

Dec. 7, 1965

H. GELLING

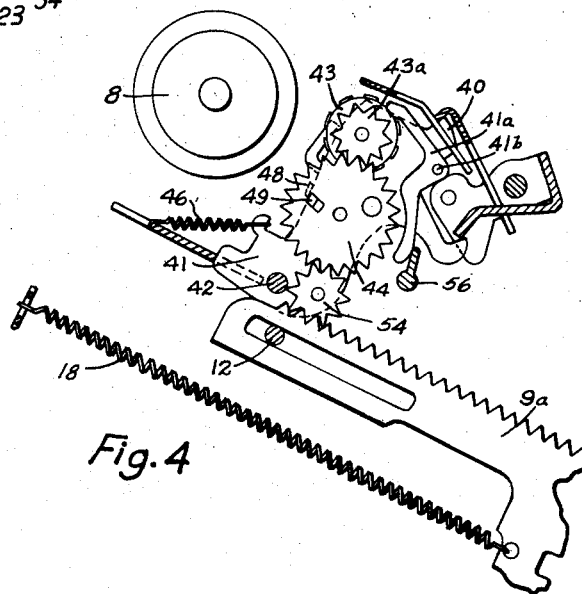
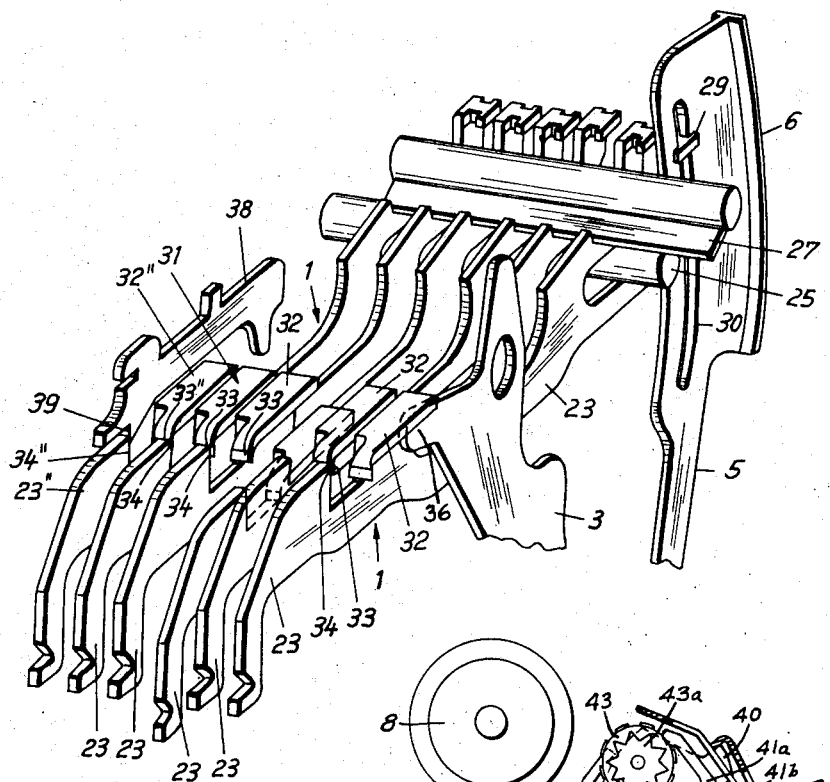
3,221,644

PRINTING DEVICE WITH ZERO SUPPRESSING MEANS

Filed March 28, 1963

3 Sheets-Sheet 1

Fig. 1



Dec. 7, 1965

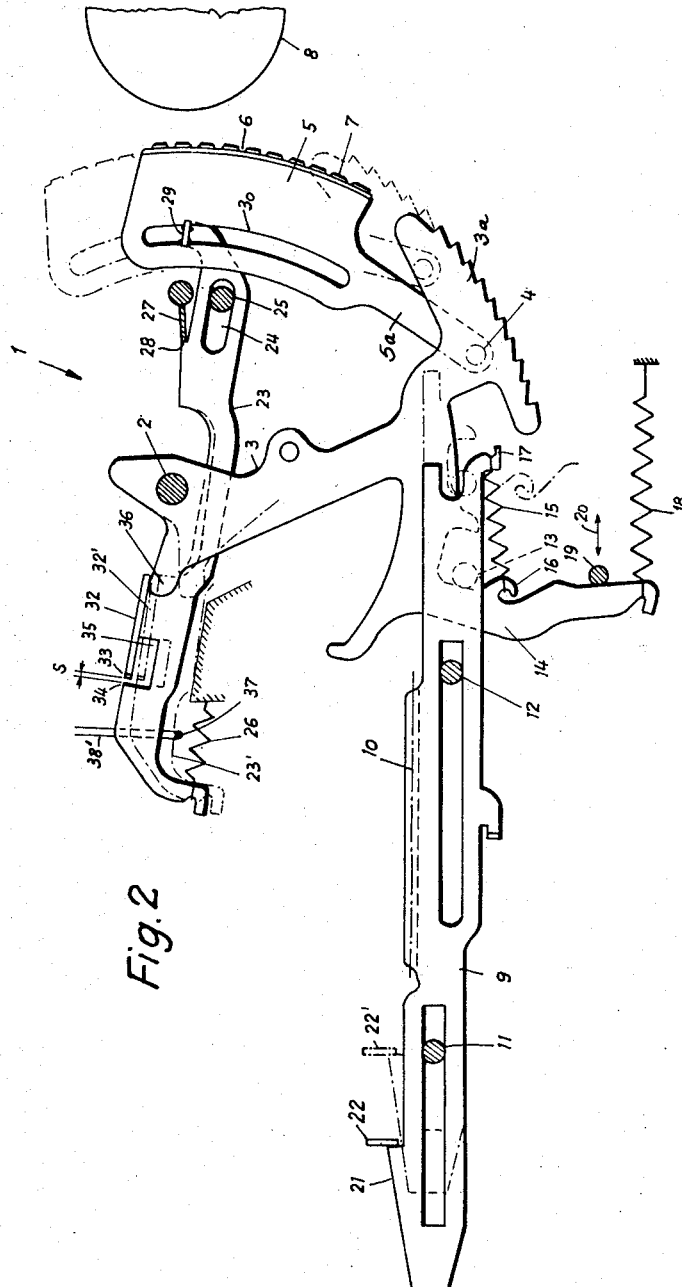
H. GELLING

3,221,644

PRINTING DEVICE WITH ZERO SUPPRESSING MEANS

Filed March 28, 1963

3 Sheets-Sheet 2



Dec. 7, 1965

H. GELLING

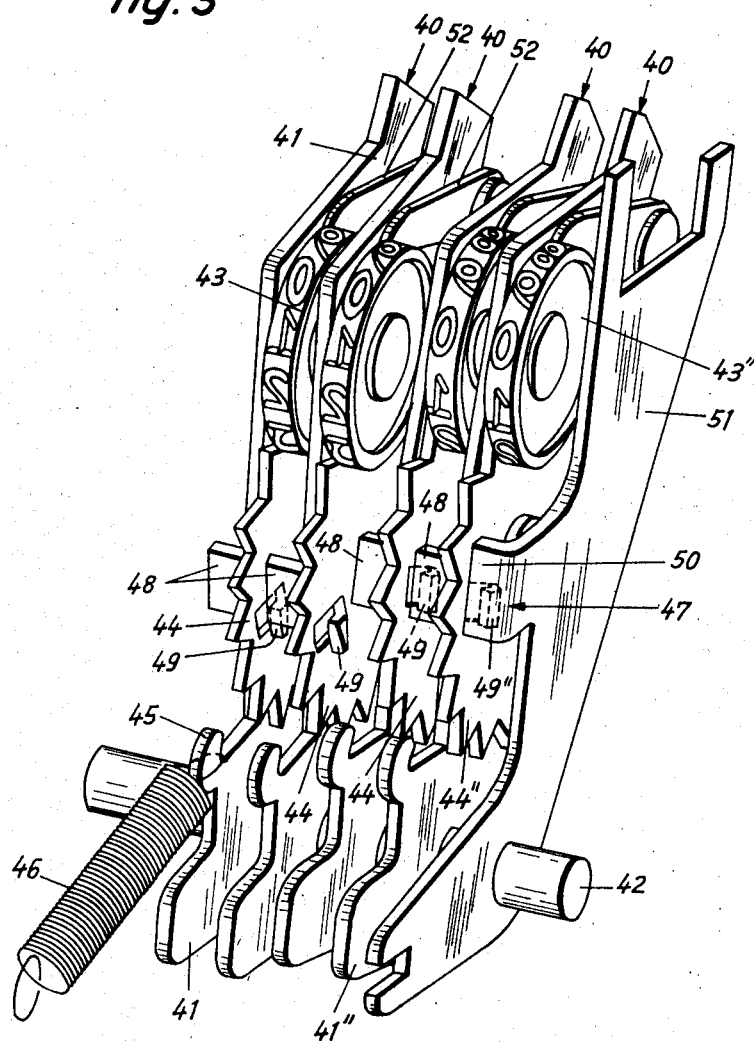
3,221,644

PRINTING DEVICE WITH ZERO SUPPRESSING MEANS

Filed March 28, 1963

3 Sheets-Sheet 3

Fig. 3



1

2

3,221,644

PRINTING DEVICE WITH ZERO SUPPRESSING MEANS

Helmut Gelling, Dietlikon, Zurich, Switzerland, assignor
to Precisa AG, Rechenmaschinenfabrik, Zurich, Switzerland

Filed Mar. 28, 1963, Ser. No. 268,646

Claims priority, application Switzerland, Apr. 5, 1962,

4,164/62

2 Claims. (Cl. 101—93)

The present invention relates to printing devices for calculating machines comprising so-called "live bridges" preventing the printing of zeros on all decade positions higher than a decade position adjusted to a non-zero figure, while the zeros at lower decade positions are printed.

The live bridges of known printing devices of the kind referred to are formed by abutments and counter-abutments provided on locking levers, which are provided for this special purpose and are arranged side by side, so as to be capable of locking the printing mechanisms associated with various decimal positions. The numerous components required for these known live bridges, such as locking levers, springs etc. are comparatively expensive and are moreover required to be produced in practice extremely accurately, namely with tolerances of only 0.01 to 0.02 millimetres.

The invention has the object of providing a printing device of the kind referred to which dispenses with additional components constituting the abutments and counter-abutments of said live bridges.

It is another object of the present invention to provide a printing device of the kind referred to which allows substantially wider tolerances than hitherto permissible.

With these and other objects in view which will become apparent later from this specification and the accompanying drawings, I provide a printing device, for calculating machines comprising in combination: a fixed frame, a plurality of printing mechanisms comprising type members having types to be printed, adjustment means adjusting said type members to a selected type, abutments and counter-abutments provided on said printing mechanism, said abutments and counter-abutments forming a live bridge preventing the printing of zeros for all decade positions higher than the first non-zero decade position, said abutments and counter-abutments being integral with components required for the functioning of said printing mechanisms anyway.

Said type members may be of circular arc shape, or type wheels, in any case carrying the type characters 0, 1, 2 . . . 9 to be printed.

These and other features of my said invention will be clearly understood from the following description of two embodiments thereof given by way of example with reference to the accompanying drawings, in which:

FIG. 1 is a perspective view of a printing device of a calculating machine only the printing mechanism of six decade positions being shown;

FIG. 2 is a side elevation of one of the printing mechanisms according to FIG. 1,

FIG. 3 is a perspective part view of another printing device, and

FIG. 4 is a longitudinal cross-sectional view of the printing mechanism shown in FIG. 3.

In the drawings, and more in detail, attention is first directed to FIGS. 1 and 2 wherein there is shown a printing mechanism for an addition and similar machines of a conventional type which, for example, is provided with twelve mechanisms 1 arranged in side by side relation each of which is intended to print a number of a predetermined decimal position. However, only the printing

mechanisms 1 associated with the six highest decimal positions are partially illustrated in FIG. 1. In the following the parts of a single printing mechanism 1 and its arrangement in the frame of the machine is described. An axle 2 (FIG. 2) affixed to the not shown frame of the machine has pivotally mounted thereon a rocking lever 3 which has its lower end portion shaped to provide an arcuate rack bar section 3a. A type lever 5 is pivotally connected with a downwardly extension 5a at 4 to the rocking lever 3. The type lever 5 is provided with an arc-shaped sector 6 on which is mounted ten printing characters or types 7 to print the numerals 0, 1, 2, 3 through 9 on a suitable sheet of paper (not shown) supported on the roller platen 8.

A control bar comprising a toothed rack bar 9 whose teeth 10 are indicated by the pitch line only, is in mesh with a gear wheel of the calculating mechanism (not shown). The rack bar 9 is slidably guided longitudinally in the conventional manner on a pair of bars 11 and 12 arranged in transverse fixed relation to the frame. The rack bar 9 is provided with an abutment formed by a pin 13 with which one arm 14 of the rocking lever 3 is maintained in contactual engagement by means of a tension spring 15, the ends of which are affixed to hook-shaped projections 16 and 17 on the arm 14 and on the toothed rack bar 9, respectively. Another spring 18 is attached to the lower end of the arm 14 of the rocking lever 3 to yieldingly urge the same in a counterclockwise direction about the axis of the axle 2 and thereby moves the rack bar 9 in a direction toward the right owing to the provision of the abutment 13. A rod 19 which is moved transversely to and fro in the usual manner in the direction of the double arrow 20 is adapted to tension the springs 15 and 18 when the rod 19 is moved toward the left. Formed on the left hand end of the rack bar 9 is a projection 21 forming a shoulder which upon movement of the rod 19 in a direction toward the right abuts the lower end of a pin 22 reciprocally mounted in a pin box of a conventional type and which corresponds in position to a number character introduced into the box by means of the usual keyboard (not shown). The pin box and keyboard of conventional calculating machines are well known in the art and by way of example attention is called to the United States Patents Nos. 2,346,265 and 2,975,971.

The rack bar 9 is illustrated in FIGURE 2 in full line, and in that position, the pin 22 corresponding to the "0" character which has been entered, while the dash-dotted line position of the mechanism corresponds for example to the adjustment or setting of the pin 22' to the "5" position.

A series of hammers 23, one for each printing mechanism 1, is supported in the mechanism for reciprocation to and fro in a longitudinal direction. Each of the hammers is provided with a slot 24 adjacent one end which receives a rod 25 suitably affixed to the frame. A tension spring 26 is connected to the other end of each hammer 23 to yieldingly urge the same in a direction toward the right and to resist movement of the hammer 23 when the same is moved in a direction toward the left by the rod 25 when the same is moved transversely by suitable setting mechanism on the frame (not shown). A trigger bar 27 comprising a circular rod with a radial vane thereon is pivotally mounted in the frame about a fixed axis, and in the position illustrated in FIG. 2 engages with the outer edge of its vane a shoulder 28 provided on the right hand end of each hammer 23 so that the hammers will remain in their tensioned positions when the rod 25 is transversely moved in a direction toward the right.

Formed on the right hand end of each hammer 23 (FIG. 2) is a projection 29 which protrudes at right angles thereto and projects into an arcuate slot 30 of the type

lever 5. It will be seen, that depending upon the position into which the rack bar 9 is shifted which in turn depends upon the number character adjusted or set into the mechanism by means of the adjustment pin 22 the rocking lever 3 will assume a predetermined position and consequently the type lever 5 will be rocked since it is pivotally attached to the rocking lever at 4 and guided on the hammer 23 at its end 29, thus, the printing type corresponding to the number character entered in the machine is pre-set and moved into the starting position for printing. When the trigger bar 27 is rocked about its fixed axis in a clockwise direction, the hammer 23 will follow the pull force exerted by the spring 26 and the corresponding type lever 5 will be rocked about its pivot pin 4 in a clockwise direction and forcibly projected in the direction toward the platen 8 and will print the pre-set number character on the paper thereon.

Each of the twelve printing mechanisms would thus print a number when the trigger bar 27 is rotatably moved out of engagement with the shoulder 28, so that for example the following number would be printed: 000002389024. The printing of the five zeros ahead of the number to be printed, i.e. ahead of the highest decade position not occupied by a zero, however, is undesirable, and in order to prevent this printing a so-called "live bridge" 31 (FIG. 1) is provided. This live bridge 31 consists mainly of bridge elements 32 constituting abutments which are provided on one end of the hammers 23. The abutment point of each bridge element 32 is designated with 33 and lies in the plane of movement of a counter-abutment stop edge 34 provided on an adjacent hammer 23 of a lower decade position. In the present embodiment the bridge element consists of a lug 32 turned at an angle of 90° from the upper edge of a piece of sheet metal forming the body of the hammer 23, while the counter-abutment edge 34 is formed by the left-hand upper portion of the edge of a recess 35 (FIG. 2) provided in the hammer 23 of the sheet metal-piece. Obviously the terms "abutment" and "counter-abutment" could be interchanged.

When the printing mechanism 1 is set and adjusted to the printing of an "0" i.e. when the same is in the position shown in FIG. 2 in full lines, the bridge element 32 on one of the hammers 23 rests on a projection 36 of the rocking lever 3, when the rocking lever 3 has been turned into a position corresponding to any other figure than "0," the lug 32 cannot follow up the projection 36, but reaches the position 32', which is determined by the hammer falling by gravity or dropping on the yoke 37 of a loop 38'. This position of the hammer is indicated in chain-dotted lines in FIGURE 2 and is denoted 23'. Above the hammer of the highest decade position, which in FIG. 1 is designated with 23'', there is arranged an element 38 attached to the machine frame, of which in the present context a downwardly projecting projection 39 is of interest. This projection 39 lies immediately in front of the counter-abutment edge 34'' of the hammer 23'', when the latter is adjusted to "0."

In FIG. 1 the hammer 23'' and the next two hammers 23' and 23 are adjusted to "0" while the fourth hammer is adjusted to another figure and the fifth and sixth again to "0." When the trigger bar 27 is now rotated and its vane releases the shoulders 28, on the hammers the hammer 23'' cannot yield to the pull of the associated spring 26 (see FIG. 2), because it is arrested by the projection 39 fixed to the frame and disposed opposite the counter-abutment edge 34''. Since the first hammer 23'' does not move, its bridge element 32'' holds the second hammer back at the point 33'' by its counter-abutment edge 34; likewise, the bridge element 32 of the second hammer 23 detains the third hammer 23. The fourth hammer 23, which is not adjusted to "0," and accordingly is in the lowered position 23' (see FIG. 2), is not however detained by the bridge element 32 of the third hammer 23, since this bridge element 32 is positioned above the coun-

ter-abutment edge of the fourth hammer. The fourth hammer is accordingly pulled to the right by its spring 26, whereby one of the printing types 7 adjusted to its desired position by type lever 5 is forcibly projected against the paper sheet on the platen 8 by the spring 26 and prints e.g. a number "3." The bridge elements 32 of the fourth and fifth hammers are in contact with the fifth and sixth hammers, respectively, which are both in the "0" position. Nevertheless the fifth and sixth hammers are not detained, since the fourth hammer being projected for producing an impact; the two zeros following the number "3" on the right hand side are accordingly printed. Likewise all other figures farther to the right are printed by the further six printing mechanisms (not shown).

The spacing between the type 7 which is in a position ready for printing and the surface of the platen 8 amounts, as usual, to about 6 millimeters or more. When the design dimension of the play *s* between the bridge element 32 at the point 33 and the counter-abutment edge 34 amounts e.g. to 0.2 millimeter and a tolerance of 0.1 millimeter is allowed for this play in the worst case, namely when the play *s* for all twelve bridge elements 32 has the highest permissible magnitude of 0.3 millimeter, and when all digits are adjusted to zeros, the hammer 23 of the unit decade position may move towards the platen 8 a distance of $11 \times 0.3 = 3.3$ millimeters when released by the trigger bar 27, so that it is still arrested at a distance of 2.7 millimeters away from the platen. The magnitude of 3.3 millimeters, which denotes the limit distance of the live bridge 31 is considerably larger than that of the live bridges of conventional mechanisms, the components of which have to be produced in practice with tolerances of only 0.0–0.02 millimeter. The advantage of a larger tolerance is of the greatest importance for the production, quite apart from the very great advantage, that the bridge elements 32 are each integral with one of the hammers 23, while the elements of the live bridges hitherto—as mentioned hereinabove—are provided on separate levers, which block the movement of the type levers and are pivotally mounted on an axle fixed to the frame, and loaded individually by springs. It is clear that in principle even a limit distance exceeding 3.3 millimeters, say of 5 millimeters, would be permissible.

In the FIGS. 3 and 4 a printing mechanism is illustrated which is provided type wheels instead of arc-shaped type carrying sectors, whereby only parts of the printing mechanisms 40 of the four highest decade positions are illustrated. Each printing mechanism 40 has a substantially vertically disposed type lever 41 which is pivotally mounted with its lower portion on an axle 42 fixed to the frame. On the upper portion of the type lever 41 a type wheel 43 is rotatably mounted, which has a spur gear 43a (FIG. 4) in mesh with a gear wheel 44, which is likewise rotatably mounted on the type lever 41. On the type lever 41 a further gear wheel 54 (FIG. 4) is rotatably mounted, which meshes on the one hand with the gear wheel 44 and on the other hand with a toothed rack 9a corresponding to the toothed rack 9 of FIG. 1. On a hook 45 of the type lever 41 a tension spring 46 is attached, which when tensioned tends to turn the type lever 41 about the axle 42, so that a type adjusted on the type wheel 43 hits the platen 8 or the paper arranged thereon. The members serving for tensioning the springs 46 of the printing mechanisms are well known and accordingly have not been illustrated. Likewise a trigger bar 56 corresponding to the trigger bar 27 of the form of the invention shown in FIGS. 1 and 2 and cooperating with the lower ends of angle levers 41a pivoted at 41b to the upper ends of the type levers 41 is employed as shown in FIG. 4. In FIG. 3 it is assumed that the trigger bar 56 has released the type levers 41, but only the two type levers illustrated on the left hand side of FIG. 3 are turned towards the platen 8 under the bias of their springs 46 and thereby each print a

5

numeral "1," while the two type levers illustrated on the right hand side, i.e. of the highest and next highest decade positions, whose type wheels 43 are adjusted to "0," have not or nearly not at all moved owing to the live bridge 47 to be explained hereinafter.

This bridge is composed of abutments 48 provided on the type levers 41 and of counter-abutments 49 provided on the gear wheels 44. The abutment is formed by a lug 48 extending laterally towards the left from the margin of the type lever 41, while the counter-abutment consists in a tongue 49 cut or punched out of the body of the gear wheel 44 and turned up towards the right. The tongue 49 of the gear wheel 44 of the type lever 41 of the highest decade position cooperates with an abutment 50, which is provided on a frame element 51.

The tongues 49 are arranged on the gear wheels 44 in such a position that upon adjustment of the associated type wheel 44 to its "0" position they are disposed in rear of the lug 48 of the adjacent type lever 41 of the next highest decimal position while the tongue 49 of the highest decade position is disposed in rear of the abutment 50 fixed to the frame. It is clear that the type lever 41 of the highest decade position cannot be turned by its spring even after being released by the trigger bar 56, since the abutment 50 detains the counter-abutment 49. For any other adjustment of the type wheel 43 the counter-abutment 49 would clear the abutment 50 freely. Likewise the tongue 48 of the second gear wheel, whose type wheel is adjusted to "0," is detained by the lug 49 of the first type lever 41. The tongue 49 of the third gear wheel, whose type wheel is not adjusted to "0" but e.g. to "1" does not hit the adjacent lug 48 of the next higher decimal position, so that the type lever concerned, after being released by the trigger bar 56, is turned forcibly and suddenly by its spring towards the platen, and the numeral "1" is printed. Consequently none of the type levers 41 of lower decimal positions can be detained by the live bridge 47.

On top of each type lever 41 a pawl 52 is pivotally mounted in any approved conventional manner, which resiliently engages the teeth of the aforesaid spur gear of the type wheel 43 and at any time accurately retains the same in its adjusted position, in order to prevent small rotational movements of the type wheel, which could be caused upon rocking the type lever about its lowermost gear wheel 54 which would slightly move away from the associated toothed rack 9, whereby a larger play in the teeth is created or generated.

In the embodiment according to FIGS. 3 and 4 there is a large limit path available for the live bridge, so that wide tolerances are permissible for the parts 48 and 49. The maximum permissible limit path is shorter than in the first embodiment, since the arc described by the parts 48 and 49 when the type levers 41 are rocked is only about half of that of the types. In both cases the limit path is almost parallel to the path covered by the types during the printing operation, and almost of the same order of magnitude with the latter.

It will thus be seen that the present invention provides a so-called live bridge or interlock between adjacent movable type carrying members ranging from the highest order or digital position to the lowest order with the projections or lugs on each movable printing member support engageable with an adjacent printing member mechanism to prevent the printing of zeros in all digital positions higher than that typed or printed by the selection of a printing numeral character above zero, thus preventing zeros from being printed to the left of a printed numeral character.

The calculating machine of which the present invention forms a part is illustrated as being of the ten key

6

type having rack bars controlled by the pins in a pin box, but obviously the printing mechanism can be associated with other types of machines and calculators of a similar nature.

It is to be understood that the forms of the invention herewith shown and described are to be taken as preferred embodiments thereof, and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

What I claim as my invention and desire to secure by Letters Patent, is:

1. A printing device for a calculating machine comprising:

- (a) a rotary platen,
- (b) a plurality of printing mechanisms arranged in side by side relation and each adapted to print selectively any one of the numbers "0" to "9" on a sheet placed on said platen,
- (c) each one of said printing mechanisms including a rocking lever 3 pivotally mounted about a fixed axle, a type carrying member 5 carrying a number of types from "0" to "9," means operatively connecting said type carrying member with said rocking lever, a control bar movable lengthwise of its length engageable with said rocking lever for rocking said rocking lever to move said type carrying member and thereby a selected type on said member 5 into a position ready for printing,
- (d) each printing mechanism also including a longitudinal hammer means 23, rod means 25 for slidably supporting said hammer means for lengthwise movement, means 29 for operatively connecting one end of said hammer means with said type carrying member 5 carrying said number of types, a projection 36 on said rocking lever for supporting the other end of said hammer means, spring means 26 for urging said hammer means in a direction in which the selected type on said member is caused to perform its printing movement, and means 27 operatively engaging said hammer means for preventing said printing movement until released from engagement with said hammer means,
- (e) and abutment means 32 formed integrally with each one of said hammer means for engagement with a counter-abutment means 34 formed integrally with the next adjacent hammer means to prevent a lengthwise movement of those hammer means in a printing direction whose associated type carrying members for all digital positions higher than the first non-zero digital position are adjusted to zero.

2. A printing device as claimed in claim 1, wherein said abutments are formed by struck-up lugs extending laterally from the upper marginal edges of said hammer means, said abutments being adapted to engage said counter-abutments formed by recesses 35 cut in one edge 34 of adjacent hammer means to provide a stop shoulder for said lugs.

References Cited by the Examiner

UNITED STATES PATENTS

1,812,161	6/1931	Mapel	101—93
1,951,592	3/1934	Barret	101—93
1,954,618	4/1934	Coxhead et al.	101—93
2,100,213	11/1937	Garbell	101—93
2,109,309	2/1938	Breitling	101—93
2,346,265	4/1944	Mehan	101—96
2,506,337	5/1950	Boyden	101—94

WILLIAM B. PENN, *Primary Examiner.*