June 13, 1961 A. D'ONOFRIO ET AL 2,988,193

AUTOMATIC TABULATING APPARATUS FOR TYPEWRITERS OR LIKE MACHINES

Filed June 10, 1959

3 Sheets-Sheet 1

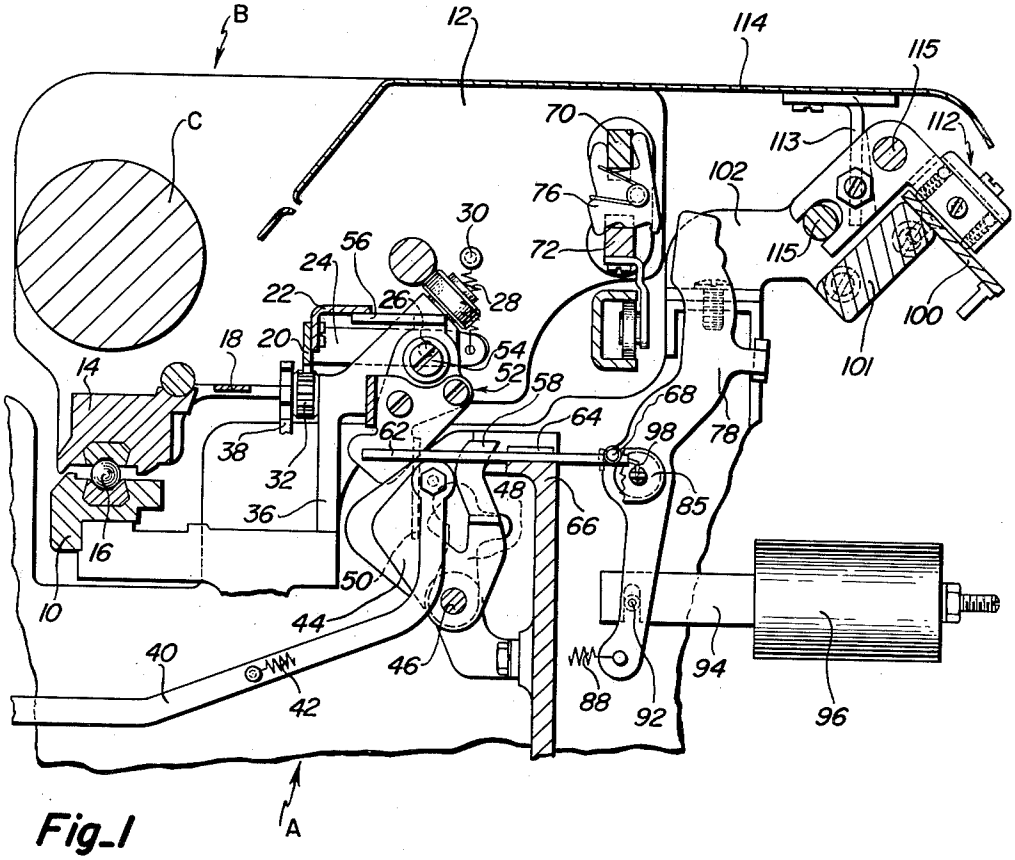


Fig_1

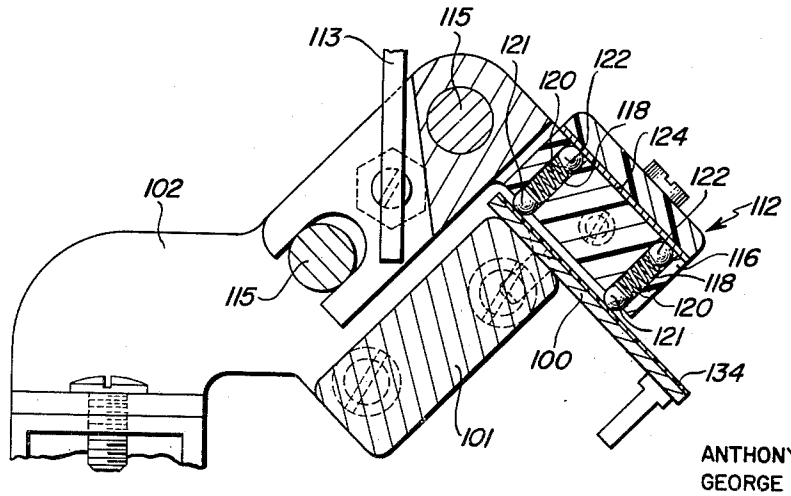


Fig_3

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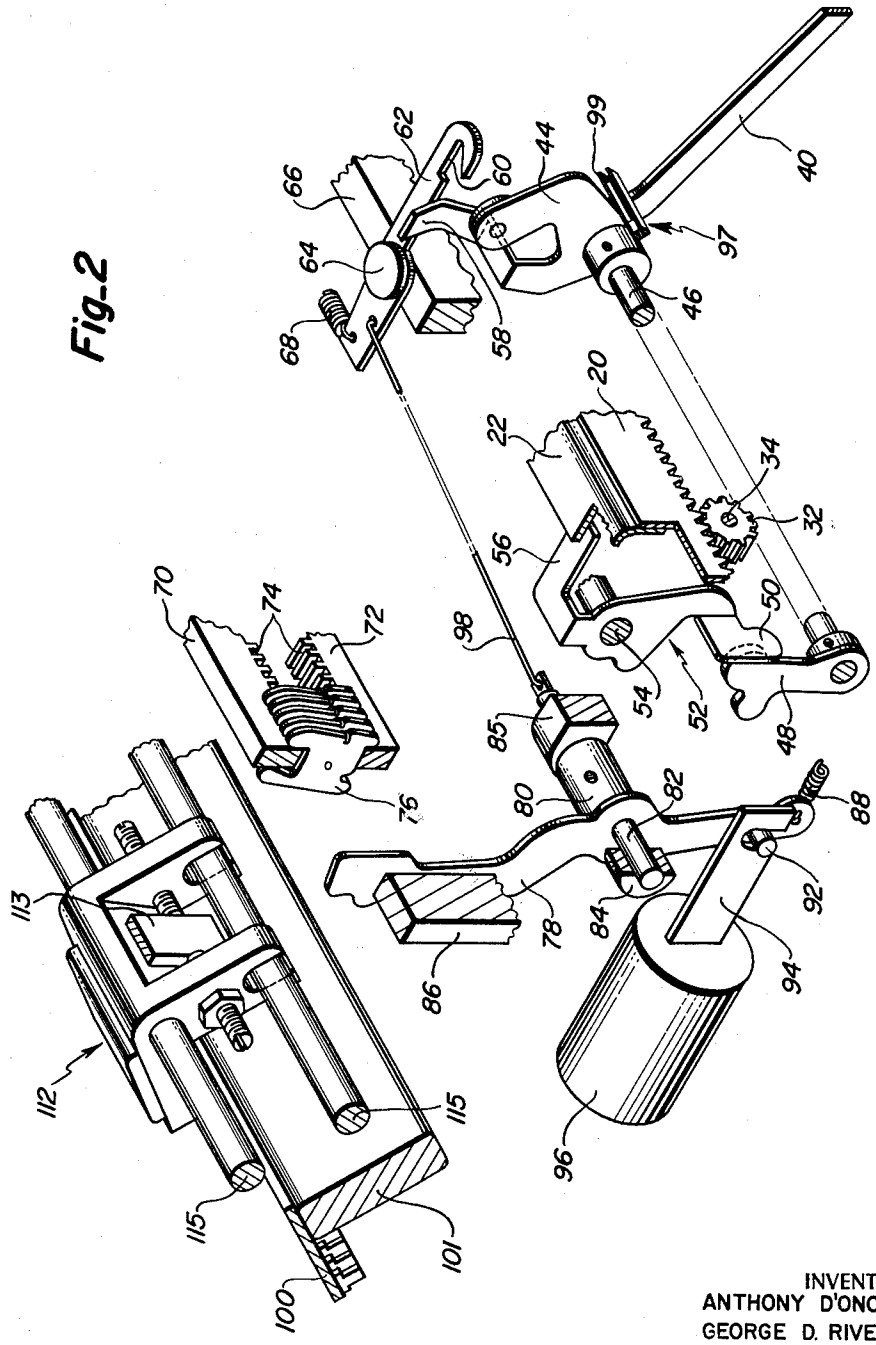
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Fig. 2



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3 Sheets-Sheet 3

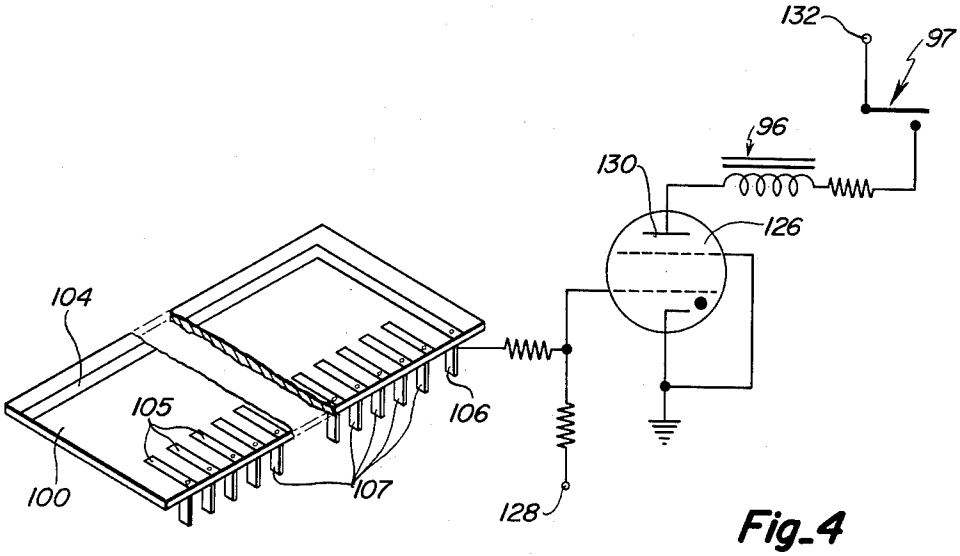


Fig_4

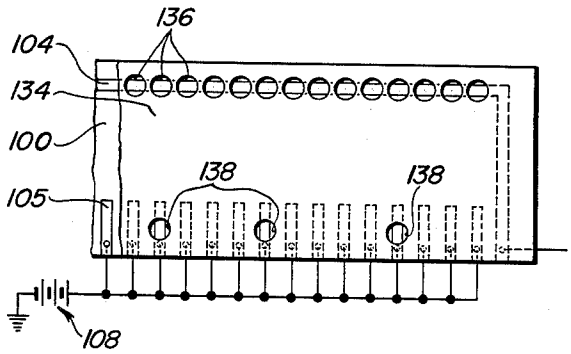


Fig_5

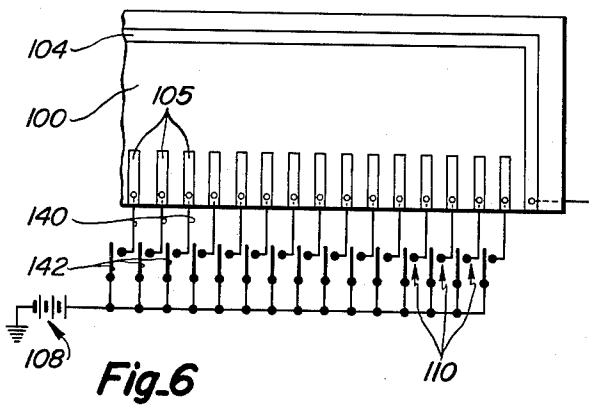


Fig_6

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AUTOMATIC TABULATING APPARATUS FOR TYPEWRITERS OR LIKE MACHINES

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6 Claims. (Cl. 197—177)

This invention relates to automatic tabulating apparatus for typewriters or like machines; more particularly it relates to an automatic tabulating apparatus wherein the positioning of a typewriter carriage is under the control of a device programmed in accordance with desired horizontal zones on forms wherein the line to line format is the same; and specifically it relates to an automatic tabulating apparatus wherein tabulating advance of a typewriter carriage is arrested by an electrically actuated tabulation terminating interposer operable in response to signals sensed from a program device upon movement of the typewriter carriage to a preselected zone or print position.

Present day business practice involves the typing of information on forms which require the mechanical setting of an array of tabulation stops for limiting tabulating advance of the typewriter carriage at horizontally spaced zones. Obviously different forms require an operator to reset all of the stops with concomitant carriage movement. This procedure is not only time consuming but does not lend itself readily to automatic control.

In accordance with the present invention the disadvantages inherent in mechanically settable tabular stops are obviated in the provision of a typewriter wherein all of the tabular stops are permanently set and in the provision of a solenoid operated tabulation terminating device adapted to be interposed into the tabular stop rack and be engaged by one of the set stops. The solenoid for operating the tabulation terminating device is adapted to be energized when effective ones of a plurality of switch contacts positioned longitudinally of the carriage at tabulation terminating positions are bridged upon movement of the carriage thereto. Predetermined ones of the switch contacts are made effective by a fixed though changeable program device, or made effective through closure of contact position selection switches. The above two methods for rendering predetermined ones of the switch contacts effective thereby constitute a fixed programming and a universal programming arrangement, respectively, for controlling tabulation to successive zones on a form wherein the line to line format is the same. All that an operator need do when the need for typing on a form having a different horizontal format arises, is to change the fixed program or reset position selection switches; no concomitant carriage movement as with present mechanically set stops being necessary.

An object of the invention is to provide an automatic tabulating device.

Another object of the invention is the provision of an automatic tabulating device which does not require the mechanical setting of tabular stops.

A further object of the invention is the provision of a typewriter wherein tabulation to a desired position automatically effects the engagement of a tab interposer with a set tab stop.

A further object of the invention is the provision of a typewriter wherein the position to which tabulating advance is desired is determined by programs selected for particular forms.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like reference numerals designate like parts throughout the figures thereof and wherein:

FIGURE 1 is a cross sectional view of a typewriter showing the tabulator mechanism;

FIGURE 2 is a perspective view of the escapement release and tab switch latching mechanism;

FIGURE 3 is an enlarged cross sectional view of the ball sensing and program device;

FIGURE 4 is a schematic view of circuitry employed to effect automatic tabulation;

FIGURE 5 is a schematic view of a fixed program device; and

FIGURE 6 is a view of an alternative programming arrangement.

The typewriting mechanism shown by way of example as embodying the invention in a preferred form is generally similar in many respects to the Royal electric typewriter. As shown in FIGURE 1 it includes a main frame element A provided with a lower track or rail **10** on which a carriage element B including end plates **12** is mounted for letter spacing and return movements by means of a carriage or top rail **14** and ball rollers, one of which is shown at **16** in FIGURE 1. The carriage B is equipped with the usual cylinder or platen C. The carriage B is urged in a letter space direction by suitable means such as a spring drum which exerts a steady pull on a draw band **18** connected to the right hand carriage end plate. Movement of the carriage in letter spacing direction is controlled by escapement mechanism illustrated partially as including a rack **20** carried by an angle bar or rail **22** having rearwardly extending arms **24** pivotally mounted on the carriage at **26**. Springs **28** connected to rearwardly extending portions of the arms **24** and anchored at **30** on the carriage, normally hold the escapement rack **20** in mesh with an escapement pinion **32** journalled on a shaft **34** carried by an escapement frame **36** secured to bottom rail **10**. The pinion **32** is adapted to rotate with an escapement wheel **38** secured to shaft **34** during letter feed movement. The escapement wheel **38** is adapted to co-operate with escapement pawls or dogs (not shown) which are well understood in the art and which when actuated permit the wheel **38** and pinion to turn in step-by-step increments so as to permit the rack **20** and consequently the carriage to be fed in a letter space direction.

The tabulating mechanism for raising the carriage rack **20** to permit movement of the carriage, free of restraint by the escapement in a letter spacing direction, is partially illustrated in FIGURES 1 and 2 wherein is shown a tabular link **40** adapted to be actuated through connection with a driving element (not shown) which operates continuously. Controllable driving connections (not shown), which normally are inoperative or ineffective, but which may be conditioned by the operator by depression of a tabulator key, effect operative driving connection between the continuously moving driving member and the tabulator link **40**. Inasmuch as this action is well known, suffice it to say that upon depression of the typewriter tabulator key, link **40** will be pulled forwardly or to the left as viewed in FIGURE 1 against the force of an associated return spring **42** suitably secured thereto and to the typewriter frame. Link **40** is pivotally connected to a lever arm **44** fast on a shaft **46** mounted in the typewriter frame whereby as link **40** moves forwardly shaft **46** is rocked counterclockwise. Shaft **46** also has secured thereto a rack bar lifting lever **48** adapted to engage an ear **50** on and to rock clockwise a rack bar lifting arm generally designated **52** pivoted as at **54** on escapement frame **36** and having an upper arm **56** extending under the rack rail **22**. When arm **52** rocks clockwise as viewed in FIGURE 1 the rack **20** is moved out of engagement with the escapement pinion **32** thereby

freeing the carriage for movement by the spring motor in letter space direction.

Lever arm 44 is also provided with an extension 58 adapted to be engaged by a slot 60 formed in a latch member 62 pivoted at 64 on a bracket 66 secured to the typewriter frame. A spring 68 interposed between the rear end of member 62 and an ear (not shown) on the bracket 66 urges latch member 62 to rock clockwise as viewed in FIGURE 2 so that when shaft 46 rocks counterclockwise extension 58 will move forwardly until it reaches slot 60 whereupon spring 68 will pivot latch member 62 clockwise latching lever arm 44 and shaft 46 in actuated position whereby the rack 20 will be held out of engagement with the escapement pinion 32.

The tabulation mechanism also includes a support mounted on the carriage comprising upper and lower rack bars 70 and 72 respectively formed with aligned transverse grooves 74 (FIGURE 2) which are spaced longitudinally of the rack bars at letter space intervals. A plurality of tabular stops 76 are mounted in the grooves of the rack bars and all are mounted on and always remain in a set or operative position to engage a tabulation terminating interposer when the latter is in its operative position as will hereinafter appear. Such an arrangement constitutes a "solid" tab rack. In the form shown the tabulation terminating interposer is constituted by a tabular stop blade 78 having a boss 80 secured by a set screw to blade mounting means comprising a shaft 82 mounted for both axial and rocking movement in bearing lugs 84 and 85 on a bracket 86. The tabular stop blade 78 is normally biased out of engagement of the tab rack by a spring 88 suitably secured thereto and to the typewriter frame. The tabular stop blade is adapted to be moved into the path of a tabular stop through connection as at 92 with the armature 94 of a solenoid 96 suitably mounted on the typewriter frame. The tabulation terminating interposer or tabular stop blade 78 is also connected by a link 98 most clearly seen in FIGURE 2, to actuate the latch member 62 and permit the rack 20 to re-engage the escapement pinion 32 as will hereinafter be more fully explained. In the normal position of the parts the tabular stop blade abuts bracket 86 and boss 80 is axially spaced from bearing lug 85; spring 68 being ineffective to move blade 78 axially to the right through link 98 because of the abutment of extension 58 with latch member 62.

The above arrangement of parts differs from the Royal electric typewriter in that a solid tab rack is provided and the tab stop blade 78 is solenoid actuated rather than being linked to rock shaft 46.

Further in accordance with the invention a form A tab latch switch 97 is provided on the typewriter frame and disposed thereon as shown in FIGURE 2 so as to move the movable contact 99 thereof to its closed position by movement of lever arm 44 to actuated position.

In accordance with the invention a longitudinally disposed program plate 100 is secured to a bar 101 which is secured at either end to brackets 102 fixed on the typewriter frame. The program plate preferably carries printed circuitry comprising as seen in FIGURE 4 a common longitudinally disposed conductor 104 and a plurality of individual printed conductors 105 spaced at letter space intervals. The common conductor 104 is connected to a terminal 106 riveted to the plate 100 as are each of the individual conductors to terminals 107. The individual conductors 105 are adapted through terminals 107 to be connected directly to a power supply 108 as shown in the embodiment of FIGURE 5, or indirectly as shown in the embodiment of FIGURE 6 through position selector switches 110 which may be selectively closed by an operator to connect power to selected ones of the individual conductors 105. The former arrangement as will hereinafter appear is adapted for operation with a template constituting a fixed program; the latter constitutes a universal program. A sensing device generally designated 112, which functions as a movable switch contact, is mounted for movement with the carriage by an arm 113 secured to and depending from the carriage top plate 114 and is guided on frame mounted rails 115. The sensing device is adapted, as will hereinafter appear, to sense the individual conductors 105 which are connected to power. As seen in FIGURE 3 the sensing device comprises an insulating block 116 having spaced bores 118 wherein are disposed springs 120 adapted to bias contact balls 121 and 122 at either end respectively, against the printed circuits on the program plate 100 and a contact plate 124. The spacing of the bores is such that balls 121 will bridge the common conductor 104 and successsive individual conductors 105 as the carriage moves in letter space direction.

Referring more particularly to FIGURE 4 the circuitry for energizing the tab lever control solenoid is illustrated schematically. As may be seen the common conductor terminal 106 is connected to the grid of a thyratron 126 which is normally biased below its firing potential through connection to a bias supply terminal 128. The plate 130 of the thyratron is adapted to be connected to a plate voltage supply terminal 132 through the tab blade control solenoid 96 and the tab latch switch 97.

In operation when a tabulation operation is initiated, link 40 will rock shaft 46 as heretofore explained. This will cause rack 22 to be lifted from the escapement pinion, extension 58 of latch lever 44 to engage the slot 60 in latch member 62 whereby the rack will be held out of engagement from the escapement pinion, tabular stop blade 78 to move axially to the right into abutment with bearing lug 85 under the action of spring 68, and tab latch switch 97 to close thereby connecting plate supply voltage to the thyratron conditioning it for firing upon receipt of a signal on its grid. The carriage will therefore move until the ball sensing device bridges an individual conductor 105 corresponding to a desired zone position on the form being typed, i.e. one which is connected to power supply 108, and the common conductor 104. The grid of the thyratron will rise thereupon above the tube firing potential, the thyratron 126 will fire and the tab lever control solenoid 96 will be energized. Energization of the solenoid will move the tabular stop blade 78 between tab stops 76 and immediately before the tab stop 76 corresponding to the zone position on the form to which carriage movement was desired. The tab stop 76 will engage the tabular stop blade 78, moving it against bracket 86 thereby arresting movement of the carriage. Movement of the tabular stop blade 78 axially to the left as viewed in FIGURE 2 will pull latch member 62 thereby unlatching lever arm 44 and rack bar lifting lever 52, whereupon the rack 20 re-engages the escapement pinion 32 and the tab latch switch 97 opens. The opening of switch 97 deenergizes solenoid 96 whereupon tab lever 78 moves out of the path of the tab stop 76.

Selection of the zones to which tabulating advances is desired is accomplished through the use of a perforate mask 134 of insulating material as shown in FIGURE 5. The portion of the mask over the common conductor 104 has perforations 136 in every letter space position, while the portion of the mask over the individual conductors 105, which in this embodiment are all connected directly to power supply 108, is selectively perforated in positions 138 corresponding to the letter space positions of the carriage to which tabulating advance is desired. This modification which is a form of fixed program only requires that a new mask 134 with a different hole combination be inserted between the printed circuit plate 100 and the ball sensing device 112 as shown in FIGURE 3.

In FIGURE 6 there is shown a universal programming arrangement. In this arrangement the program plate shown in FIGURE 4 is employed with the terminals 107 of the individual conductors 105 connected to the stationary contacts 140 of the position selector switches 110, the movable contacts 142 of which are connected to power supply 108. As before the common conductor 104 is connected to the grid of the thyratron. In this embodi-

ment when a different format is required all that an operator need do is to close those position selector switches 110 corresponding to the desired horizontal stopping positions.

It should be understood that the foregoing disclosure relates to only a preferred embodiment of the invention and that it is intended to cover all changes and modifications of the example of the invention herein chosen for the purposes of the disclosure, which do not constitute departures from the spirit and scope of the invention.

The invention claimed is:

1. In a business machine having a movable carriage, a tabulating mechanism for releasing said carriage for unrestricted movement in letter space direction, a tabular stop blade movable from a normal inoperative position to an operative position, said tabular stop blade being normally maintained in said inoperative position during tabulating movement, a plurality of fixed stops adapted to engage said tabular stop blade in its operative position, and means responsive to movement of the carriage to a desired letter space position for actuating said tabular stop blade to its operative position comprising a solenoid, and switch means at said desired position adapted when closed upon movement of the carriage thereto to effect the energization of said solenoid.

2. In a business machine having a frame, a carriage mounted for movement on said frame in letter space and return directions, a tabulating mechanism for releasing said carriage for unrestricted movement in a letter space direction, a tabular stop blade, means urging said tabular stop blade into inoperative position, a plurality of tabular stop elements fixed in position at letter space intervals so as to engage said tabular stop blade in its operative position, a frame mounted program device comprising a normally open switch in every letter space position, means mounted for movement with said carriage adapted to successively close said switches as the carriage moves in letter space direction, means for rendering predetermined ones of said switches effective, and means responsive to closure of said predetermined switches for actuating said tabular stop blade to operative position.

3. An apparatus as recited in claim 2 wherein said means for rendering predetermined ones of said switches effective comprises a program template of insulating material perforated at predetermined positions thereby permitting closure of said normally open switches only at said predetermined positions.

4. An apparatus as recited in claim 2 wherein said means for rendering predetermined ones of said switches effective comprises a position selector switch associated with each of said switches, said position selector switches being adapted to selectively connect desired ones of said switches in a power circuit.

5. In a business machine having a frame, a carriage mounted for movement in letter space and return directions, a tabulating mechanism for releasing said carriage for unrestricted movement in letter space direction, a tabular stop blade mounted on said frame, means urging said tabular stop blade into inoperative position, a plurality of tabular stop elements fixed in position at letter space intervals on said carriage adapted to engage said tabular stop blade in its operative position, a printed circuit plate mounted on said frame having a common longitudinally disposed contact and a plurality of contacts spaced at letter space intervals, a solenoid adapted when energized to actuate said tabular stop blade to operative position, a solenoid control circuit, means connecting said common contact to said solenoid control circuit, means responsive to the initiation of a tabulating operation for enabling said control circuit, means on said carriage adapted to connect said common contact with successive ones of said plurality of contacts during tabulating movement, a program template perforated to permit predetermined ones only of said plurality of contacts to be connected to said common contact, said control circuit being effective upon connection of said common contact with a predetermined one of said plurality of contacts to energize said solenoid whereby tabulating advance is arrested, and means responsive to the arrest of tabulating advance for disabling said control circuit.

6. In a business machine having a frame and a carriage movable on said frame, tabulating mechanism for initiating tabulating movement of said carriage, a tabular stop blade mounted on said frame for movement from a normal inoperative position to an operative position, means for maintaining said tabular stop blade in said inoperative position during tabulating movement of said carriage, a plurality of tabular stop elements operatively positioned on said carriage so as to engage said tabular stop blade in its operative position, a solenoid adapted when energized in response to tabulating movement of said carriage to predetermined positions to actuate said tabular stop blade to its operative position, a solenoid control circuit conditioned upon initiation of tabulating movement of said carriage, contact means at said predetermined positions, and means operative upon movement of said carriage relative to said contact means for connecting said contact means to said conditioned solenoid control circuit, whereby said solenoid is energized and said tabular stop blade is actuated to its operative position.

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