July 7, 1964 F. HILPERT 3,139,819

PRINTING UNIT

Filed March 16, 1961 3 Sheets-Sheet 1

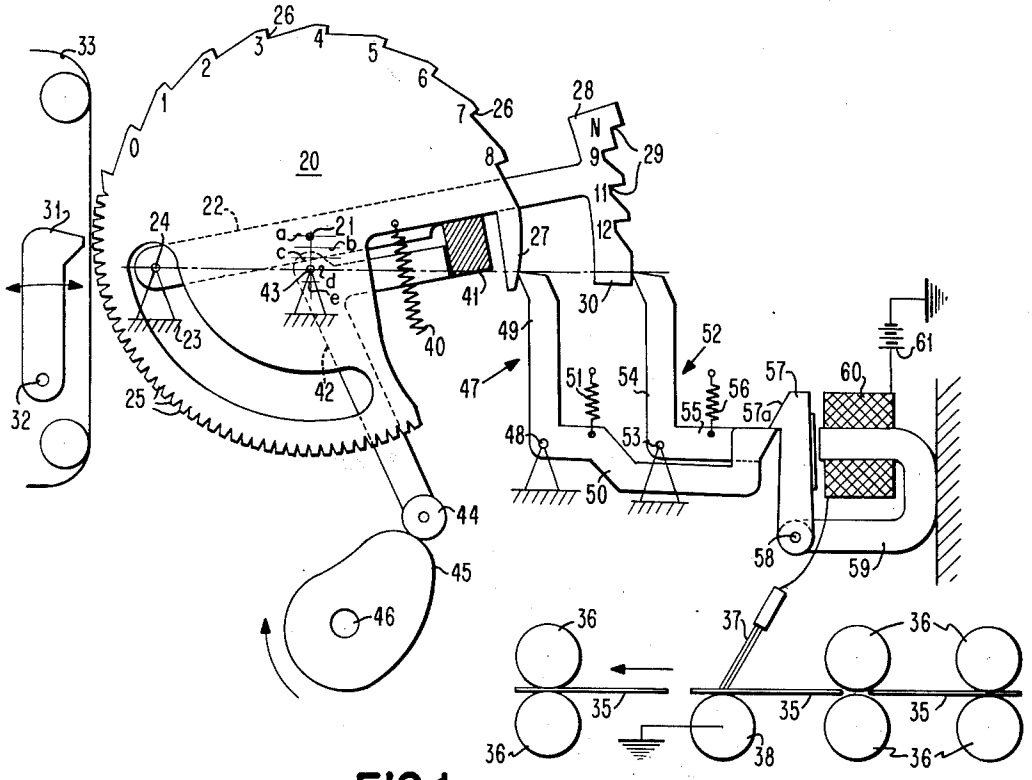


FIG. 1

1	HOLE ROW	12	ZONE
2	" "	11	"
3	" "	9	"
4	" "	8	NUMERIC
5	" "	7	"
6	" "	6	"
7	" "	5	"
8	" "	4	"
9	" "	3	"
10	" "	2	"
11	" "	1	"
12	" "	0	"

FIG. 6

ZONE → / NUM. ↓	CODING			
	12	11	9	N
8	A	J	•	8
7	B	K	S	7
6	C	L	T	6
5	D	M	U	5
4	E	N	V	4
3	F	O	W	3
2	G	P	X	2
1	H	Q	Y	1
0	I	R	Z	0
ZONE WITHOUT NUM. DESIGNATION	*	–	9	EMPTY

FIG. 7

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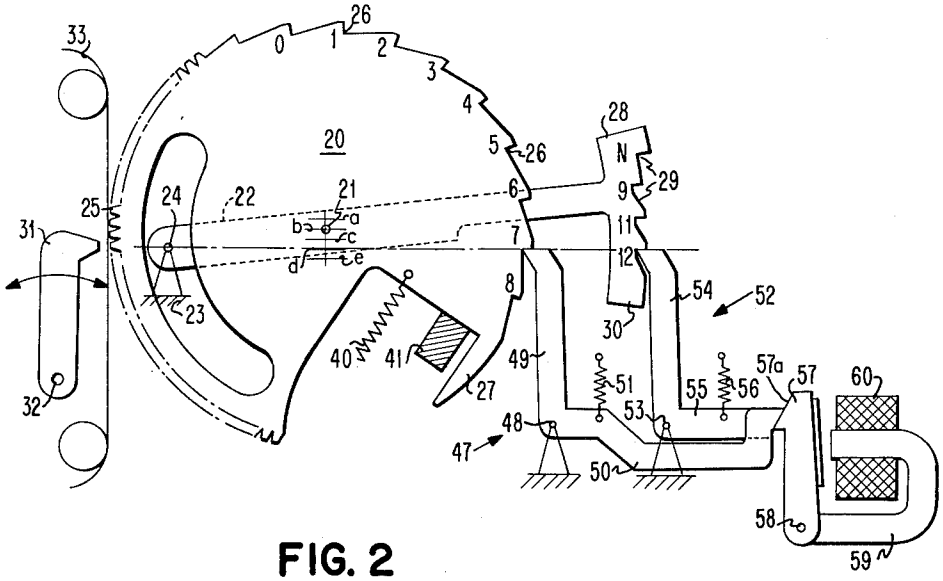


FIG. 2

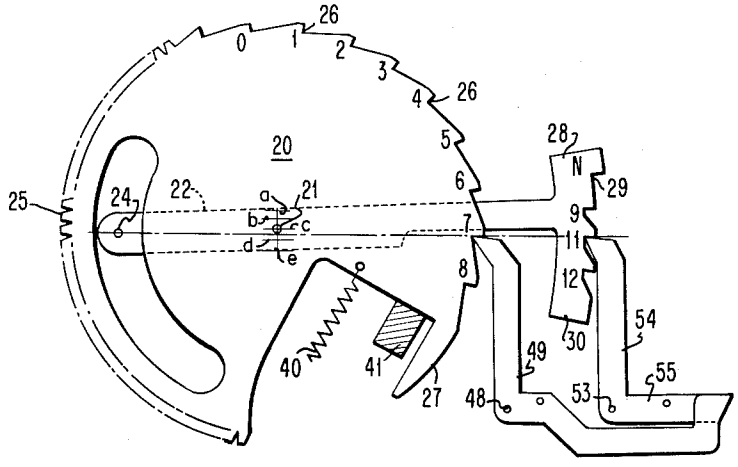


FIG. 3

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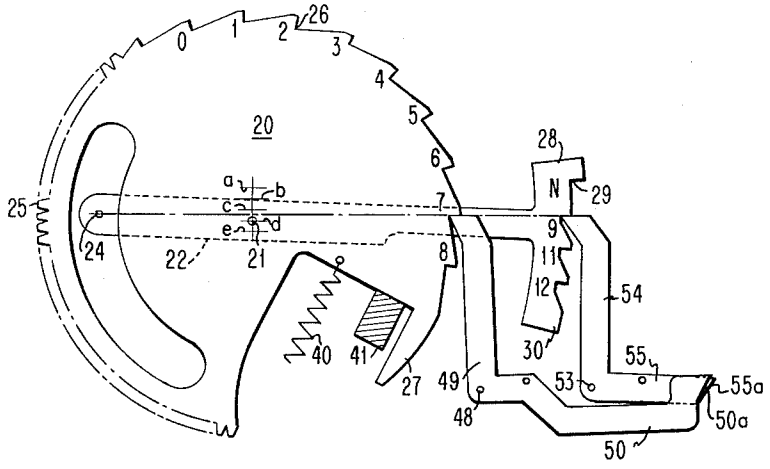


FIG. 4

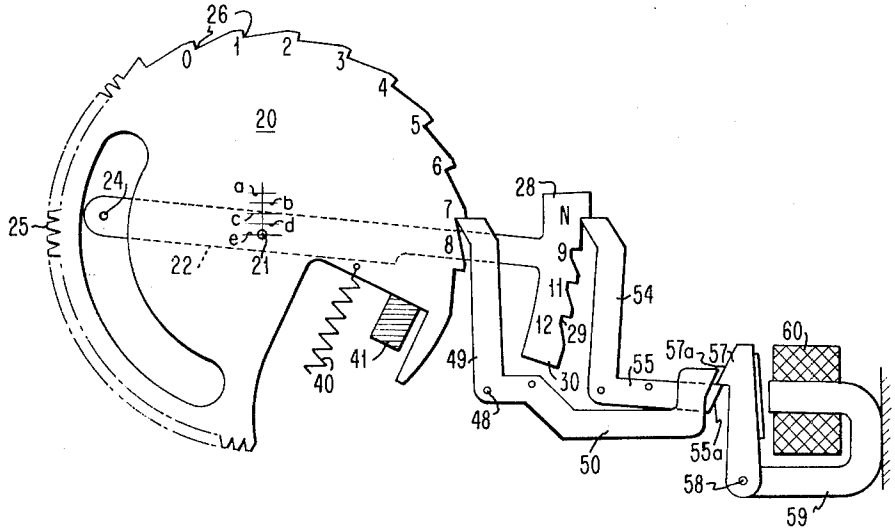


FIG. 5

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PRINTING UNIT

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2 Claims. (Cl. 101—93)

This invention relates to printing apparatus and more particularly to a print mechanism of the type having particular utility in business machines such as an accounting machine where printing is effected in connection with the analyzing of an indicia-bearing member such as a punched card or the like.

In punched card machines, electric pulses generated when the punched cards are sensed may be used to set up one or more printing units. It is common practice to have numeric data represented on a card by a single perforation whereas alphabetic data or special characters are designated by two perforations. In connection with the present invention, this convention is followed by providing that the setup of a numeric digit is effected by a single electric pulse while a letter or a special character is set up by two pulses.

It is general usage in such printing units to synchronously move a type carrier or a setup element for a type carrier with the indicia-bearing record as it passes through a sensing station. If an indicia is detected, the type carrier or the setup element thereof is stopped by some means controlled by an electric pulse. The type elements on the type carrier are so arranged that the digit corresponding to the indicia being sensed is in printing position at that time. In alphabetic printing, the situation is somewhat more complex inasmuch as in setting up the type carrier, two pulses must be considered which may occur within a plurality of intervals of time different from the number of characters being selected. Previously, the type carriers for alphabetic and numerical printers have been bar shaped which in general were set up through the operation of differential drives operable to arrest the carriers in one of a number possible positions. Where the number of characters to be printed is large, e.g. 38–48, the distance of displacement was extensive, high setup speeds were required, and very high forces were produced requiring complex mechanism and controls in the setup drive units. In order to avoid the disadvantages occurring in the printing units for bar shaped type carriers as mentioned above, printing units were provided which were arcuate type carriers, frequently referred to as type sectors. Such type carriers, while providing some simplification, still involve substantial complexities.

Other printing mechanisms, for example those which utilize type wheels, have been setup through a mechanism requiring linearly displaceable racks and rotatably mounted gear segments. A measure of simplification was possible in such devices; however, because of the very narrow tolerances and the high susceptibility to disturbances, such designs have not been fully satisfactory.

It is therefore an object of the present invention to provide an improved printing unit which substantially avoids the above mentioned disadvantages.

It is a particular object of the present invention to provide a printing unit having a particularly simple structure.

It is a further object of the present invention to provide a printing unit which is suitable for printing both numeric and alphabetic information particularly for use in connection with indicia-bearing records such as cards or the like.

In general the above objects and others may be attained in accordance with the practice of the present invention by providing a type carrier which has a center of rotation which is shiftable angularly relative to a print location to effect the selection of certain individual type elements carried by the type carrier. More specifically, the present invention relates to a print mechanism including a type carrier such as a type sector or the like having a plurality of type elements thereon arranged in groups which is rotatable on its axis to make a group or "field" selection. The selection of an individual type element in a group otherwise referred to as a "zone" selection is obtained when the axis of rotation of the type carrier is angularly shifted relative to a print location. For making the group selection the type carrier is provided with a number of stops corresponding in number to the number of groups of type elements carried thereby. A field selection pawl operably coacts with the stops to arrest the rotation of the type carrier in different print positions corresponding to a group or field selection. In other words, each angular position of the type carrier which is defined by a stop on the type sector corresponds to a group of characters. Considerable simplification is realized by rotatably mounting the type carrier on a pivotable lever or the like. The rocking of the lever results in the displacement of the axis of the type carrier to effect zone selection. The lever is provided with zone selection stops corresponding to the number of type elements in each of the type element groups on the type carrier. A second selectively controllable pawl operably coacts with the zone stops to arrest the lever in different "zone" positions. Further simplification is realizable by moving the type carrier and the lever with a single cam-operated bail operable in synchronism with the indicia-bearing record being sensed. The arrangement and operation of the control pawls, type carrier and lever is such as to realize "zone" and "field" selection with a single electromagnet.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a schematic portion of a side elevation of a printing unit showing it in the initial position from which type element selection begins.

FIGS. 2–5 are schematic elevation views showing various positions of a type sector and lever for the selection of various type.

FIG. 6 shows the arrangement of perforations on a punched card usable in connection with the print mechanism of FIGS. 1–5.

FIG. 7 illustrates the arrangement of type elements on the type sector of the printing unit of FIGS. 1–5.

Referring to the drawings, FIG. 1 shows a print mechanism comprising a type sector **20** rotatably mounted in any well-known manner at point **21** on a lever **22** which is pivotally mounted to a stationary member **23** such as a frame at point **24**. Type sector **20** may take various forms but is preferably a single piece having a first portion of its peripheral edge formed with a plurality of integral type elements **25** such as embossed characters. A second or control portion of the peripheral edge of type sector **20** immediately adjacent the type element portion is provided with a plurality of integral control stops such as teeth **26**. The control portion of type sector **20** terminates in an integral tail piece **27**, the purpose of which will be more fully explained hereinafter. The type elements **25** on type sector **20** are arranged in groups or fields. A tooth **26** is provided for each group. The angular separation of teeth **26** is proportionate to the

angular separation of the type groups to which they correspond.

At the end remote from its pivot point, lever **22** has an integral zone control crossbar **28**. The peripheral edge of crossbar **28** is provided with a plurality of integral control stops such as teeth **29**. The crossbar **28** terminates in a tail piece **30** which extends beyond the stop portion, for a purpose to be more fully explained hereinafter. The number of teeth **29** is equal to the number of type elements **25** in a group on type sector **20** and the spacing of teeth **29** on a crossbar **28** is proportionate to the angular spacing between individual type elements **25** at the print location.

A print hammer **31** pivotally mounted at point **32** is controllably operated by means such as an electromagnet (not shown) in any well-known manner to cause a print medium such as paper **33** to be impacted against the type elements **25** which have been set up at the print location.

In the preferred embodiment of the present invention, the print mechanism of FIG. 1 operates under the control of an indicia-bearing member such as punched cards. As is well known in such apparatus, punched cards **35** are fed seriatim to and from a read station by means such as feed rollers **36**. In accordance with the present invention, a single reading brush **37** is provided at the read station which is electrically connected with a coil **60** of a control electromagnet and a power source such as a battery **61** which may have one end grounded. A grounded roller **38** coacts with brush **37** when a perforation is read to close the control circuit energizing coil **60**.

Spring **40** connected at one end to type sector **20** and anchored at the other end applies a clockwise rotational bias to both type sector **20** and lever **22** for rotation about their respective points **21** and **24**, urging them into contact with a cyclically operable selection control and restore bail **41**. A crank **42** pivoted at fixed point **43** and supporting bail **41** on one arm, carries a follower roller **44** or the like, on a second arm which is biased through the action of spring **40** into contact with a cyclically operable synchronizing and selection control cam **45** rotatably mounted on shaft **46**.

A group or field selection pawl **47** pivotally mounted at fixed point **48** has a vertical arm **49** for engaging the type sector **20** along its peripheral edge and a horizontal arm **50** for engagement with armature **57** of the control electromagnet. Spring **51** connected to horizontal arm **50** biases field control pawl **47** counterclockwise about point **48** for contact with the control portion and tail piece **27** of type sector **20**.

A zone selection pawl **52** pivotally mounted at point **53** has a vertical arm **54** for engaging the zone control crossbar **28** of lever **22** and a horizontal arm **55** for contacting electromagnet armature **57**. A spring **56** connected to the horizontal arm **55** of zone pawl **52** biases it counterclockwise around point **53** toward engagement with the tail piece **30** and the stop portions of crossbar **28** of lever **22**. Armature **57** which is pivotally mounted at point **58** on core **59** of the control electromagnet is provided with a catch or the like to engage the upper portions of the horizontal arms **49** and **55** of the selection pawls **47** and **52** and when so engaged opposes the bias of springs **51** and **56**.

It will be understood that the printing mechanism just described may be used at plural locations along a print line and plural hammer mechanisms **31** may be provided so that line printing on paper **33** may be obtained. It can further be understood that the operational description which follows, while applying to single print mechanisms will apply to a print apparatus where plural mechanisms are used as will be understood by persons skilled in the art.

By way of illustrating the principles of the present invention an alphanumeric code system accommodating thirty-nine characters will be described. For that purpose, twelve index points, **0–8**, **9**, **11**, and **12** are provided on cards **35** as set forth in FIG. 6. In accordance with the practice of the present invention, the code indicia are arranged in a single row so that a single leaf brush **37** is used for reading both numeric and alphabetic information. The specific character selected by the combination of "zone" and "field" pulses derived from cards **35** may be seen by reference to FIG. 7. By way of example, the perforation on a card **35** at index point **12** followed by a perforation at index point **5** will operate to select a letter D while a single perforation at index point **5** will select a digit 5. Since the particular code selected produces a total of 40 possible characters and the illustrative example is to pertain to 39 characters, one code table position remains empty as indicated in FIG. 7. A third special character could, of course, be provided in that space.

As shown in FIG. 7, there are nine groups of characters, consequently, there will be nine groups of type elements **25** on type sector **20**, the teeth **26**, one for each group, are identified by the number designation **0–8** to correspond with the numeric designation established in FIG. 6. Further, as shown in FIG. 7, there are four characters in each type group, consequently, zone control crossbar **28** of lever **22** is provided with four teeth **29** identified respectively as **12**, **11**, **9** and N where N indicates the stop position for selecting certain numeric characters in various groups.

As a card **35** moving **12** index forward arrives at the read station, and the reading process begins, cam **45** which is synchronized to rotate with the advancement of card **35** past brush **37**, as is well known in the art, crank **42** rotating clockwise causes bail **41** to move clockwise thereby allowing lever **22** and type sector **20** to advance similarly in a clockwise direction under the bias force provided by spring **40**. At the time sector **20** and lever **22** advancement is initiated, field selection pawl **47** and zone selection pawl **52** have their vertical arms **49** and **54** in contact with tail portions **27** and **30** respectively. Both pawls **47** and **42** in that position are latched by armature **57** of the selection control magnet. As index point **12** of card **35** arrives at brush **37** to be read, notch **12** of crossbar **28** has been advanced into position to be engaged by zone control pawl **52** and center of rotation **21** of type sector **20** has been shifted from line position *a* to *b*. At this point in the operation cycle, the first type character **25** of a group has been positioned at the print location. In the event the perforation is read at index point **12** on card **35**, the circuit is closed from roller **38** through brush **37**, coil **60**, battery **61**, and ground. Coil **60** being energized, armature **57** rotates clockwise around pivot point **58** out of contact with the ends of horizontal arms **50** and **55** thereby releasing pawls **47** and **52** respectively for rotation counterclockwise under bias forces supplied by springs **51** and **56**. At that time, pawl **52** will so rotate causing arm **54** to engage crossbar **28** by dropping into notch **12**, with the end of arm **54** clearing cam surface **57***a* of armature **57**. Field selection pawl **47**, however, is prevented from rotating counterclockwise by the obstructive action of tail piece **27** of type sector **20** on arm **49**.

As card **35** advances from index point **12**, the circuit including coil **60** is disrupted deenergizing the same, causing armature **57** to be magnetically released so as to be rotated counterclockwise in a suitable manner (e.g. by spring bias action) to engage arm **50** of field control pawl **47**. Zone selection pawl **52** having dropped into notch **12** is clear of the latch of armature **57** (see FIG. 2).

As card **37** advances further through read station, and brush **37** riding thereover through succeeding index points, bail **41** rotating clockwise under control of cam **45** advances type sector **20** clockwise so that successive field notches **0-8** are moved into position to be contacted by arm **49** of field control pawl **47**. As a second perforation is sensed at a numeric index point on card **35**, in

accordance with the arrangement in FIG. 6, electromagnet coil **60** is energized by a second pulse, armature **57** thereby is attracted for clockwise rotation about point **58** by core **59** releasing pawl **47** for counterclockwise rotation causing arm **49** to move into the appropriate field notch on type sector **20**. At this point in the operation cycle, further setup movement of sector **20** will cease and the type element character **25** corresponding to the code character of FIG. 7 as identified by the perforations in card **35** will have been located in the print position. As the card **35** passes from the read station, coil **60** is deenergized, armature **57** will move counterclockwise, with cam surface **57***a* abutting cam surfaces **50***a* and **55***a* respectively of pawls **47** and **52**. Cam **45** continues to rotate causing roller **44** to ride over a surface portion which produces no further type sector motion until after print operation occurs whereby hammer **31** strikes paper **33** against the selected type character **25**. At a later period in the cycle of operation of cam **45**, follower **44** is gradually raised causing crank arm **42** and bail **41** to turn counterclockwise thereby rotating type sector **20** toward the original position shown in FIG. 1. As type sector **20** is rotated counterclockwise, arm **49** riding over the edge of type sector **20** to the high point of a tooth **26** causes pawl **47** to be rotated clockwise in opposition to the bias of spring **51**. The cam surface **50***a* at the extremity of arm **50** of pawl **47** operating on surface **57***a* cams armature **57** clockwise. As soon as the high point of the tooth **26** on the type sector **20** is reached, the end of arm **50** of pawl **47** clears the end of the latch of armature **57**. Armature **57** now released by pawl **47** rotates counterclockwise and latches it clear of the field selection notches **0-8** of type sector **20**. Meantime, pawl **47** is held in that position by the armature **57** until the end of arm **49** of pawl **47** is riding on tail piece **27** of type sector **20**.

At this position, bail **41** continues its counterclockwise rotation picking up lever **22** rotating it counterclockwise. If arm **54** of pawl **52** has entered either of the zone notches **12, 11,** or **9** on crossbar **28**, a tooth **29** associated with either of these notches will rotate pawl **52** clockwise against the bias of spring **56** causing cam surface **55***a* to contact cam surface **57***a* causing armature **57** to be cammed clockwise about the point **58**. Since tail piece **27** of type sector **20** is now under the end of arm **49** of field selection pawl **47**, the counterclockwise rotation of pawl **47** is prevented as arm **55** of zone pawl **52** cams armature **57** clockwise. When arm **54** of zone pawl **52** rides on the high surface of a tooth associated with the notches **9, 11,** or **12** of crossbar **28**, the end of arm **55** clears the latch portion of armature **57** which under bias of a suitable spring armature **57** will move counterclockwise latching both pawls **47** and **52** in preparation for the beginning of a second cycle.

FIG. 2 shows the position of pawls **47** and **52** and notches **7** and **12** respectively so that character B of FIG. 7 is set up for printing. FIG. 3 shows pawl **47** and notch **7** of pawl **52** and notch **11** setting up a character K in the same group of type elements **25**. At that point, center of rotation, point **21**, of the type sector **20** will have been shifted to position line *c*.

Similarly FIG. 4 shows pawl **52** in zone notch **9** and pawl **47** in field notch **7** setting up a character S. Point **21** of type sector **20** has now been shifted from position line *c* to *d*.

FIG. 5 shows the pawl **52** in zone notch N of crossbar **28** with pawl **47** in field notch **7** setting up a numeric character 7. The center of rotation **21** of type sector **20** has been shifted from position line *d* to *e*. It is noted that pawl **52** in position N is still latched by armature **57**. In that event, as type sector **20** is rotated counterclockwise by bail **41** on the restore part of the operation cycle, as previously described, only pawl **47** is reset to be latched by armature **57**. This will occur before bail **41** picks up lever **22** to reset it to the initial position where pawl **52** engages the high portion of tail piece **30** of crossbar **28**. The restoration of lever **22** to position of FIG. 1 of course results in the reshifting of center point **21** of type sector **20** to line position *a*.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. In an apparatus having record analyzing means, a print mechanism operable in response to said analyzing means comprising a pivotable lever, a type sector rotatably mounted on said lever, said type sector having a plurality of type elements arranged in predetermined groups, said type sector having field selection stops corresponding with said groups carried thereby and said lever having zone selection stops corresponding with the number of type elements in said groups, means for rotating said sector on said lever and for rotating said lever about its pivot, and means for selectively limiting the degree of rotation of said sector and said lever whereby a group and individual type elements therein are positioned at a print location, including first and second selectively operable selection members controllably operable by a control member electrically operable for respectively engaging said type sector and said lever upon successive electrical pulses from an indicia-bearing record or the like.

2. In an apparatus having record analyzing means, a print mechanism in accordance with claim 1 in which said stop means comprises notches or the like integral with said type sector and said lever, and said type sector has means for preventing the operation of said first selection member by said electrically operable control member when said second member is operated thereby whereby said first and second selection members are operable successively by successive pulses to said electrically operable control member.

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