stopping position in front of the catch member 15 at the foremost cam assembly. If neither rotor positioning, or calculation shall follow the check bail 134 is pulled back by the transmitting lever 133 urged by a spring 135. The cam assemblies are not stopped thereby. For rotor positioning the return pawl 124 extends on top of the projection 133a on the transmitting lever 133 when the latter has been rocked downwards, the check bail 134 thereby being arrested in the stop position of the hook member 15.

The time at disposal for the rotor positioning corresponds to less than a third of that of a machine revolution. By that reason the return pawl 124 is adapted to be moved out of its engagement with the transmitting lever 133 when the three-pronged boss (FIG. 4) belonging to the continuously rotating drive wheel (not illustrated) will cease to impart drive to the cam assemblies when the hook member 15 is moved out of engagement with one of the boss prongs 16 by the action of the check bail 134, said cam assemblies being simultaneously arrested in a predetermined position through the cooperation of the hook member 15 and the check bail 134. Subsequently a pawl 138 mounted on the foremost cam assembly and shaped with a tooth 138a extending in between the prongs 16 during drive is swung outwards by one prong 16 whereby one leg 139a of a bail member 139 is engaged by the pawl 138. The bail 139 which is mounted at the left-hand side wall of the mechanism is swung thereby to make its other leg actuate the return pawl 124 whereby the latter is swung out of engagement with the transmitting lever 133, and the check bail 134 is pulled away from its arresting position by the spring 135 whereby the cam assemblies are started up at the same time as the lever 125 is moved back to initial position.

When a calculation is to be carried out the sensing member 103 plunges deeper into the schedule bar and thereby the return pawl 124 will first drop into active position and the operations described above will be set, after which a calculating pawl 140 which engages the

interponent 122 by a projection 140a drops on top of the projection 133a when the lever 120 is swung by the sensing member 103, the interponent 122 being carried along. When the calculating pawl 140 swings clockwise its upper portion 140b prepares the calculating mechanism for computing (not illustrated). During the whole of the calculation the projection 140a on the calculating pawl 140 will retain through the transmitting lever 133 the check bail 134 in its arresting position whereby the cam assemblies will be held motionless. When the calculation has been carried out, and the calculating rotor moves from the last calculating position into initial position a pin 142a mounted on a rocker arm 142 is engaged by an arm 141 that normally effects braking of the rotor when the latter moves towards the right (not illustrated) whereby the pin 142a is moved along a slot 143a shaped in a transmitting arm 143. The transmitting arm 143 is normally held in a retracted position by a spring 144 acting on the rocker arm 142 provided with the pin 142a. Thereby the projection 139a will not influence the transmitting arm 143 upon the angular motion of the bail 139 since the projection clicks in that position into a recess 143c provided at one end of the transmitting arm 143.

When the arm 141 brings the rocker arm 142 into assuming a forward position the pin 142a will be moved along the slot 143a in the transmitting arm 143, and subsequently a spring 145 will move the transmitting arm 143 into engagement with the pin 142a. The transmitting arm 143 is at its other end connected by means of a slot to a pin 146a on an arm 146. When the transmitting arm 143 takes up its forward position, a raised edge 143b thereon lies opposite the projection 139a on the bail 139 and is actuated upon the angular motion of the bail, whereby the transmitting arm 143 swings about the pin 142a and an anticlockwise movement is imparted to the arm 146. The calculating pawl 140 which is rigidly mounted on a common hub with the arm 146 is actuated to release the projection 133a whereby the check bail 134 moves away from its position of abutment against the hook member 15, and the cam assemblies are started afresh.

#### ENGAGEMENT AND DISENGAGEMENT OF THE QUOTIENT REGISTER

In the rearward portion of the printing mechanism and below the assembly of calculating bars there is provided a quotient register the purpose of which is to accumulate numerals which are entered therein by means of the calculating bars, and these numerals subsequently may be read by means of the calculating bars either in such way that the numeral is retained, or in such way that the quotient register is cleared. For controlling these functions a sensing member 106 is provided (FIG. 15) which sets in its first position the reading and clearing of the quotient register and in its second position sets reading with the numeral retained, whereas in the third position the sensing member sets the entering of numbers in the quotient register.

When the sensing member 106 drops into a schedule bar recess a link 150 is actuated. One end of this link 150 is connected to the through-going axle 106b of the sensing member and the other end of the link is connected by means of a pin 151a to a selector lever 151. The link 150 will move backwards upon the motion of the sensing member, and the selector lever 151 will be swung clockwise about a pivot 152a on a bellcrank 152. The selector lever 151 is apertured as at 151b, and into this aperture two setting arms 153, 154 extend which are actuated for each revolution of the cams by two corresponding rocker arms 155, 156 engaging cams 157 and 158, respectively. The setting arms 153, 154 are pivoted at one end in slots shaped in the right-hand side wall 27, their opposite ends being forced downwards upon rotation of the cams. In the first position of the sensing member 106 the position of the selector lever 151 is such that the setting arm 153

engages a cam projection 151c in the aperture 151b whereby the selector lever 151 is forced downwards and rocks the bellcrank 152. A link 159 is hingedly connected by one end to the bellcrank 152, whereas the opposite end of the link 159 is hingedly connected to another bellcrank 160 which will thereby be rocked counterclockwise. A pin 160a mounted on the bellcrank 160 engages an open-ended slot in a shift member 161 mounted on an axle 162. This axle 162 will transmit the motion imparted to it by the shift member 161 to two cams 163, 164 secured to the axle. The shift member 161 may be held disengageably in any one of three distinct positions by a positioning arm 165 shaped with three notches for receiving a pin 161a belonging to the shift member 161. Between the cams 163, 164 an axle 166 extends guided by slots 163a, 164a in the cams as well as by vertical slots in the printing mechanism side walls (not illustrated). When the cams 163, 164 are rotated counterclockwise the axle 166 is raised whereby digit wheels mounted at the axle (not illustrated) move into engagement with the calculating bars in the printing mechanism (not illustrated), and when the calculating bars are released backwards the numeral of each digit wheel is transferred to the corresponding calculating bar through turning the digit wheel to zero position and arresting it therein whereby also the calculating bar is arrested. If the digit wheels are moved in this position out of engagement with the calculating bars the quotient register will be cleared, and this will be effected through the action of a rocker arm 167 which is actuated by a cam 168 and raises the setting arm 153 which consequently strikes against the upper edge of the aperture 151b and returns the whole assembly to zero position.

In the other position of the sensing member 106 the selector lever 151 will be in a more retracted position, both setting arms 153, 154 will lie directly opposite the cam projection 151c. The cams 157 and 158 are shaped in such a way that the cam 157 firstly actuates the rocker arm 155 and brings the quotient register into engagement with the calculating bars in the manner described above. After about half a revolution of the cams the rocker arm 167 will raise the setting arm 153, which latter does not by its movement raise the selector lever 151, as the upper edge of the aperture 151b is shaped with a recess 151d and the setting arm 153 consequently does not strike the upper edge of the aperture 151b. Immediately after this movement the rocker arm 156 will act upon the setting arm 154 which lies opposite the cam 151c in that position, but said movement does not influence the setting in the said position, as the quotient register already engages the calculating bars. The numeral set up in the quotient register has been transferred to the calculating bars upon the rearward movement of the latter, and is again fed into the quotient register on the forward movement of the calculating bars. Disengagement of the quotient register is effected subsequently by the sensing member 106 being raised, as already described, and the upper edge of the recess 151b being moved into a position such that the selector lever 151 is raised when the rocker arm 167 again raises the setting arm 153 towards the end of the cam revolution.

When the sensing member 106 takes up its third position the selector lever 151 position is such as not to be influenced by the setting arm 153. The latter is received by a notch in front of the cam projection 151c, and consequently the quotient register is not engaged until the cams have rotated about half a revolution, the cam 158 acting upon the rocker arm 156 and the selector lever 151 being depressed by the setting arm 154 which abuts the cam projection 151c. The quotient register will be brought into engagement with the calculating bars only when the latter have moved backwards, and will retain its engagement with the latter during the forward movement. The numeral represented by the calculating bars will by that action be entered into the quotient register, the latter be-

ing subsequently disengaged from the calculating bars towards the end of the cam revolution in a manner already described.

#### REVERSING COMPLEMENTARY NUMBERS

When the numeral in the product register is negative, the numeral itself will not appear in the register, but instead its complementary number. This latter numeral must be "reversed" before printing, to be readable in conventional manner. To indicate whether the numeral in the product register is negative, a lever 211 (FIG. 17) is provided in the calculating mechanism which passes through the control mechanism and is guided in a slot in its right-hand side wall 27. The position of this lever indicates if the numeral is a "real" numeral or a complementary number, and this position is sensed from a projection on the lever 211 extending beyond the said right-hand side wall. The lever 211 normally takes up a middle position, but is rocked to move the projection into a forward position when a complementary number appears in the product register. This forward position is sensed by a lever 212 which is pivotally supported by a bail structure 213, formed with a lug 213a which is urged into engagement with a cam 214 in the foremost cam assembly by a spring 216. Consequently, the bail structure 213 is reciprocated about an axle 215 for each revolution of the cam 214. The lever 212 will share this movement. When the lever 211 is in its middle position, the mechanism will remain inactive, whereas, when the lever has been moved to a forward position a lug 212a formed at the lever 212 will abut the lever 211, and the point of contact will become a pivot for the lever 212 when the bail structure 213 is rocked clockwise. Thereby a cam surface 212b formed at the lever 212 will engage a pin 217a mounted on a link 217. This link 217 is formed near one end with a slot engaging a pin 203 at the right-hand side wall 27 and is hingedly connected by its opposite end to a lever 219. It is held in a retracted position by a spring 220. The link 217 will be pulled forward when the lever 212 engages the pin 217a, thereby swinging the lever 219 counterclockwise. A pin 219a on the lever 219 and engaging a slot in a lever 221 will swing the latter clockwise. The lever 221 is provided with a pin 221a to which a setting arm 222 is hingedly connected. This setting arm 222 at its other end is formed with a slot receiving a pin mounted on a position lever 223 (FIG. 16). The axle 107b of a sensing member 107 extends into a slot 222a formed in the setting arm 222 (FIG. 17). The position lever 223 raises and lowers the setting arm 222 when rocked by the action of a sensing member 109 which is connected by a resilient link 224, 225 to the position lever 223. When the sensing member 109 takes up inactive position, that is abuts the edge of a schedule bar, the setting arm 222 will be in a position such that the sensing member axle 107b is free to move within the upper portion of the slot 222a and thus will not be influenced, if a signal for reversing is transmitted from the lever 212, the setting arm 222 being advanced by the assembly 212, 217, 219, 221. When the sensing member 109 is entered into a recess in a schedule bar the position lever 223 is rocked counterclockwise whereby the axle 107b of sensing member 107 will be situated in the lower part of the slot 222a. On receiving a reversing signal the sensing member 107 will be rocked counterclockwise by the engagement of the axle 107b with an edge portion 222b of the slot 222a, whereby the sensing member 107 is moved out of engagement with the schedule bar and consequently does not block the latter at the next feed movement. Accordingly the schedule bar is reversed by one step and is held up by the positioning bail 39 (FIG. 2) whereafter reversal is carried out. As the feed movement of the schedule bars is effected after the sensing members have been raised by the lifting bar 34 the preselected operation must be stored until feed takes place, and this storing is effected by help of a lever 226 (FIG. 16) which may be rocked by a crank

pin 227 eccentrically mounted on the shaft carrying the foremost cam assembly. When the sensing member 109 moves the position lever 223 into reversing position, a projection 223a at the lever will upon its counterclockwise rocking movement be caught by the lever 226 and arrested in that position until feed has taken place.

Since the sensing member 107 arrests the schedule bars in a sensing position wherein reversing shall not be carried out, the sensing member 107 is not influenced by the lifting bar 34, as the sensing member 107 must not be raised during feed movement. The sensing member 107 consequently always glides along the schedule bars and is moved out of engagement position by the spring tensioning plate 35. To return the lever 211 from the end position to middle position the return mechanism is employed. It is engaged by means of the sensing member 102. This sensing member 102 will bring the product register into engagement. The latter should always be activated when reversing takes place. A lever 240 (FIG. 16) is pivotally mounted at the outside of the right-hand side wall 27 and is urged by a spring 241 into permanent engagement with the sensing member axle 102b. The lever 240 is formed at the top with a cam curve 240a engaged by a pin 242a secured to a setting plate 242 mounted at the outside of the right-hand side wall 27, said plate 242 being held in engagement with the lever 240 by means of a spring 243 extending between the pin 242a and a pin 240b on the lever 240. The setting plate 242 is formed with an open-ended slot 242b engaged by a shouldered pin 244a secured to a clearing (zeroizing) arm 244 linked to a lever 245 which is pivotally mounted at the inside of the right-hand side wall 27. The lever 245 engages at its bottom end a pin 246a projecting from a crank plate 246 to which the motion for clearing the calculating rotor is imparted. Normally, the rearmost clearing arm portion 244b lies underneath the lever 211 and is moved rearwards by the influence of the pin 246a through the lever 245, without the lever 211 being affected. The return movement is powered by a spring 247. When the sensing member 102 is moved into its lowermost position the lever 240 is tilted counterclockwise and causes by its cam curve 240a an upward motion of the setting plate 242. The clearing arm 244 is displaced thereby and strikes the lever 211 at its rearward motion, the lever 211 thus being returned to middle position.

#### SETTING THE SPECIES OF CALCULATION

For setting the kind of calculation a sensing member 108 is provided (FIG. 14) that does not set only calculation in its zero position, whereas it is adapted to set additional revolutions in its first active position. In the consecutive positions computing operations are selected in the order: division, addition, subtraction, positive multiplication and negative multiplication.

A lever 230 abuts the sensing member 108 and engages by a roller 231 a spring-loaded cam 232 mounted on a pivoted arm 233. A spring 234 urges by the intermediary of the cam 232 the lever 230 into engagement with the sensing member 108 which controls its motion. A further spring 235 urges the arm 233 into engagement with a pin 232a. The arm 233 is arrested in the zero position by a pin 236 secured to the base plate (not illustrated) of the machine. On the clockwise swinging of the sensing member 108 the cam 232 with the pin 232a is moved away from its engagement with the arm 233. The motion of the latter and of a selector bar 237 hingedly connected therewith will be limited in this manner which is necessary for lack of space. When the sensing member 108 is swung into a schedule bar the whole assembly will be carried along by the action of the spring 234. Thereby four teeth 237a provided at the selector bar 237 will be set in different positions relative to a number of engagement arms 238 in the calculating mechanism. When an arm 239 engaging a slot in the selector bar 237 is rocked at each cam

revolution the teeth 237a will actuate the arms 238, and the sensed kind of calculation will be set.

#### NON-COMPLIANCE

In the course of the addition of many numerals it may happen that the sum will exceed the capacity of the product register, whereas in multiplication the multiplier and the multiplicand may together comprise so many digits that the capacity of the product register will be exceeded. In order to prevent the machine from delivering an incorrect result in such instances a non-compliance action will intervene to the effect that further calculations will become blocked until the machine has been cleared by a special schedule bar denoted correction bar. Also for division non-compliance may ensue, to prevent the start of any division by zero, as this would lead to an infinite operational sequence.

On starting a multiplication the multiplier set up in the pin carriage will be transferred to the multiplying mechanism, and subsequently the multiplicand entered in the quotient register will be transferred to the calculating rotor. During these transfers of numerals to the respective calculating units the number of their digits are sensed by the calculating bars in the printing mechanism by the assistance of which these transfers of numerals will be carried out.

In FIG. 19 calculating bars 248 belonging to the printing mechanism are illustrated. These calculating bars are each provided at one end with a tooth 248a, and these teeth can engage corresponding teeth 249a provided at sensing levers 249. Said sensing levers are pulled by springs 251 towards the calculating bars 248 upon clockwise rotation of a check bar 250. Of the calculating bars those transferring the digits of a numeral have been moved rearwards, and consequently the teeth 249a of the corresponding sensing levers do not strike against the teeth 248a of those calculating bars, but are swung into a position wherein a projection 249b on each sensing lever will be arrested against a radially inner cylinder surface 252a on a stepped cylinder 252. When this cylinder is rotated counterblockwise, it will be held up by the leftmost sensing lever 249 which has been swung into engagement with the said inner cylinder surface 252a. This functioning results by virtue of the arresting shoulders 252b being step-wise arranged, the leftmost calculating bar therefore being sensed as the first one. The sensing lever 249 that arrests the stepped cylinder 252 prevents the latter from revolving through an angular portion of the whole possible rotation which corresponds to the number of digits of the set-up numeral.

The motion of the stepped cylinder 252 is derived from a control unit comprising two structural plates 253, 254 with a cam assembly, sensing members and a storing unit for set-up numerals disposed therebetween. Upon rotation of the cam assembly that receives its drive from a rotary shaft in the printing mechanism (not illustrated) a cam 255 actuates a bellcrank 256 which engages the cam by a roller 257. The bellcrank 256 is connected to a link 258 the opposite end of which is hingedly connected to a tooth segment 259 by means of a pin 259a. The bellcrank 256 is swung clockwise during part of the rotation of the cam 255, and the link 258 will receive a forward motion thereby which is transmitted to the tooth segment 259. The latter will turn counterclockwise and transmit rotary motion to a tooth wheel 260 secured to a shaft 261. A coupling disc 262 is rigidly secured to the shaft 261 and is provided with a lug 262a by which it will actuate the stepped cylinder 252. The tooth wheel 260 and the stepped cylinder 252 will be rotated clockwise thereby through one full revolution. When this revolution has been accomplished the tooth segment 259 begins to turn clockwise by the action of a spring 263 connected by one end to an axle 264 and by the other end to the bellcrank 256. By this arrangement, the roller 257 is compelled to follow the cam 255 during the return move-

ment, as well. The stepped cylinder 252 will then be rotated counterclockwise and is arrested against that sensing lever 249 representing the highest denomination in the numeral set up. The stepped cylinder 252 is held up for a short while in this position to allow a cipher wheel 265 to be moved into engagement with a tooth wheel 266 mounted rotatably on the shaft 261 and destined to be carried along by the tooth segment 259 through the intermediary of a drive segment 267. This drive segment is adapted to be carried along on the counterclockwise movement of the tooth segment 259 by a spring 268 connected to pins mounted at the tooth segment 259 and drive segment 267, respectively, the tooth wheel 266 being rotated thereby and being forced upon the clockwise rotary motion of the tooth segment 259 to participate in that motion by the engagement between a pin 259b and a pin 267a.

In this direction the motion is spring-actuated, however, and thus may be interrupted in any position.

The cipher wheel 265 is brought into engagement with the tooth wheel 266 by a sensing member 111 (FIG. 24) which actuates by means of a bellcrank 269, a resilient link 270, 271 and a setting lever 272, a rocker arm 273 (FIGS. 19, 20 and 24) to assume one of three active positions, in which a selecting lever 274 is moved with a tooth 274a underneath a corresponding one of three actuating levers 275, 276 and 288, to which a clockwise swinging movement is transmitted by levers 277 and 278 (and a third lever, not illustrated) from the corresponding cams 279, 280 (and a third cam, not illustrated) in the cam assembly. The selecting lever 274 which is slideably mounted on a lever 281, is depressed by the actuating lever 275 in question to rock the lever 281 about a pivot 282. A pin 283a engaging a cam slot 281a in the lever 281 is mounted on a coupling arm 283 which is on depression of the lever 281 swung counterclockwise about an axle 284 to swing the cipher wheel 265 mounted for rotation on an axle 283d at the coupling arm 283 into engagement with the tooth wheel 266.

In all of those three active positions referred to which may be taken up by the selecting lever 274 the cipher wheel 265 is brought into engagement with the tooth wheel 266, with the only difference that the cams 279, 280 (and the third one not illustrated) are staggered relative to each other, so that the engagement and disengagement will take place at different times and in such a way that the duration of the engagement will depend upon the cam configuration. Through variation of the moment for the engagement different data may be stored in the cipher wheel 265. The clearing of the latter is effected in similar manner.

In multiplication the sum of the multiplier and multiplicand digits must not exceed the digital capacity of the product register (in this instance 13 digits) and further the digit number of the multiplier must not exceed 7. In order to check that these conditions are fulfilled the cipher wheel 265 is moved, after a signal from the sensing member 111 in a manner already described, into engagement with the tooth wheel 266 when the stepped cylinder 252 has been arrested against the sensing levers 249. The angular position of the stepped cylinder 252 will then correspond to the digit number of the sensed numeral.

After the cipher wheel 265 has been engaged the sensing levers 249 are disengaged by the counterclockwise turning of the check bar 250. The stepped cylinder 252 will now complete the revolution earlier interrupted, driven by the spring 263 which imparts through the bellcrank 265, the link 258, the tooth segment 259 and the tooth wheel 260 a counterclockwise rotation to the stepped cylinder 252 until the tooth segment is checked by the axle 264, the revolution being then completed. During this motion the drive segments 267 moves in unison with the tooth segment 259, and the tooth wheel 266 actuated by the drive segment 267 will transfer the motion to the

cipher wheel 265 which is rotated clockwise thereby. The mechanism is such that a digit sensed by the stepped cylinder 252 corresponds to the tooth pitch. When the rotation has been accomplished the cipher wheel 265 is moved out of its engagement with the tooth wheel 266 by a spring 285 which returns the lever 281 to initial position when the actuating lever 286 moves back. The cipher wheel 265 will then be brought into engagement with a tooth wheel 287. This is done in such a manner that the setting of the cipher wheel is not affected, as the engagement with the tooth wheel takes place before the cipher wheel has ceased its engagement with the tooth wheel 266. In this position it is established by sensing, whether the digit number of the multiplier is seven, at most, or greater. This is done in the following way: A sensing member 113 (FIG. 2) acts through the lever 288 (FIG. 24) and a resilient link 289, 290 on a setting lever 291 which engages in its turn a setting bail 292 (FIGS. 19 and 24) comprising two side plates mounted on pivots in the structural plates 253, 254 of the control mechanism and supporting between them a circular segment 293 with slots 293a therein. For each revolution three sensing levers 314, 315, 316 are released by a stop member 294, as the latter is swung clockwise for each revolution by a cam 295 (FIG. 23) engaged by a cam follower 296 connected by an arm 297 to the stop member 294.

At this swinging movement the stop member 294 will cease engagement with the sensing levers 314, 315, 316 by being swung into a position directly opposite recesses 314a, 315a, 316a provided in the sensing levers 314, 315, 316, respectively (FIG. 22). The sensing levers now will be swung clockwise by springs 298, and teeth 314b, 315b, 316b, respectively (FIG. 22), formed at the sensing levers will be moved towards the circular segment 293. If any one of said teeth 314b, 315b, 316b penetrates into a slot 293a the corresponding sensing lever will move some further distance and is arrested by a hook portion 314c, 315c, 316c, respectively, formed at the sensing lever, abutting the cipher wheel 265.

If anyone of the sensing levers 314, 315, 316 strikes against a tooth of the cipher wheel 265, this level will be arrested at an earlier stage than if it strikes against the non-toothed cylindrical wheel surface the diameter of which is equal to that of the base circle of the teeth. The difference between those two alternative positions is sensed at the heel portion 314d, 315d, 316d, respectively, of the sensing levers thereby that a sensing axle 299 performs for each revolution a rotary motion twice, firstly clockwise and subsequently counterclockwise through the action of a cam 300 actuating a cam follower 301 from which a link 302 extends to an intermediate lever 303 pivotally connected to the sensing axle 299 and at which also a lever 304 is mounted.

When the sensing axle 299 does not engage, upon its rotary motion, any heel portion 314d, 315d, 316d of a corresponding sensing lever 314, 315, 316 the lever 303 is swung about the pivot 305 of the lever 304. When the sensing axle 299 strikes against a heel 314d, 315d, 316d the motion of the sensing axle 299 and consequently also that of the intermediate lever 303 is arrested and the motion imparted by the cam 300 will cause, instead, the rocking against spring bias of the lever 304 about its pivot 306 in the left-hand structural plate 253, a lever 307 being therethrough swung counterclockwise. Said swinging movement is transmitted by a lever 308 to a bellcrank 309. To this bellcrank a resilient link 310, 311 is hingedly connected which is linked to a setting lever 312 engaged by an intermediate lever 313 adapted to raise the sensing member 116 (FIG. 2) out of its engagement with the schedule bar, whereby non-compliance will result. The storing of the non-compliance signal and the setting of the schedule bar on non-compliance will be described later.

On setting the multiplier and after the number of digits has been set in the cipher wheel 265 the sensing

lever 314 is moved towards the cipher wheel for sensing the latter. On the portion of the cipher wheel 265 which may be sensed by the sensing lever 314 the wheel is provided merely with eight teeth one of which corresponds to zero position, whereas the other correspond to the permissible number of digits, i.e. seven. When the sensing lever strikes against a tooth nothing will occur, but when it strikes the non-toothed portion the sequence described above will follow, and non-compliance will result.

On starting the multiplication the digit number of the multiplicand is added to that of the multiplier by bringing the cipher wheel 265 which has already been moved into an angular position corresponding to the digit number of the multiplier, into fresh engagement with the tooth wheel 266, whereafter the digit number of the multiplicand is entered in a manner already described. Thereafter the sensing lever 315 is moved towards the cipher wheel 265 for sensing the latter. The wheel 265 comprises fourteen teeth at its portion facing the sensing lever, and thus sensing will be effected as to whether the number of digits is greater than thirteen, whereafter any of the sequences described above will follow. When the cipher wheel 265 has been sensed it is moved into engagement with the tooth wheel 266 when the stepped cylinder 252 is rotating clockwise, i.e. not in the sensing direction. Thereby the cipher wheel 265 is rotated counterclockwise and is arrested in the zero position as a stop member 265a (FIG. 21) provided as the arm 283 strikes against an abutment 283b on the coupling arm 283 whereafter the cipher wheel 265, which will now be in its zero position, is again brought into engagement with the tooth wheel 287.

For division, the dividend must, as a rule, to enable the quotient to comprise as many digits as possible, be shifted in such a manner that it has its highest decade at the extreme left of the product register. Furthermore, division must be prevented when the divisor is zero to avoid the starting of an infinite division.

On starting division the dividend is fed back from the product register to the calculating rotor, and the number of digits may be sensed from the calculating bars. The cipher wheel 265 is brought into engagement with the tooth wheel 266 before the stepped cylinder starts its counterclockwise rotation for sensing the number of digits, and is subsequently disengaged when the stepped cylinder 252 has stopped against the sensing levers 249. The cipher wheel 265 will be set for the maximum number of digits sensed by the stepped cylinder 252 (in this instance 13) minus the number of digits in the numeral concerned. The resulting number of digits indicates the number of steps the numeral is to be shifted in order to be positioned at the extreme left of the product register. To mark out this position to the calculating rotor a rotor abutment (not illustrated) is actuated, and this action is controlled by a sensing member 114 (FIG. 2) followed by a lever 317 (FIG. 24) from which a resilient link 318, 319 extends. This link is connected to a setting lever 320 by its end portion remote from the lever 317. A selecting member 321 abuts the setting lever 320. Into an aperture 321a (FIG. 21) in the selecting member 321 a projection 322a provided at an arm 322 extends, and thus is prevented by the selecting member 321 in the zero position of the sensing member 114 from being pulled upwards by a spring 323. After the sensing member 114 has been moved deeper into the schedule bar the selecting member 321 is swung to enable the projection 322a to move upwards in the upper narrow portion of the aperture 321a. As a consequence a tooth segment 324 will impart drive to a rotor stop wheel 329 connected to a rotor stop cylinder 325 (FIG. 19). The magnitude of this motion is limited by a tooth segment 326 (FIGS. 19 and 21) which is in permanent engagement with the tooth wheel 287 and influences through this wheel 287 the cipher wheel 265 which is rotated counterclockwise thereby and is arrested when the stop member 265a strikes against the abut-

ment 283*b*. Therethrough the maximum number of digits which the stepped cylinder 252 is able to sense minus the digit number of the numeral concerned has been entered into the rotor stop cylinder 325, whereafter the rotor abutment (not illustrated) may be set. The tooth segment 324 and the rotor stop wheel 329 is returned thereafter to initial position by a cam 327 engaging a roller 328 mounted for rotation on an axle 324*a* at the tooth segment 324 (FIG. 21). At the same time also the tooth segment 326, the tooth wheel 287 and the cipher wheel 265 are returned, and the arm 322 is hooked up on the selecting member 321. The connection between the rotor stop cylinder 325 and the rotor stop wheel 329 is such that the former may remain in its pulled-forward position when the rotor stop wheel 329 returns, by being retained by a pawl 330 actuated by a cam 331 and adapted to be moved on actuation into engagement with a tooth wheel 325*a* secured to the rotor stop cylinder 325. In this position the rotor stop cylinder 325 is retained until the calculating rotor has sensed the rotor abutment, and thereafter, on further rotation of the cam 331, the pawl 330 releases the tooth wheel 325*a*, a torsion spring 332 returning the rotor stop cylinder to initial position.

Since the calculating rotor affords a maximum displacement of seven steps relative to the product register, and the capacity of the latter is thirteen decades, the machine performs the operation described above twice, and thereafter the numeral is set up at the extreme left of the product register. During the time the dividend is set up in the manner described above, the divisor entered in the pin carriage is completed to six digits, if the numeral set-up comprises fewer digits than six, whereby it will be possible, after the numeral has been entered in the calculating rotor and the latter has been positioned, to shift the numeral into a position wherein its highest decade will assume the same stepwise position as the thirteenth decade of the product register.

The sensing of the numeral and setting of the rotor stop is carried out in the same manner as when entering a dividend, the cipher wheel 265 being pulled counterclockwise to move the stop 265*a* against the stop 283*b* for rotor stop setting during which the cipher wheel 265 is in its initial position. If the sensed number of digits is less than six which is the case if only zeros are set, or if a setting-up has not been effected the rotor stop will not pull the cipher wheel 265 to zero position, since the rotor stop is shaped for a maximum of seven digits. A sensing lever 316 is moved in this position into sensing the cipher wheel 265. If the latter is in zero position the sensing lever 316 strikes a tooth 265*b*, and non-compliance will not occur. If, on the contrary, the sensing lever does not strike the tooth 265*b*, there will occur non-compliance in a manner already described.

#### EXCEEDING THE CAPACITY

As already mentioned the sum of the addition of numerals may become so great that it passes beyond the capacity of the product register. In that instance the lever 211 (FIG. 17) is actuated to move into a rearward position which is sensed by a sensing lever 333 (FIG. 18) mounted on the bail 213 (FIG. 17) in the same manner as the sensing lever 212 which has been described already in conjunction with negative numerals in the product register.

When the sensing lever 333 strikes against the lever 211, i.e. when the capacity is exceeded, an arm 334 is moved forward by the action of the sensing lever. This arm 334 is shaped for this purpose with a guide slot in its end portion adjacent the sensing lever, and this guide slot receives a pin 335 mounted at the outside of the right hand side wall 27. At its other end the arm 334 is hingedly connected to a bell crank 336 to which is imparted a counterclockwise movement when it is actuated by the arm 334. This motion is transmitted by a link 337 to the intermediate lever 313 that actuates thereby the

sensing member 116. Since a schedule bar has been fed forwards and the spring tensioning plate 35 has been moved rearwards, the sensing member 116 drops towards the schedule bar and is urged against the latter by a spring 338. When the schedule bar is returned the sensing member will check its motion by means of abutment surfaces 339.

Upon non-compliance or exceeding the capacity thus the intermediate lever 313 is swung clockwise and the sensing member 116 swings out of engagement with the schedule bar. Upon the forward motion of the arm 334 a pin 334*a* will pass beyond a hook 347*a* at a lever 347 which is now swung counterclockwise by a spring 348. The hook 347*a* then will move in front of the pin 334*a* and prevents the arm 334 from being moved back by the action of a spring 349. During this same movement of the arm 334 a pin 334*b* compels a latch 350 to swing counterclockwise. An arm 351 being hooked up on a projection 351*a* at a tooth 350*a* on the latch 350 is released thereby, and is swung counterclockwise by a spring 352. The projection 351*a* will thereby be moved in above the lever 208 to prevent the latter from swinging counterclockwise. Since the lever 208 acts upon the lifting bar 34 (FIG. 3) which permits upon counterclockwise swinging of the lever 208 the sensing members to assume sensing engagement with the schedule bar, the sensing members will be prevented from swinging towards the schedule bar as long as the projection 351 is situated above the lever 208. The machine functions will remain obstructed as long as this condition prevails, i.e. the machine will be non-compliant. Only a special schedule bar denoted correction bar can move the arm 251 aside to enable the arm 208 to be swung counterclockwise, again.

Against the transmitting arm 33 for the correction bar a lever 341 (FIG. 18) abuts mounted on an axle 342 extending between the shanks of a bail 343 and permanently urged by a torsion spring 344 towards this position of abutment. When the correction bar has been fed forwards a projection 341*a* drops into a slot 33*a* in the transmitting arm 33, and upon the return movement of the correction bar thus the lever 341, the shaft 342 and the bail 343 are carried along. An end extension of the axle 342 will engage the arm 351 and swing the latter clockwise, the projection 351*a* being moved out of engagement with the lever 208. The lever 208 now may swing clockwise again, and the sensing members are released to engage the schedule bar at the same time as a stud 208*a* will swing the lever 347 clockwise, the latter releasing the pin 334*a* to permit the arm 334 to be returned.

During the continued return motion of the correction bar a lug 341*b* on the lever 341 is urged against a pin 345 mounted at the left-hand side wall 26. The lever 341 is swung clockwise and out of engagement with the slot 33*a*, and a spring 346 subsequently pulls the bail 343, the axle 342 and the lever 341 back to initial position. The arm 351 will be hooked up on the tooth 350*a* therethrough.

When the non-compliance signals is received from the checking mechanism and the intermediate lever 313 (FIG. 24) is engaged by the setting lever 312 the arm 334 will be hooked up via the link 337 and the bellcrank 336 in the manner described above, and the same sequence will be repeated thereafter.

In those positions wherein the sensing member 116 arrests the correction bar the latter lacks the corresponding tooth abutment 340 for the positioning bail 39. By that reason the sensing member 116 will be swung away from the schedule bar by the intermediate lever 313 on exceeding the capacity and non-compliance, whereby the schedule bar will not be arrested. Since the positioning bail 39 cannot arrest the schedule bar in this position, the correction bar will be moved a step forward by the spring 32 and is arrested in this new position by the positioning bail 39. Different positions of the correction bar will

then be attainable for non-compliance and correction (clearing).

What I claim is:

1. In a control mechanism for a power operated calculating machine of the kind comprising means for carrying out addition and subtraction, means for effecting automatic multiplication and division calculations and means for printing set-up numerals as well as computed results, in combination a plurality of schedule bars, operation key means operable to cause a selected schedule bar to be shifted from its initial, non-operative position to an operative position, abutment means for limiting the travel of any activated schedule bar, drive motor contact means, a drive mechanism, a plurality of sensing members, means operable by the said abutment means to close said contact means upon engagement of the said abutment means with a shifted schedule bar for starting said drive mechanism and for bringing said sensing members into engagement with said shifted schedule bar, the said schedule bars being shaped with such a configuration as to arrest sensing members in different sensing positions, means operable by the said sensing members which have moved to active sensing positions to effect the engagement between the said drive mechanism and calculating control mechanisms to thereby carry out calculating operations sensed off from said shifted schedule bar, means operable to feed the said schedule bar upon the accomplishment of the said operations back toward its initial position by at least one step, corresponding to the position of engagement of a particular sensing member against the schedule bar, means operable to move the said sensing members out of the way during said stepwise rearward motion of said schedule bar, means operable to move said sensing members into new engagement with the said schedule bar, to sense the configuration thereof in the fresh sensing position for releasing further machine operations, to be followed by a fresh stepwise return feed motion towards the initial position, and means operable to open the said contacts when the said schedule bar returns to initial position, thereby to cut out the drive, each schedule bar shifting means being operable by at least two different operation keys, a common abutment member for all schedule bars, means operable to set the said abutment member in an arresting position corresponding to the operation key actuated, to enable said sensing members to engage said shifted schedule bar in different positions thereof, thereby to bring different schedules into operation.

2. A control mechanism as claimed in claim 1 com-

prising means operable on shifting of a schedule bar to set said common abutment member in a first position of two predetermined positions in dependence of digits having been set in a digit setting pin carriage.

3. A control mechanism as claimed in claim 2 comprising means operable on activation of a schedule bar to set said common abutment in the second position of said two predetermined positions when no digits have been set in the pin carriage, wherein said schedule bar is positioned to cause calculating mechanisms to perform a different schedule of operations.

4. A control mechanism as claimed in claim 3, said common abutment member being shaped as a stop bail, means operable to move the said stop bail on depression of predetermined operation keys into an upper stop position, and on depression of other predetermined operation keys, to be moved into a lower stop position, four different stop positions thus being provided for each schedule bar, corresponding to four different schedules for each bar.

5. A control mechanism as claimed in claim 4, comprising means operable to cause the stop bail, upon arresting a shifted schedule bar, to be carried along by a short distance, and means for connecting the machine drive mechanism to the drive motor for operating the same.

6. A control mechanism as claimed in claim 5, comprising means operable by the said stop bail to close said contact means for starting up the drive motor.

7. A control mechanism as claimed in claim 1 wherein means are provided for operating a selected schedule bar to initial position to open said contact means when the machine capacity is exceeded and wherein a correction key and correction schedule bar are provided, said correction key being operable to initiate shifting of said correction schedule bar to be sensed by said sensing means to restore the calculation to the condition prior to calculations resulting in exceeding the machine capacity.

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