

July 23, 1957

R. E. EDMINSTER ET AL

2,800,539

PROGRAM DEVICE

Filed Dec. 6, 1954

2 Sheets-Sheet 1

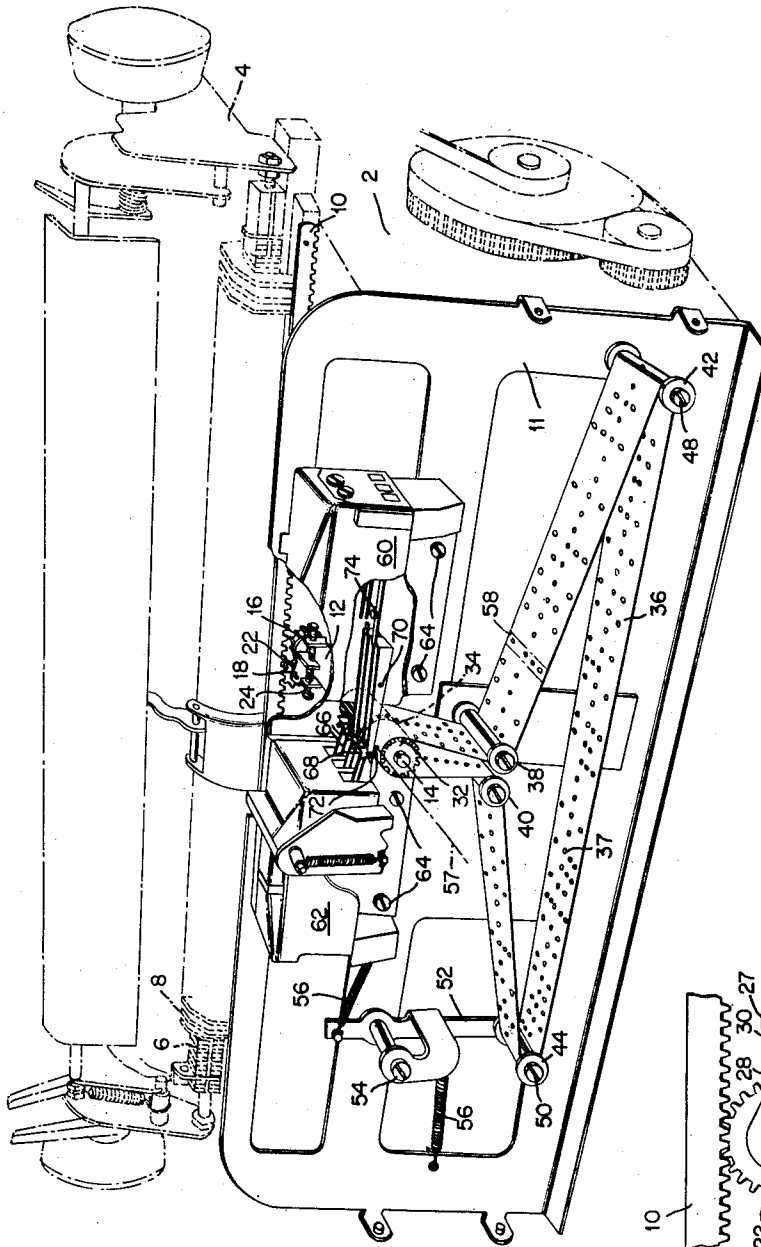


FIG. 1

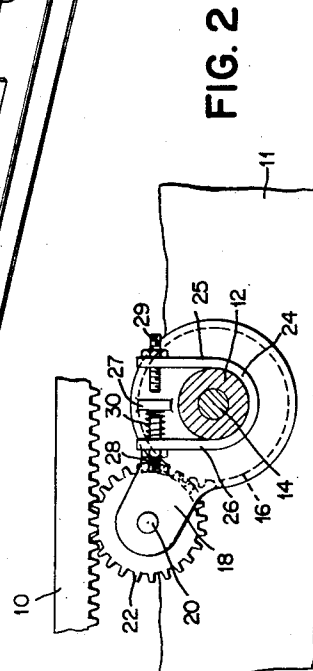


FIG. 2

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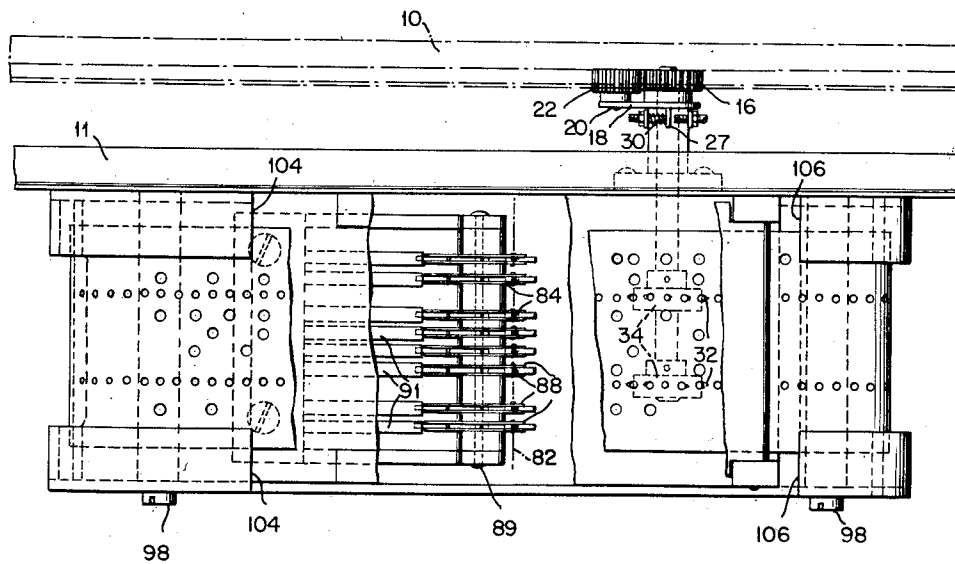
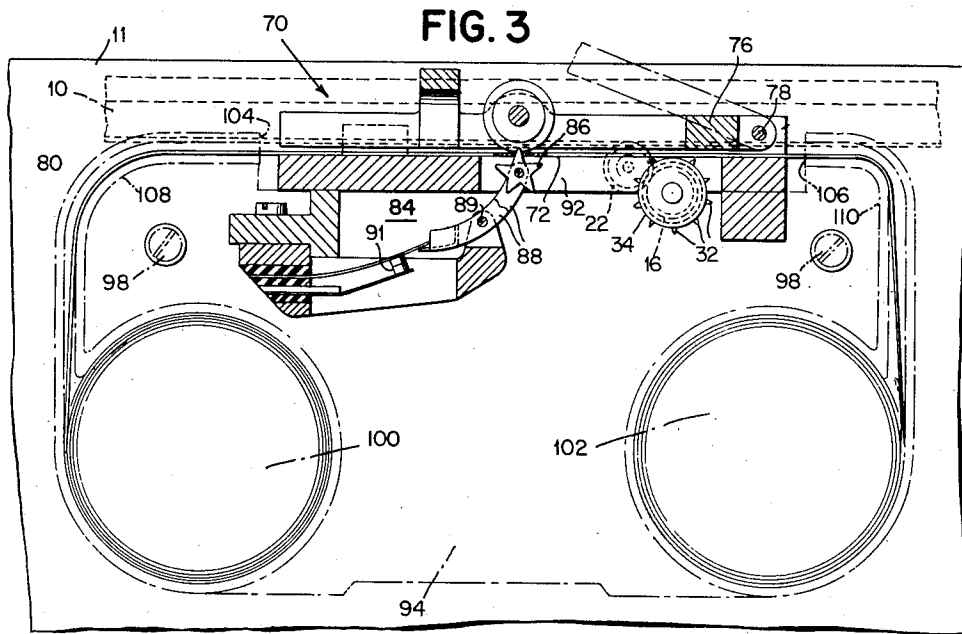


**FIG. 4**

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## PROGRAM DEVICE

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10 Claims. (Cl. 200—46)

This invention relates to programming devices and more particularly to an improved program device operable, when used in conjunction with a business machine having a movable carriage, for conditioning electrical switches in response to the carriage position.

For background purposes, reference is made to co-pending U. S. patent application of C. R. Doty Serial No. 250,647, filed October 10, 1951, wherein a typewriter tape punch and its operating features and principles are described. Basically, it is pointed out in the copending application, that a typewriter is used in conjunction with a paper tape punching device, whereby selected ones of the typewriter keys are operable to condition a tape punch machine to perforate a tape in some code that will indicate the character typed.

The perforated tape can then be used for transmittal over telegraphic wires or as a storage media for information to be punched into statistical cards. In the copending application, the function of a program device was explained as controlling the punch on and punch off fields of the typewriter carriage. For example, in an insurance form, it might be desirable to punch in a tape the information typed in columns 1 through 20 of the form; then turn off the punch while typing in columns 21 through 40; and then turn the punch on again during the typing in columns 60 through 80. To accomplish this result, it is necessary to condition electrical switching devices in response to the position of the typewriter carriage whereby the typewriter keys will emit pulses to operate the tape punch only during the specified typing fields.

In the co-pending Doty application, a program bar is mounted on the rear of the typewriter to carry lugs which operate electrical switches to selectively condition the machine for a tape punching condition.

It is the first object of this invention to provide an improved programming device for conditioning electrical circuits in response to the position of a business machine carriage.

It is a further object of this invention to provide an improved programming device which will operate to condition electrical switches in response to the carriage position irrespective of the vibration or bounce in the carriage.

It is a still further object of this invention to provide an improved programming device for a movable carriage business machine wherein the program can be readily interchanged.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated of applying that principle.

For simplicity of description, this invention is explained with reference to a typewriter carriage, but it is not intended that such reference be considered a limitation, since the invention is operable with any movable carriage machine.

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In the drawings:

Fig. 1 is a perspective view of the invention attached to the rear of an IBM electric typewriter.

Fig. 2 is a diagrammatic view of a planetary gear drive.

Fig. 3 is an end view of another embodiment of this invention.

Fig. 4 is a plan view of the embodiment of Fig. 3.

Briefly, this invention comprises the positioning of a rack on the typewriter carriage which rack is used in conjunction with a gear train device to synchronize the operation of a program tape driving device. The program tape, in turn, is perforated to condition electrical switches whereupon circuits are established in response to the carriage position.

Referring to the drawings, a typewriter 2 is shown having a carriage 4 movable transversely of the typewriter for a letter spacing operation. The carriage has the usual tab rack 6 and the tab stops 8 which are selectively positioned to stop the carriage during a tabulation run in a well known manner.

A program rack 10 is secured to the carriage to be movable with it transversely of the typewriter 2 and thereby act as the positioning means for the improved programming device.

A bushing 12 is mounted on the typewriter frame to support a shaft 14 for rotation. A tape drive gear 16 is keyed or otherwise secured to the shaft 14. An arm 18 is pivotally mounted about the bushing 12 and carries a stud shaft 20 on which there is mounted a floating pinion 22. The floating pinion 22 is meshed with both the program rack 10 and the tape drive pinion 16.

The arm 18 is spring biased clockwise as viewed in Fig. 1 and/or Fig. 2, so as to resiliently hold the floating pinion 22 in engagement with the rack 10 irrespective of the vibration and bounce of the carriage relative to the tape drive pinion 16.

In the illustrated embodiment, the biasing means for the arm 18 comprises a U-shape member 24 secured to bushing 12 and having its legs 25, 26 extending outwardly from the bushing on opposite sides of an ear 27 secured to arm 18. Each leg 25, 26 is threaded to receive an adjustable screw stop 28, 29 for limiting the rocking of arm 18 relative to bushing 12. A spring 30 is mounted over the adjustable stop 28 and wedged between leg 25 of the U-shaped member 24 and the ear 27 of arm 18, thereby biasing the arm clockwise as viewed in Fig. 1 and Fig. 2, into engagement with the program rack 10.

Shaft 14 also carries a drive capstan 32 including a sprocket 34 which is keyed or otherwise secured to the shaft 14 to be rotatable therewith. With this mechanism, a movement of the carriage transverse to the typewriter 2 will rotate floating pinion 22, to drive the tape drive pinion 16 and consequently, the shaft 14 along with tape drive capstan 32.

#### Program tape

In one embodiment shown in Fig. 1, a continuous strip program tape 36 is mounted to be driven by sprocket 34 of tape drive capstan 32. The tape is guided by pulleys 38, 40; positioning pulley 42, and a take up pulley 44. Preferably tape 36 is made of one of the more durable plastic materials, for example, that tape sold under the trade name "mylar" by the Du Pont Co., which may be perforated and driven by the tape drive capstan 32 for prolonged periods without the tape being damaged.

The program tape 36 is provided with a center row of positioning holes 37 engageable with the sprocket 32 to prevent slippage, and thereby assure synchronization of the tape and carriage.

The guide pulleys 38, 40 and the positioning pulley 42 are rotatably held in one example, to the typewriter frame

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11 by screws or other suitable securing devices 48. The take up pulley 44 is rotatably secured by a screw or other securing device 50 to an arm 52 which, in turn, is pivotally supported on the frame 11 by a screw or other suitable securing device 54. Springs 56 are interconnected between the arm 52 and the typewriter frame 11 to bias the arm clockwise and consequently, the take up pulley 44 applies tension to the tape to keep it taut.

With this arrangement, the program tape is driven by the tape drive capstan 32 in response to the movement of the typewriter carriage. It is obvious that the length of tape which will register with the length of the carriage may be either exactly the same length as the typing field of the carriage or it may be greater depending upon the gear ratios between the program rack 10 and the tape drive capstan 32. In any event, by moving the carriage to align the left hand margin of the printing field, with the print position of the typewriter, and by then setting the program tape 36 so that a corresponding (left hand margin) position of the tape is at the read or reference line 57 of the tape drive capstan, then as the typewriter carriage is moved from the left hand margin position towards the right hand margin position, the program tape 36 will move from right to left across the read line of the tape drive capstan. Once again, depending on the length ratio of typing field and program tape, one column or row of the latter, e. g. column 58 will be at the read line 57 of the tape drive capstan when the corresponding column (not shown) of the typing field is at the print position of the typewriter. Each row of the tape may then be provided with some switch conditioning means whereby predetermined columns of the carriage typing field may be selectively switched to a punch on or punch off condition. In a preferred embodiment, the program tape is perforated and then the perforations are sensed to condition electrical switches.

#### *Tape sensing means*

In order to sense the perforations in the program tape, a pair of star wheel contact units 60, 62 are mounted on the typewriter frame by means of screws or other suitable mounting devices 64.

The operation of the star wheel contact devices are more particularly described in United States Patent 2,517,984 assigned to the same assignee as that of the present invention, but basically (Fig. 1) a star wheel contact unit comprises a plurality of arms 66, each carrying a rotatable star wheel 68 at its outer end. The inner end of each arm is pivoted about a stud 70 within the star wheel contact unit. When a prong 72 of one of the star wheels passes through a perforation in the program tape 36, the arm 66 to which the star wheel is attached will dip and pivot about its stud 70 and thereby close an electrical contact 74, which contact is held normally open while the star wheel glides across an unperforated column of the program tape.

In the particular embodiment shown, there are two star wheel contact units, the unit 60 has two arms 66, while the unit 62 has three arms 66. One star wheel is in registration respectively with each longitudinal channel or row in the program tape 36. In this manner, with the axes of all the star wheels being in alignment and overlying the same read line 57 on the tape drive capstan, all of the star wheels will read, simultaneously, one transverse column of the program tape 36; and depending upon the perforations in the tape, certain star wheels will dip to close their corresponding contacts.

While it is obvious that one star wheel and one channel of apertures would suffice to condition the carriage typing field for punch on, or punch off condition, the tape 36 is usually provided with five or eight holes, and a corresponding number of star wheel contacts are likewise provided whereby some combination of five or eight electrical switches may be closed for each tape column at the read line of the tape drive capstan.

The particular purpose of the combination of eight elec-

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trical switches is described in the co-pending Doty application, but basically, the purpose is to provide several programs in one tape. For example, for lines one through four of a typing form, it might be useful to have certain typing fields conditioned for punch on; while line five through ten still other fields are programmed for punch on. Through the permutation of the eight switches for each typing position of the carriage, a variety of programs may be punched in one strip of tape. Program keys shown in the co-pending Doty application are then depressed to determine which channels of the program tape are operable at any one time.

In order to remove the program tape 36, the take up pulley arm 52 is pivoted counterclockwise in opposition to the tension of spring 56 so that the program tape 36 may be slid over the take up pulley 44 whereupon the tape will be free and may be lifted from the sprocket wheel on the tape drive capstan 32 by lifting the star wheels out of engagement with the tape.

A separate program tape having its own variety of programs may then be installed over the capstan to change the punch on fields specified by the various program keys.

A second embodiment of this invention is shown in Fig. 3 of the drawings, wherein a strip of program tape is employed in place of the continuous belt shown in Fig. 1.

While the program rack 10, the floating pinion 22, the tape drive pinion 16, and the tape drive capstan 32 along with sprocket 34 are substantially identical to the heretofore described embodiment, the tape housing and reading mechanisms are changed.

#### *Reading mechanism*

Specifically, a read head 70 is secured to the rear of the typewriter frame 11 to provide a plane tape sensing surface 72 on a level with the peripheral top of the tape drive capstan 32. A read lid, or cover 76 is pivotable about a pin axis 78 carried by the read head 70. Accordingly, the member 76 may be lifted or pivoted about its pin axis 78 to expose the tape sensing surface 72 thereby facilitating the insertion of a program tape 80.

When the proper column of the tape is aligned with a read or reference line 82 (Fig. 4) so as to correlate the tape column with the desired carriage position of the typewriter, then the lid 76 is dropped back into the solid line position shown in Fig. 3 to hold the tape.

The tape is sensed by the read unit 84 which comprises star wheels 86 carried by the arms 88 in turn pivotally supported within the read unit 84 on pins 89. Once again, as shown in U. S. Patent 2,517,984, when a star wheel 86 senses perforations in the program tape, a corresponding switch 91 will be closed in the read unit 84 to establish desired circuits.

By mounting the read unit 84 under the read head 70, the star wheels 86 will be in contact with the under side of the program tape through a slot 92. Accordingly, as the tape is fed across the read line 82, the fingers will sense perforations in the tape to condition electrical switches 91 for purposes heretofore described.

In order to enclose the portions of the program tape not being read, a tape housing 94 is provided and secured to the typewriter frame 11 by screws or other securing devices 98. Housing 94 comprises a pair of wells 100, 102 located on opposite sides of the read line to store portions of the tape before and after it has been read, respectively. The wells 100, 102 have curved inner peripheries to guide the tape to form a spool in either well.

Throats 104, 106 and slides 108, 110 respectively guide the tape from the read head into either well.

In operation, after the lid 76 has been raised to expose the read surface 72, a program tape is inserted into the throats 104, 106 so that all of the tape is inserted into one of the wells, or portions of the tape are in both wells so that a predetermined column of the tape

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is aligned with the read line 82 of the read head 70 to agree with a corresponding column arranged at the print position of the typewriter. The lid 76 is then dropped into place to hold the tape in engagement with the drive capstan and star wheels 86 thereby rendering the tape sensing device operable to condition switches 91 in the read unit in response to perforations in the tape.

While there have been shown and described and pointed out the fundamental novel features of the invention, as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In a business machine having a carriage movable in column steps across a printing position, a program device operable to condition switches in response to the position of said carriage, comprising a program tape having a plurality of columns equal in number to the print columns of said business machine carriage, positive means responsive to the movement of said business machine carriage for driving said program tape in column steps across a reference line in registration with movement of said carriage across said printing position, signalling means arranged at said column positions on said program tape, switch means and means at said reference line responsive to said signalling means for conditioning said switch means.

2. In a business machine having a movable carriage, a program device operable to condition electrical switches in response to the position of the carriage comprising, indicating means operable in response to the movement of said carriage to indicate the position thereof, a tape drive pinion, a floating pinion, resilient means mounting said floating pinion for engagement with said tape drive pinion and said indicating means, a tape drive capstan, means driving said capstan in response to the operation of said tape drive pinion, a program tape having a plurality of columns and channels with the number of tape columns being equal to the printing columns on said business machine carriage, positive means responsive to the movement of said business machine carriage for driving said tape in column steps across a reference line in response to the operation of said tape drive capstan, program tape sensing means, means mounting said tape sensing means to read the column of said program tape located at said reference line, and switch means operable in response to said tape sensing means when the latter is actuated by said program tape for conditioning said electrical switches in response to the position of said carriage.

3. In a business machine having a carriage movable in column steps across a printing position, a program device operable to condition electrical switches in response to the position of said carriage, comprising a program tape having a length great enough to provide a number of columns equal to the number of columns on said carriage of printing field, means driving said program tape in column steps across a reference line in response to the movement of said carriage thereby having a predetermined tape column at said reference line respectively for each carriage column at said print position, said tape driving means comprising, a rack secured to said carriage and movable therewith, a tape drive pinion, a floating pinion, resilient means mounting said floating pinion in engagement with said tape drive pinion and biasing said floating pinion resiliently into engagement with said rack to insure a driving relation between said rack and said tape drive pinion irrespective of the bounce or vibration in said carriage, tape sensing means, means mounting said tape sensing means

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to sense the column of said program tape at said reference line, and switch means positioned for actuation in response to the operation of said tape sensing means, whereby a program device is provided for conditioning electrical switches in response to the carriage position.

4. In a business machine having a carriage movable in column steps across a printing position, a program device operable to condition switches in response to the position of said carriage comprising a program tape having a plurality of columns and channels with the number of columns being equal to the columns of the printing field on the carriage of said business machine, means mounting said program tape on said business machine for movement in column steps past a read line, drive means for said program tape, means interconnecting said tape drive means and said carriage for moving said tape in column steps in response to the column step movement of said carriage, tape sensing means, means positioning the same to sense the tape at said read line, said tape sensing means having electrical switches conditioned by said sensing means noting imperfections in said program tape at said read line, whereby a program device is provided for conditioning electrical switches in response to the position of said business machine carriage.

5. A program device operable in conjunction with a business machine having a carriage movable in column steps across a print position comprising, a tape having a plurality of columns one for each column of the printing field of the movable carriage with said tape columns being marked individually in accordance with a predetermined pattern, means mounting said tape on said business machine for movement past a reference line, positive means responsive to the operation of said business machine carriage for registering the movement of said tape with the movement of said carriage whereby one column of said tape is at said reference line as a corresponding column of the printing field on said carriage is at its print position, a plurality of electrical switches, and means responsive to the tape markings at said reference line for conditioning said electrical switches whereby said program device is operable to condition electrical circuits in response to the movement of said carriage past said print position.

6. A program device operable in conjunction with a business machine having a carriage movable in column steps across a print position comprising, a tape having a plurality of columns with one column being assigned respectively to a corresponding column on the printing field of said carriage, means mounting said tape on said business machine for movement column by column past a read position, means responsive to the movement of said business machine carriage for coordinating the movement of said tape with the movement of said carriage whereby for each column of said tape at said read line a corresponding column of said printing field of said carriage is at a printing position, a reading device for sensing said tape at said read line, and electrical switch means operable in response to the sensing of said tape by said reading device for conditioning electrical circuits in accordance with indicia on said tape.

7. A program device operable in conjunction with the business machine having a carriage movable in column steps past a print position comprising, a tape having a plurality of columns with one column being assigned respectively to a corresponding column of the printing field on said carriage, means mounting said tape for movement column by column past a read position, means coordinating the movement of said tape with that of said carriage whereby for each column of said tape at said read position a corresponding column of said printing field of said carriage is at said print position, said coordinating means comprising a rack and

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pinion member with one of said members being secured to said carriage and the other of said members to said tape moving means, said tape having a plurality of markings selectively positioned on said tape in column steps, a reading device for sensing said tape markings at said read position, and electrical switch means operable in response to the sensing of said tape by said reading device for conditioning electrical circuits in response to the movement of said carriage past said print position.

8. A program device operable in conjunction with the business machine having a carriage movable in column steps past the print position comprising, a tape having a plurality of columns marked in accordance with a predetermined pattern with one column being assigned respectively to a corresponding column of the printing field on said carriage, means mounting said tape for movement column by column past a read position, means coordinating the movement of said tape with that of said carriage whereby for each column of said tape at said read position a corresponding column of said printing field of said carriage is at said print position, said coordinating means comprising a rack secured to and movable with said carriage, a pinion driven by said rack, a tape drive capstan driven in response to the driving relationship between said rack and pinion, a reading device for sensing said tape markings at said read position, and electrical switch means operable in response to the sensing of said tape markings by said read device for conditioning electrical circuits in response to the movement of said carriage past a print position.

9. A program device operable in conjunction with a business machine having a carriage movable in column steps past a print position comprising, a tape having a plurality of columns perforated in accordance with a predetermined pattern with one column being assigned respectively to a corresponding column on the printing field of said carriage, means mounting said tape for movement column by column past a read position, means coordinating the movement of said tape in said carriage whereby for each column of said tape at said read position a corresponding column of said printing field of said carriage is

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at said printing position, said coordinating means comprising rack and pinion members with one of said members being secured to and movable in response to the movement of said carriage and the other of said members being secured to said tape moving means, a star wheel sensing device having electrical switch means therein operable in response to said star wheel sensing device detecting punchings in said tape whereby electrical switches are conditioned in response to the movement of said carriage past its print position.

10. A program device operable in conjunction with the business machine having a carriage movable in column steps past a print position comprising, a tape having a plurality of columns marked in accordance with a predetermined pattern with one column being assigned respectively to a corresponding column of the printing field on the carriage, means mounting said tape for movement column by column past a single position, means coordinating the movement of said tape with said carriage whereby for each column of said tape at said read position a corresponding column of said printing field of said carriage is at said fixed position, said carriage coordinating means comprising a rack secured to and movable with said carriage, a tape drive capstan for moving said tape, a tape drive pinion for rotating said tape drive capstan, a floating pinion, mounting means holding the same in engagement with said tape drive pinion and resiliently in engagement with said rack whereby said tape is driven in response to the movement of said carriage irrespective of the vibration of the latter relative to said tape drive capstan, a device for sensing said tape markings at said read position and electrical switch means operable in response to said tape sensing device whereby said electrical switches are conditioned in response to the movement of said business machine carriage past its print position.

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