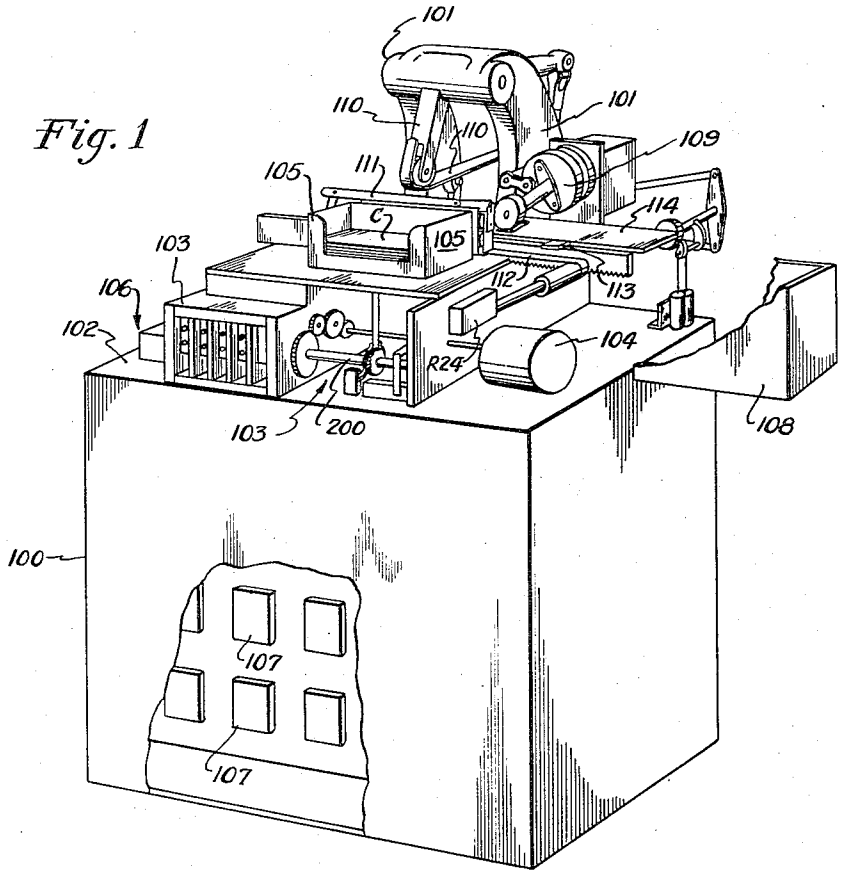
Sept. 30, 1958 A. A. BERLINSKY ET AL 2,854,117

AUTOMATIC STENCIL CUTTER

Filed May 17, 1955 11 Sheets-Sheet 1

Fig. 1



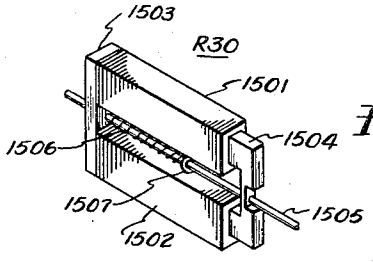


Fig. 15

INVENTORS
Anthony A. Berlinsky
Lester F. Wilkinson
Robert Kee
Leroy T. Wood

BY Arthur Vinograd ATTORNEY
Leonard X. Stoll AGENT

Sept. 30, 1958 A. A. BERLINSKY ET AL 2,854,117

AUTOMATIC STENCIL CUTTER

Filed May 17, 1955 11 Sheets-Sheet 2

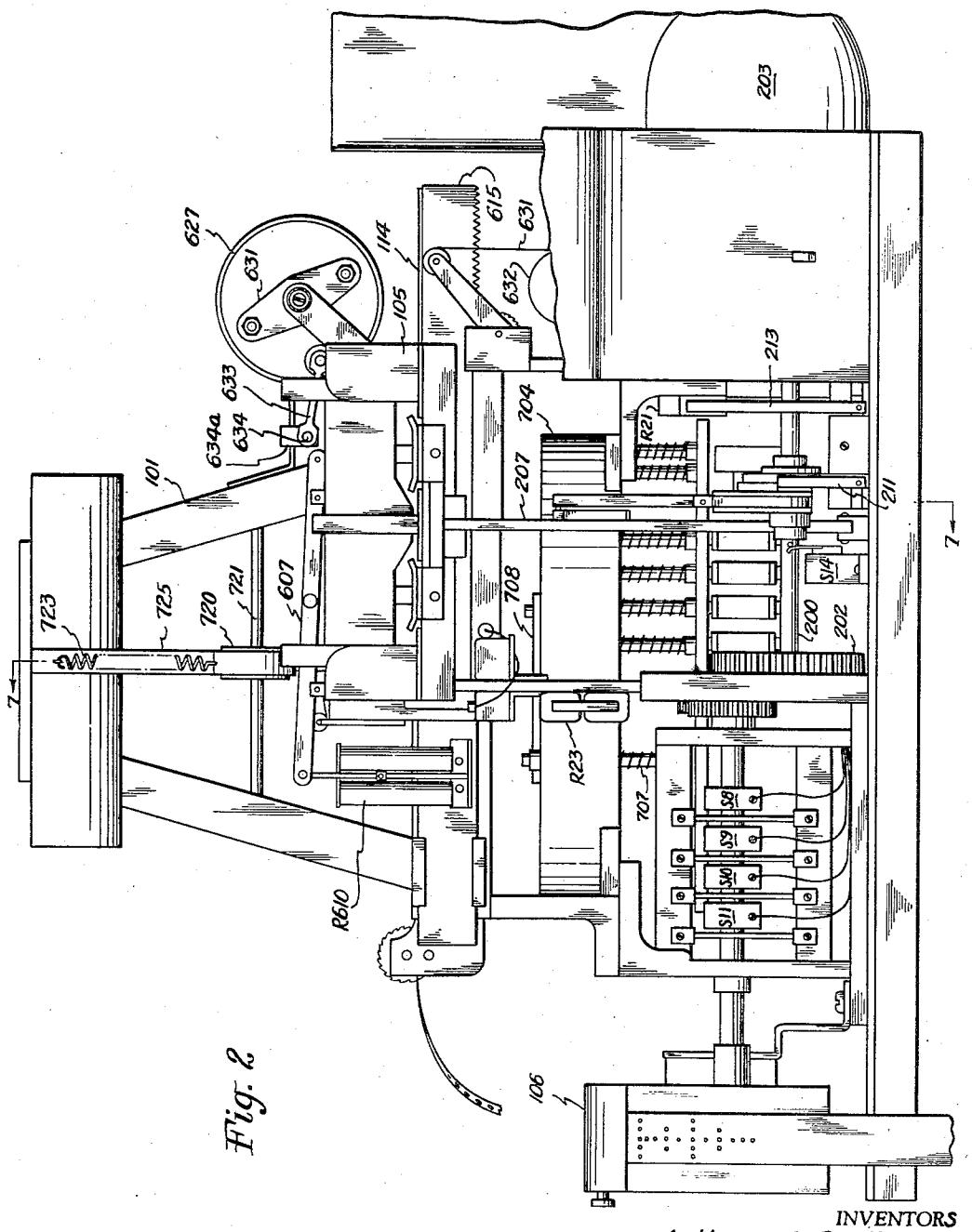


Fig. 2

INVENTORS
Anthony A. Berlinsky
Lester F. Wilkinson
Robert Kee
Leroy T. Wood

BY Arthur Vinograd ATTORNEY
Leonard F. Stoll AGENT

Sept. 30, 1958 A. A. BERLINSKY ET AL 2,854,117

AUTOMATIC STENCIL CUTTER

Filed May 17, 1955 11 Sheets-Sheet 3

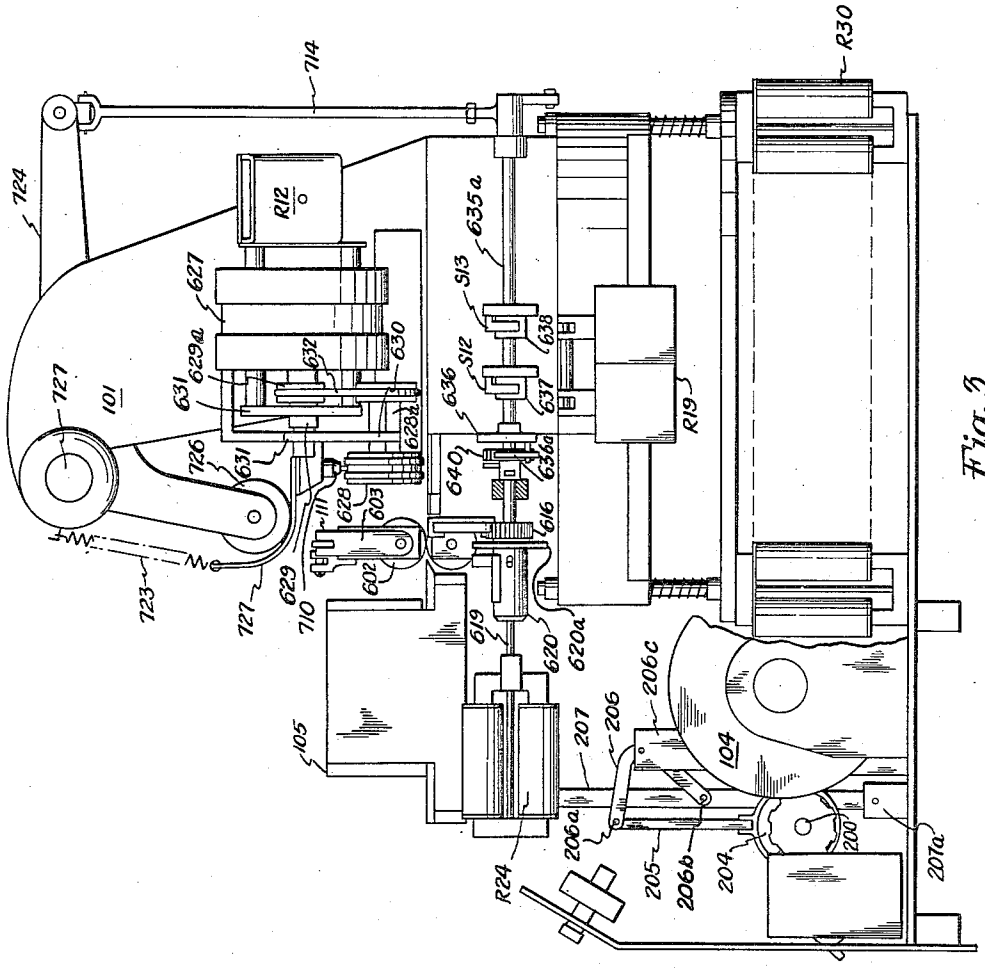


Fig. 3

INVENTORS
Anthony A. Berlinsky
Lester F. Wilkinson
Robert Kee
Leroy T. Wood

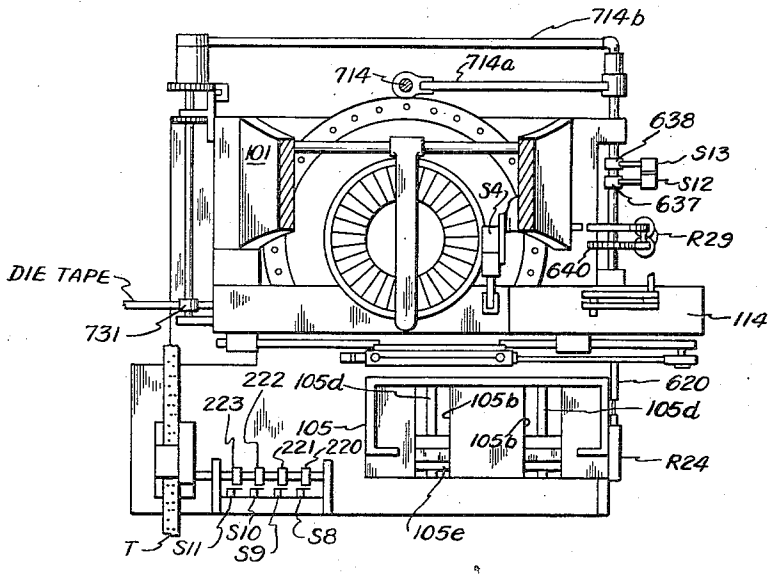
BY Arthur Winograd ATTORNEY
Leonard F. Stoll AGENT

Sept. 30, 1958 A. A. BERLINSKY ET AL 2,854,117

AUTOMATIC STENCIL CUTTER

Filed May 17, 1955 11 Sheets-Sheet 4

Fig. 4



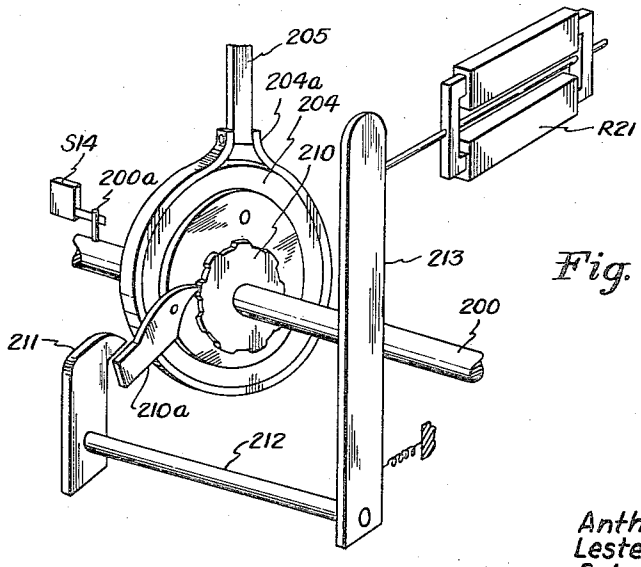


Fig. 8

INVENTORS
Anthony A. Berlinsky
Lester F. Wilkinson
Robert Kee
Leroy T. Wood

BY Arthur Vinograd ATTORNEY
Leonard F. Stoll AGENT

Sept. 30, 1958 A. A. BERLINSKY ET AL 2,854,117

AUTOMATIC STENCIL CUTTER

Filed May 17, 1955 11 Sheets-Sheet 5

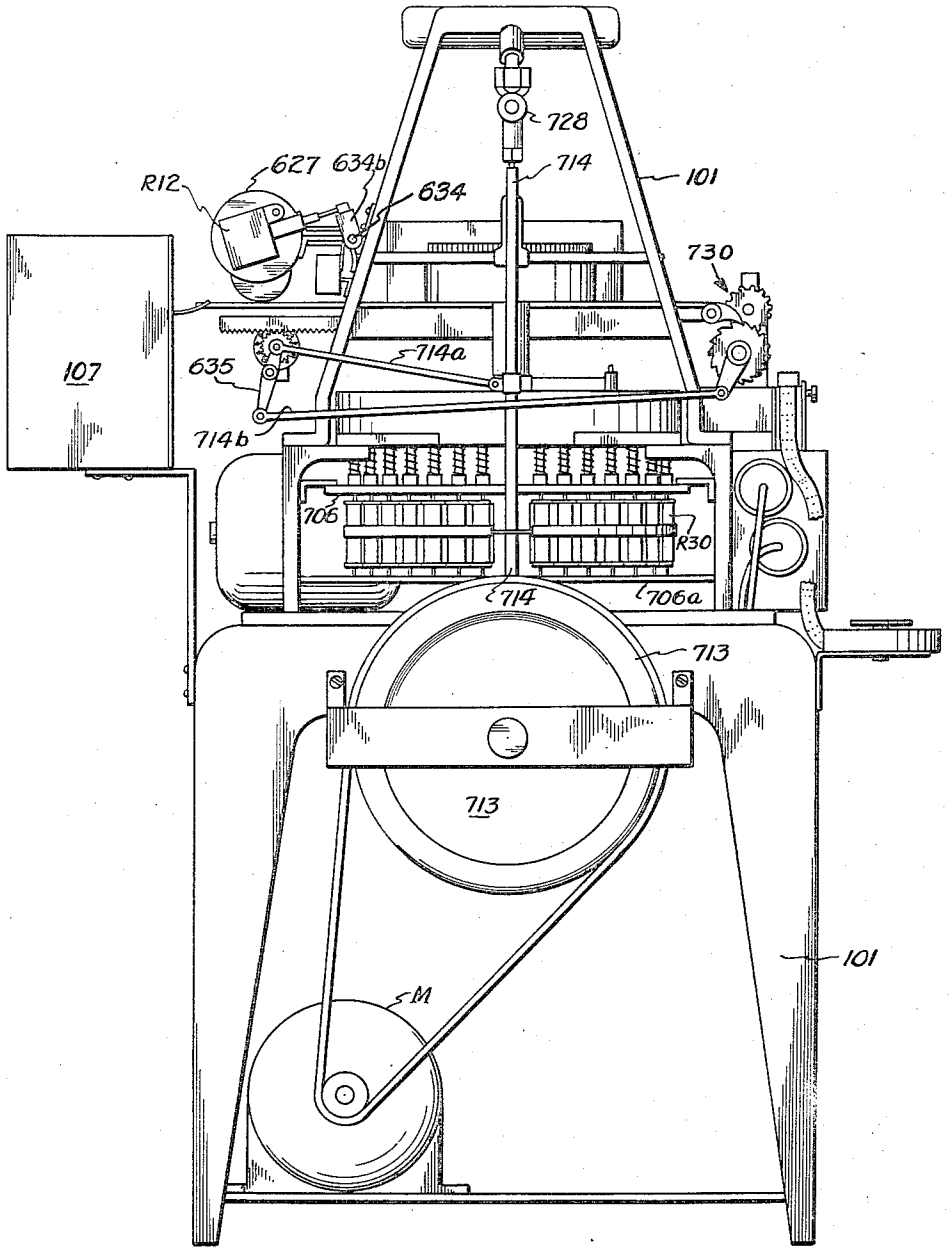


Fig. 5

INVENTORS
Anthony A. Berlinsky
Lester F. Wilkinson
Robert Kee
Leroy T. Wood

BY Arthur Vinograd ATTORNEY
Leonard F. Stoll AGENT

Sept. 30, 1958 A. A. BERLINSKY ET AL 2,854,117

AUTOMATIC STENCIL CUTTER

Filed May 17, 1955 11 Sheets-Sheet 6

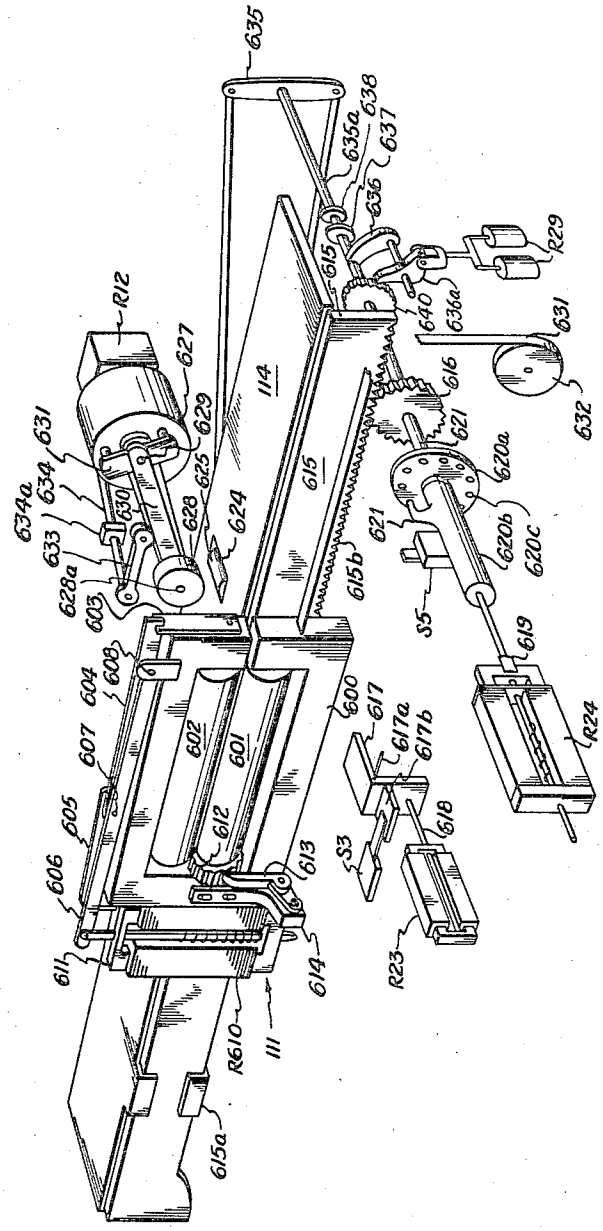


Fig. 6

INVENTORS
Anthony A. Berlinsky
Lester F. Wilkinson
Robert Kee
Leroy T. Wood

BY Arthur Vinograd ATTORNEY
Leonard F. Stoll AGENT

Sept. 30, 1958 A. A. BERLINSKY ET AL 2,854,117

AUTOMATIC STENCIL CUTTER

Filed May 17, 1955 11 Sheets-Sheet 7

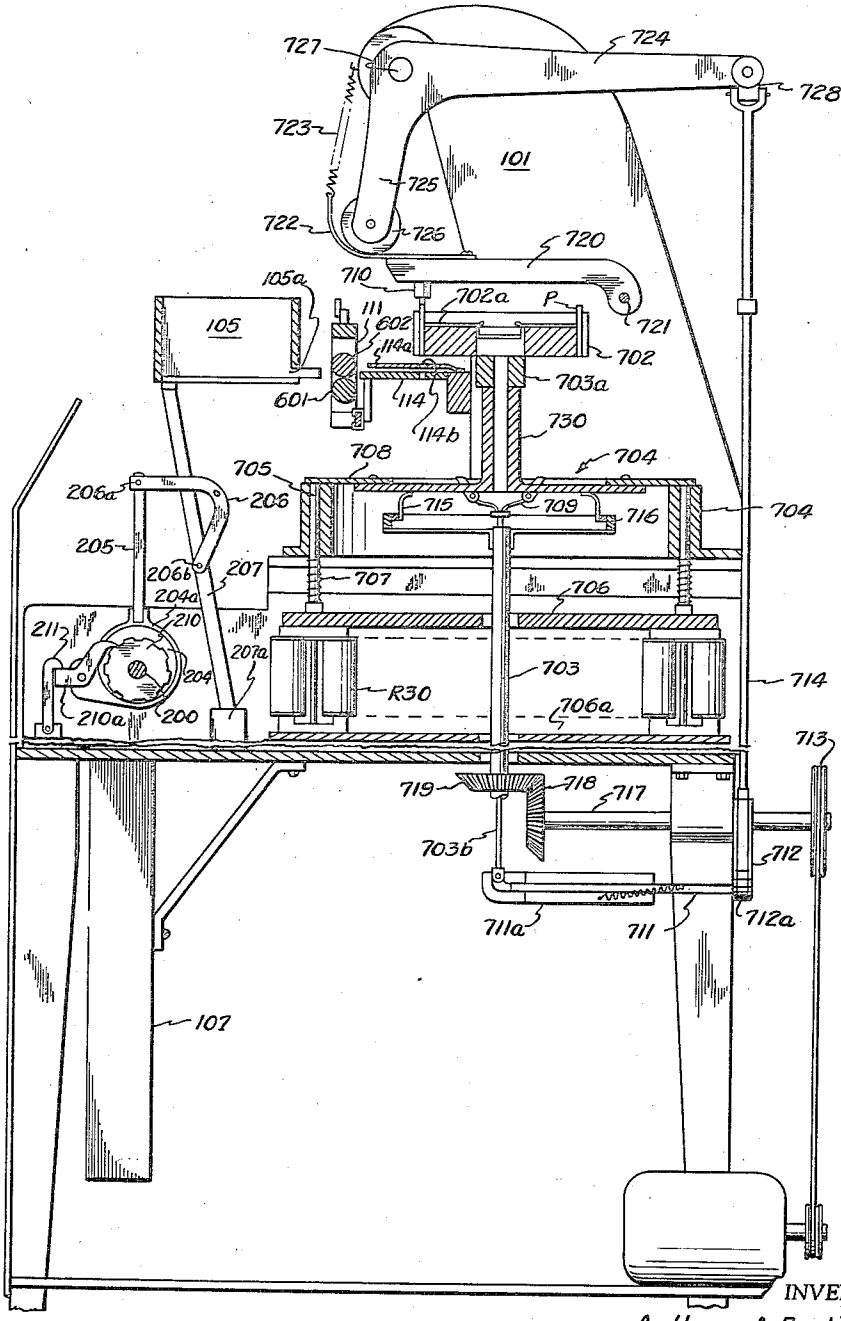


Fig. 1

INVENTORS
Anthony A. Berlinsky
Lester F. Wilkinson
Robert Kee
Leroy T. Wood

BY Arthur Vinograd ATTORNEY
Leonard F. Stoll AGENT

Sept. 30, 1958 A. A. BERLINSKY ET AL 2,854,117

AUTOMATIC STENCIL CUTTER

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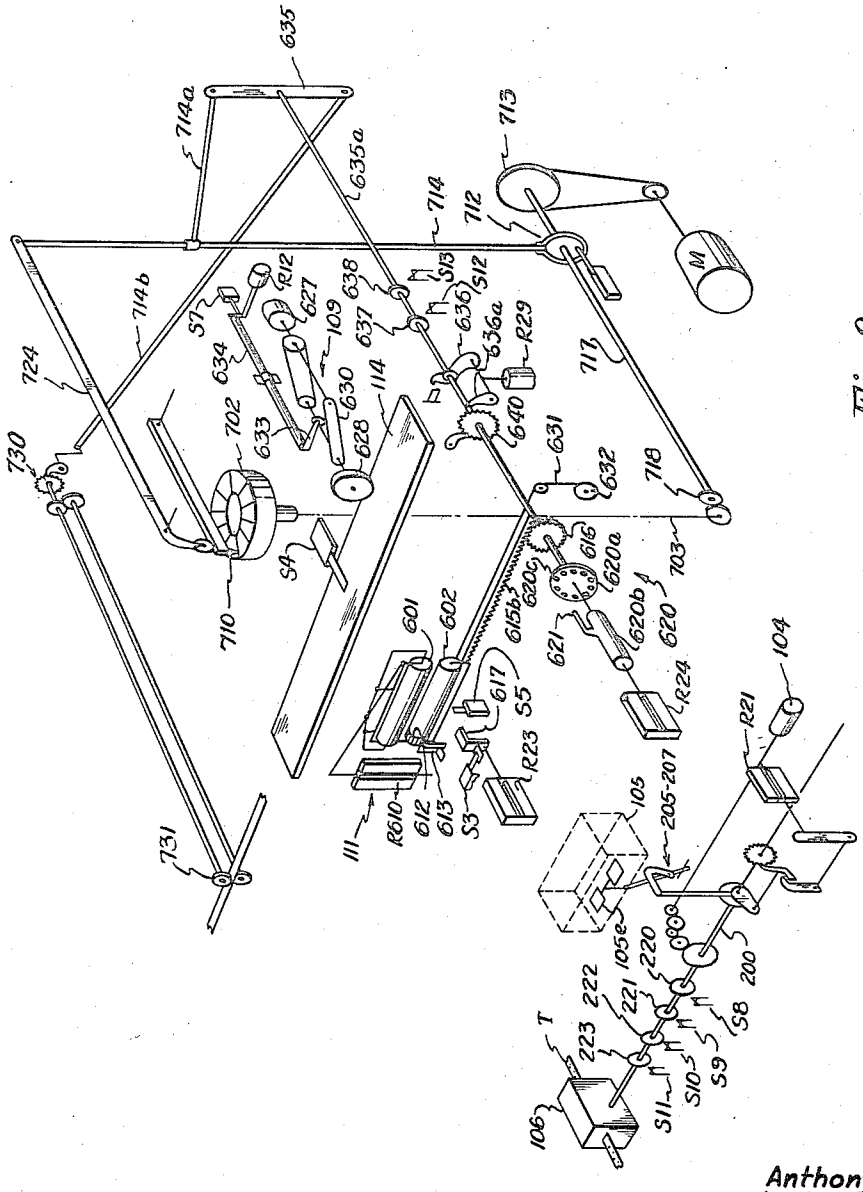


Fig. 9

INVENTORS
Anthony A. Berlinsky
Lester F. Wilkinson
Robert Kee
Leroy T. Wood

BY Arthur Vinograd ATTORNEY
Leonard F. Stoll AGENT

Sept. 30, 1958 A. A. BERLINSKY ET AL 2,854,117

AUTOMATIC STENCIL CUTTER

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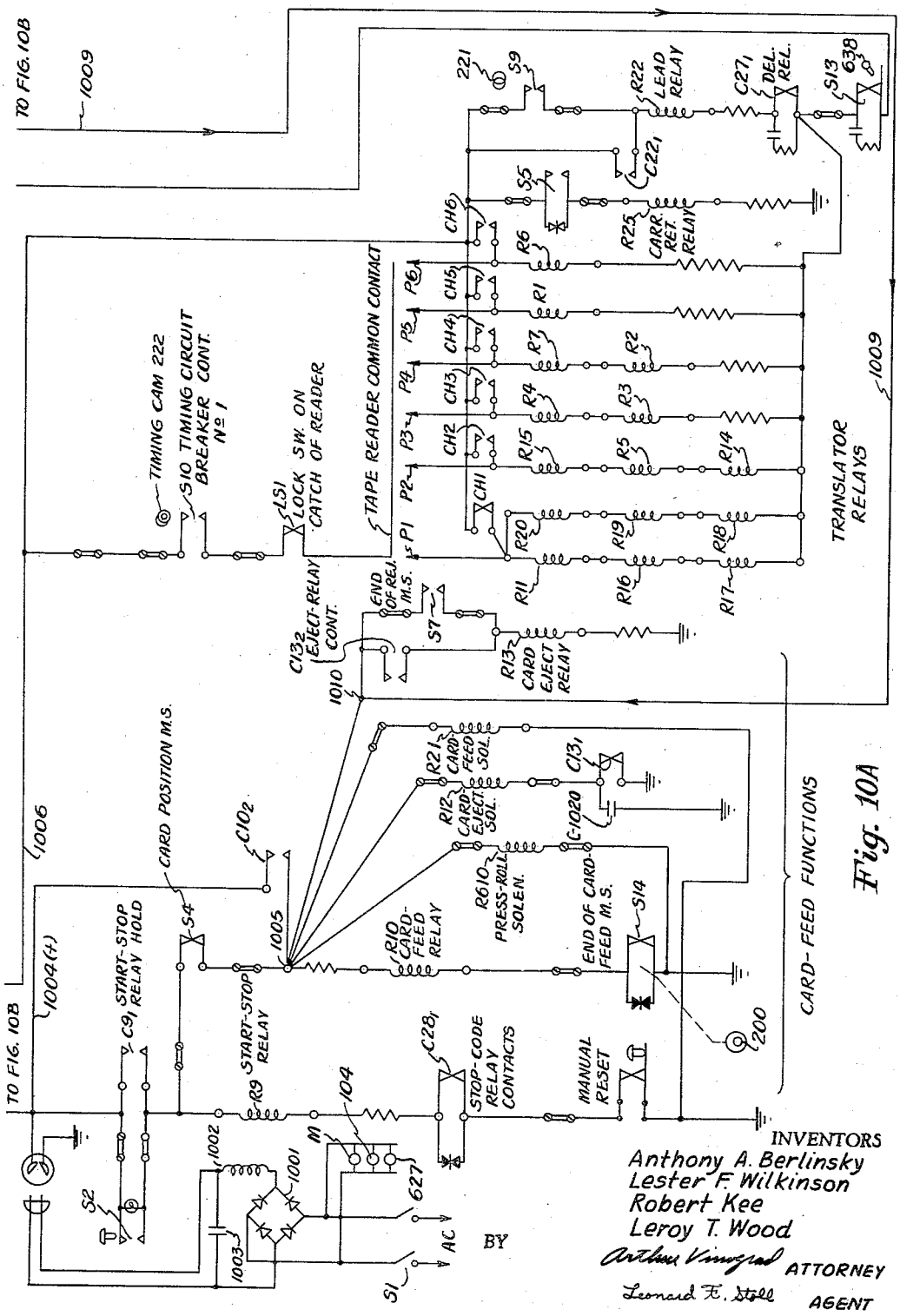


Fig. 10A

INVENTORS
Anthony A. Berlinsky
Lester F. Wilkinson
Robert Kee
Leroy T. Wood

BY Arthur Vinograd ATTORNEY
Leonard F. Stoll AGENT

Sept. 30, 1958 A. A. BERLINSKY ET AL 2,854,117

AUTOMATIC STENCIL CUTTER

Filed May 17, 1955 11 Sheets-Sheet 10

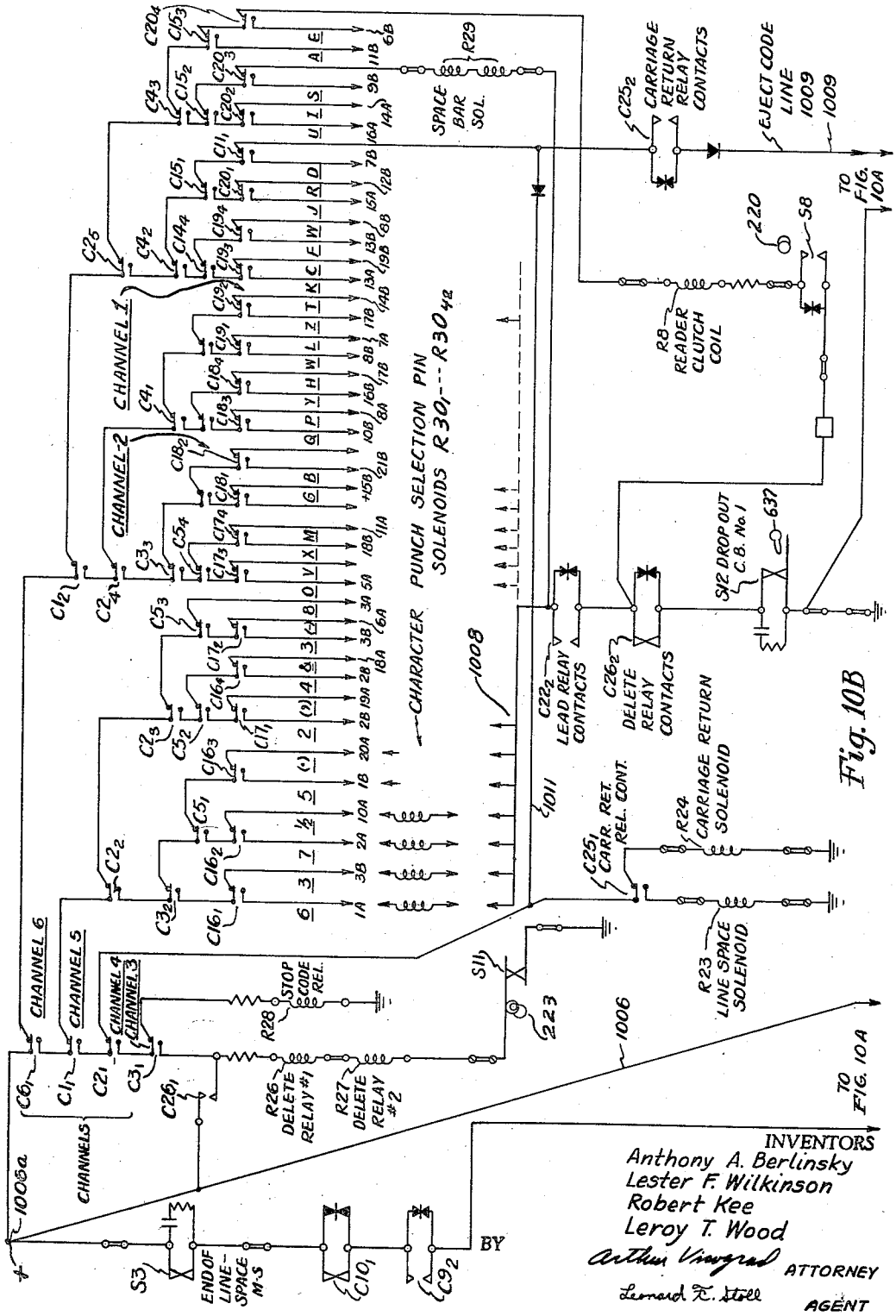


Fig. 10B

INVENTORS
Anthony A. Berlinsky
Lester F. Wilkinson
Robert Kee
Leroy T. Wood

BY Arthur Vinograd ATTORNEY
Leonard F. Stoll AGENT

Sept. 30, 1958 A. A. BERLINSKY ET AL 2,854,117

AUTOMATIC STENCIL CUTTER

Filed May 17, 1955 11 Sheets-Sheet 11

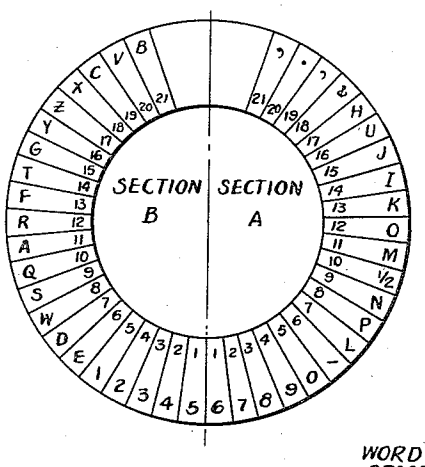


Fig. 11

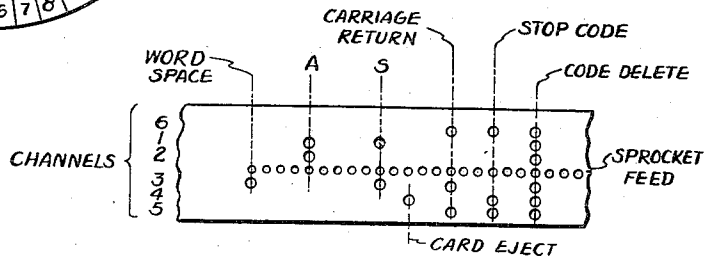


Fig. 12

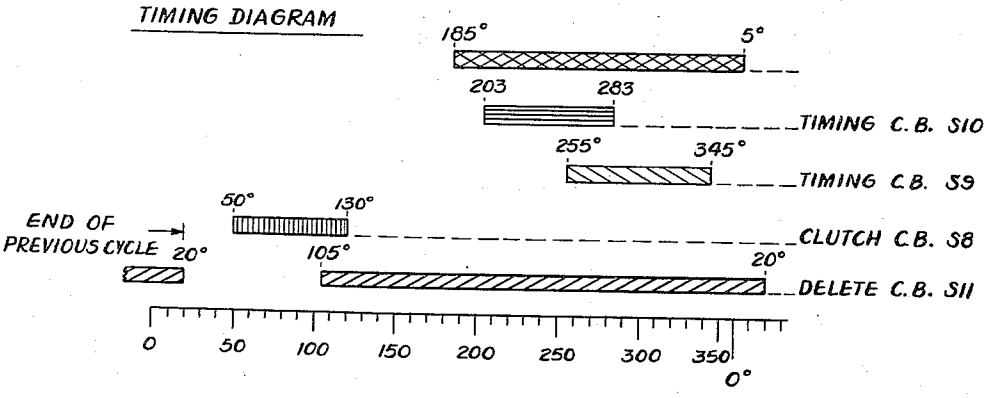


Fig. 13

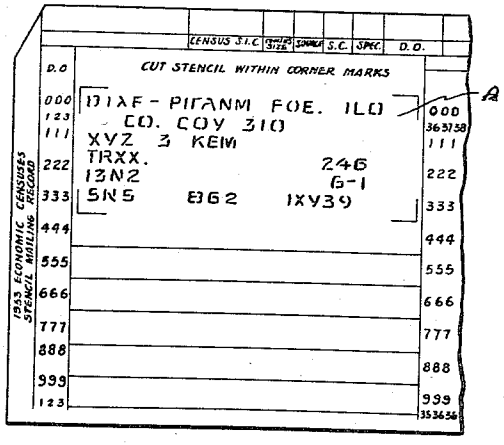


Fig. 14

INVENTORS
Anthony A. Berlinsky
Lester F. Wilkinson
Robert Kee
Leroy T. Wood

BY Arthur Vinogrud ATTORNEY

Leonard F. Stoll AGENT

United States Patent Office 2,854,117 Patented Sept. 30, 1958

2,854,117

AUTOMATIC STENCIL CUTTER

Anthony A. Berlinsky, Washington, D. C., and Lester F. Wilkinson, Churchton, and Robert Kee, Forest Heights, Md., and Leroy T. Wood, Washington, D. C., assignors to the United States of America as represented by the Secretary of Commerce

Application May 17, 1955, Serial No. 509,124

21 Claims. (Cl. 197—20)

This invention relates to an automatic stencil cutter for inscribing intelligence in response to sensed coded information. The invention particularly relates to the inscribing of intelligence such as the particular identity of a subject on a perforated card such as is commonly employed in a data processing machine.

The use of perforated cards on which information data is stored by means of Hollerith coded perforations is well known. The information generally stored on such cards includes, in addition to specific technical data of any variety, coded perforations which identify the subject of the card, as, for example, a person or company, together with the address and serial numbers which give a ready indication of information which further identifies the person or company as to address, age, type of business etc. However, in order to discern such information, the perforated cards must be run through a data processing machine which sorts the cards according to predetermined desired subject categories and then reads and decodes the perforations and prints out the desired information in an automatic typewriter.

If, for example, the name and address of the card's subject is desired, such involved procedure must be performed for each card and the resulting information thereby made available must then be transferred to an envelope either by actuating an automatic typewriter or cutting stencils for subsequent transfer to an envelope.

To obviate the necessity for such involved procedure, the present invention provides a rapid and economical way of providing on each perforated card, in addition to the coded information already provided thereon, an integral stencil which directly indicates desired information such as the name and address of the particular subject corresponding to a card. Thus there is readily available on the card, without subsequent processing, a stencil for directly addressing communications to the subject.

It is therefore an object of this invention to provide an automatic stencil cutter which is singularly adapted to punch out on a conventional perforated card or other record medium the name and address and other identifying information concerning a subject.

It is a further object of this invention to provide an automatic stencil cutter which is automatically operated in accordance with coded information provided by a programming device.

It is a still further object of this invention to provide an automatic stencil cutter which automatically handles stacked groups of cards in sequence and accurately positions and records desired information on a predetermined area of the card.

Still another object of this invention is to provide a sequence controlled stencil cutter which automatically responds to coded instructions provided in the form of programmed information which will perform the operations of (1) selecting a card from a stack, (2) positioning said card in operative position in the stencil cutter, (3) punching out groups of intelligence with automatic spacing between words, (4) automatically line-spacing the perforated information, and (5) ejecting the completed card into a collection hopper.

Other uses and advantages of the invention will become apparent upon reference to the specification and drawings.

Fig. 1 is a perspective view of the automatic stencil cutter as seen from the front;

Fig. 2 is a front elevation of a portion of the machine shown in Fig. 1;

Fig. 3 is a side elevation of the portion of the machine shown in Fig. 2, certain parts being omitted;

Fig. 4 is a top view of the machine shown partly in section and with certain parts omitted for purposes of clarity;

Fig. 5 is a rear view of the machine;

Fig. 6 is an isometric view showing the card carriage together with some of the pertinent control mechanism;

Fig. 7 is a vertical section taken on line 7—7 of Fig. 2 showing the card perforating mechanism;

Fig. 8 is an isometric view which details the card feed mechanism;

Fig. 9 is a mechanical schematic diagram showing the operative relationship among the machine components;

Figs. 10A–10B which form a single diagram with Fig. 10B arranged on top of Fig. 10A is a schematic wiring diagram illustrating the electrical circuitry;

Fig. 11 is a diagrammatic illustration showing the arrangement of the character-punch selecting solenoids employed in the machine;

Fig. 12 details a portion of a preferred type of programming tape employed and further illustrates typical coded instructions and their meaning;

Fig. 13 is a timing diagram showing the operative periods of respective control elements employed;

Fig. 14 shows the type of stencil cutting produced in a typical perforated card, and

Fig. 15 is an isometric view of a special electromagnet construction employed to actuate various mechanisms of the invention.

The overall assembly of the automatic stencil cutter is shown in Fig. 1. The machine includes a cabinet enclosure **100** which houses a main machine frame **101** portions of which are contained within the cabinet in Fig. 1. The frame includes a machine base plate **102** which serves as the support for the card handling mechanism. Mounted on such base plate is the card feed control mechanism generally designated as **103**, the tape reader and card feed drive motor **104**, the card feed hopper **105**, and the tape reading mechanism **106**. A relay type information translator **107** is shown occupying a portion of the interior of the cabinet **100**. Fig. 1 further shows the card storage hopper **108**, the card ejecting roller assembly **109**, and the card perforating punch mechanism **110**. There is also shown in Fig. 1 the shiftable card carriage **111** which is slidably mounted on a guide and is indexed by means of a carriage word spacing mechanism co-operably related with a carriage return solenoid R–**24**. The punch-cards C when in operative position are supported on a platen **114** which extends up to the storage hopper **108**.

In order to orient the various mechanisms involved in the overall functioning of the machine, the general arrangement and operation of the machine will first be described with particular reference to the mechanical schematic diagram shown in Fig. 9.

The machine is automatically sequence-controlled by a perforated programming tape T bearing distinct rows of coded information patterns each containing a particular machine control instruction as shown in Fig. 12.

The programming tape T may be of the type prepared

on a standard Flexowriter coding machine such as is manufactured by the Commercial Controls Corporation, although any known preferred method of preparing programming material can also be employed. In preparing the programming tape the operator, working from known data, will rapidly encode the desired intelligence which is to appear on the punch-card or other record medium which the machine of this invention is adapted to handle, as well as the necessary instructions required by the machine to process the punch-card through various manipulative steps as will be described.

A typical example of the type of information to be cut on the card is illustrated in Fig. 14 which shows a typical commercial punch-card which has been stencil-cut by the mechanism of this invention as indicated by the area A. It will be noted that information in the form of the name and address of a particular addressee together with other pertinent information appears in the form of distinct perforated lines each containing one or more spaced words or information groups. As will be evident from Fig. 12, each character and each particular instruction will be represented by a distinct row of coded perforations respectively on the tape. The correlation between each coded instruction and the particular intelligence or instruction represented thereby is indicated in Fig. 12. For example, a code indicating the alphabetical letter "A" will be represented in coded form by perforations appearing in channels **1** and **2** of the tape while perforations in channels **3**, **5**, and **6** indicate a carriage-return instruction.

The Flexowriter is sufficiently flexible to enable coding of instructions representing each of the 26 alphabetical characters, the various digit numbers from 1 to 9, punctuation marks, special signs, and at least 7 special control functions. The operator, in preparing the program tape, therefore merely types out on the keyboard of the Flexowriter, word by word, the desired information. When the space bar of the Flexowriter is operated, a code containing perforations in channel **3** of the tape appears whereas a line-space code corresponding to perforations in channels **3** and **5** is obtained when the carriage-return key on the Flexowriter keyboard is operated. Similarly a special code occupying channels of the tape is perforated to signify that a card has been completed and will result in the ejection of a completed card.

In this manner an operator can, with great rapidity, code a programming tape with information to be inscribed on a series of perforated cards or other record medium without limit. If the operator were to directly inscribe such intelligence directly on the punch-card by using a standard Elliott type of perforating machine the production efficiency would be greatly decreased because of the necessity of separately feeding a card into the machine and then operating on it in typewriter-like fashion.

The automatic stencil cutter comprising the present invention is designed to accomplish the stencil cutting operation automatically and at high speed. The combined advantages gained by employing the inherent high speed of operation of a tape coding device such as the Flexowriter together with the automatic stencil cutter of this invention are such as to immeasurably increase the productive efforts involved when a large amount of information must be handled. Moreover, the editing and correction of errors in the program tape minimizes the relatively high number of wasted punch-cards which have been inaccurately cut.

Fig. 9 shows the relationship among the principal mechanical components of the automatic stencil cutter comprising the present invention. Certain of the mechanisms involved including the electrical control elements have been omitted from the schematic illustration of Fig. 9 for purposes of clarity. The operative components are shown in their general orientation with respect to the centrally located platen perforating station defined by the operating punch assembly **110**.

The card carriage **111** is indicated in Fig. 9 as being slidably mounted directly in front of the platen **114** and is guided for movement parallel to the platen by means of a guide bar and a rack **615** which is operatively connected to a carriage indexing and return mechanism **620**. The latter mechanism includes a pinion **616** rotatably mounted on the carriage indexing shaft **635***a*. A clutch plate **620***a* is secured to the pinion and is adapted to rotate therewith. The clutch plate includes a plurality of circumferentially arranged, equally spaced holes **620***c* adapted to receive a connecting pin **621** secured to a shiftable sleeve **620**. The sleeve **620***b* is connected to a carriage return solenoid R–**24**. The sleeve **620***b* is normally biased so that the connecting pin **621** engages in the described peripheral holes **620***c* in the clutch plate. The card carriage **111** is normally biased to the right as seen from the front in Fig. 9 by means of a flexible tape **631** one end of which is secured to the card carriage, the other one being connected to the spring biased carriage return drum **632**. The carriage indexing shaft **635***a* carries an indexing ratchet **640** secured thereto which may be intermittently advanced by a pawl **636***a*. The pawl is adapted to be operated either by a rocker plate **636** secured to the indexing shaft or collaterally by the armature of an indexing solenoid R–**29** secured to the machine frame. It will be apparent from Fig. 9, that as the indexing shaft **635***a* is reciprocated by the indexing-shaft lever **635**, the pawl **636***a* will intermittently engage with and step the ratchet wheel **640** in a counterclockwise direction as viewed from the front in Fig. 9. The pinion **616** is directly coupled to clutch plate **620***a* and both such elements are adapted to be connected to the index shaft **635***a* by sleeve **620***b* and pin **621**. When such connection is established, it will be apparent that the card carriage can be advanced step by step to the left from its initial right-hand position in Fig. 9.

As will subsequently be described, each time a character is perforated in the perforated card by the perforating mechanism of the stencil cutter, the indexing shaft will be reciprocated once by lever **635** and the card carriage **111** will consequently be indexed one letter space in conventional typewriter fashion. Word spacing is provided for by specially actuating the above-described carriage indexing mechanism by means of the word-space solenoid R–**29**. The sequenced instructions provided in the programming tape T as described will transmit a word-space instruction signal each time a word space is required. Such signal is manifested by energization of the word-space solenoid R–**29** shown in Fig. 9. As already described, such solenoid is operatively associated with the indexing pawl **636***a* and will therefore act to index the carriage the requisite number of times to provide a word space.

Means are operatively provided in connection with the card carriage **111** to provide for line spacing when called for by an instruction in the programming tape. The card carriage **111** includes a pair of card gripping rollers **601**, **602** which are normally in engagement so as to firmly grip therebetween a punch-card C. The lower roller **602** is provided at one end with a roller indexing ratchet **612** adapted to be stepped by a pawl **613** slidably carried by the frame of the card carriage. As will be described, the roller advancing pawl **613** is adapted to be stepped by a line-space solenoid R–**23** whenever the carriage is in its initial right-hand position as viewed from the front in Fig. 9. Thus when carriage return movement is accomplished the action of the line-space rocker **617** which is secured to a line-space solenoid R–**23** will act to index the rollers and displace the punch-card one line space with respect to the perforating station.

Normally, the line-space solenoid R–**23** is spring biased to hold the rocker **617** in a retracted position to preclude line spacing when the carriage is returned to initial position. When one or more line spaces is required by instructions from the programming tape, the line-space

solenoid will be energized and will pivot the rocker **617** to actuate the line spacing pawl **613** and a line space will thereby be performed. The rocker **617** is adapted to engage the lever of an end-of-line-space micro switch S–3 mounted on the machine frame adjacent the rocker lever **617**. The purpose of this switch is to de-energize the line-spacing control circuit after a line spacing operation has been performed as will be described.

Carriage return movement is obtained by energization of the carriage return solenoid R–24 which will retract the sleeve **620***b* and disconnect pin **621** from engagement with the clutch plate **620***a*. Since only the sleeve **620***b* is connected to index shaft **635***a*, clutch plate **620***a* and pinion **616** are thereby rendered freely rotatable on the indexing shaft **635***a* and the carriage return drum **632** will return the card carriage **111** to its initial right-hand position. An end-of-carriage-return microswitch S–5 is positioned to be intercepted by the carriage when it arrives at such initial position. The microswitch S–5 is operatively related to the carriage-return solenoid circuit to be described and acts to de-energize the solenoid R–24 upon completion of carriage return movement.

A normally closed card-position microswitch S–4 is diagrammatically shown in Fig. 9 mounted over the card platen **114** so that it is held open by a punch-card when carried in the card carriage **111**. Such switch is part of the card feed control circuit and functions to disenable a card feed operation so long as a card is held in the card carriage.

The card perforating and carriage indexing mechanism are both operated by a main drive motor M. As shown in Fig. 9, the motor drives a power shaft **717** through a conventional belt and pulley drive **713** and the power shaft is connected by bevel gears **718, 718***a* to a vertical drive shaft **703** which carries the character punch magazine **702** and character punch selecting mechanism, only portions of which are shown in Fig. 9 for purposes of clarity. The means for selecting a desired character is a modification of a conventional Elliott perforating machine and will be described in connection with the detailed description of the machine construction.

The character punch operating member **710** is reciprocated by a lever **724** and is driven by an eccentric **712** fixed to the power shaft **717** through a one-cycle clutch. When the clutch is engaged, a vertical plunger **714** is reciprocated by the eccentric and causes a selected character punch to perforate the card. The plunger **714** also concurrently transmits reciprocative motion through link **714***a* to the indexing shaft operating lever **635** and, through link **714***b* and ratchet drive **730**, to the die tape feed rollers **731**.

When stencil cutting of a card is completed, ejection of the card from carriage **111** into storage hopper **108** (Fig. 1) is obtained through energization of a card ejection mechanism generally designated at **109** comprising an ejection roller **628**, a card ejection drive motor **627**, a control solenoid R–12 and related linkage. The ejection roller **628** is carried in a normally suspended position above and out of contact with the platen **114** and is continuously driven by the ejection drive motor **627** through a belt drive. The roller **628** is mounted on a carrier arm **630** normally biased to a raised position and pivotally supported by the motor frame. A rocker arm **633** is adapted to engage the carrier arm when actuated by the card eject solenoid R–12 mounted adjacent the eject motor. The rocker arm is connected to the solenoid R–12 by a shaft rockably mounted on the machine frame in a manner to be described. When completion of a card is manifested by an instruction on the program tape, energization of the eject solenoid R–12 will cause the rocker arm **633** to depress the eject roller **628** into contact with the surface of a punch-card lying on the platen **114**. At such point in the operation of the machine the roller-release solenoid R–610 on the card carriage **111** will also be energized to separate the rollers in the card carriage and the punch-card is thereby rendered free to be propelled by the action of the eject roller into the collection hopper.

The machine is provided with mechanism to feed cards for presentation to the perforating station as shown in Fig. 9. The card feed mechanism is mounted in front of the card carriage and platen. The card feed mechanism comprises a card feed hopper **105** and a card feed mechanism **205—207** articulated with the tape reader driving shaft **200**. The shaft is continuously driven by the tape reader drive motor **104**. The card hopper is mounted adjacent the front of the platen and directly in alignment with the referred to space between the rollers **601, 602** of the card carriage **111**. A pair of reciprocating fingers **105***e* are provided in suitable guides at the bottom of the hopper. These fingers are machined so as to be engageable with the edge of a bottommost card only. The linkage **205—207** reciprocates the fingers to feed a bottommost card from the stack into the space between the rollers. A card feed solenoid R–21 is provided which, when energized, initiates a one-cycle clutch arrangement to be described which causes the motor **104** to drive the card feed linkage through a card feed cycle. An extension of the shaft **200** also rotates four timing cams **220, 221, 222, 223** operatively associated with a like number of timing circuit breaker contacts S–8, S–9, S–10, and S–11 whose function in the control circuit will be subsequently described. The timing shaft also energizes a standard Flexowriter tape reading mechanism **106** symbolically shown in Fig. 9.

The operation of the over-all mechanism diagrammatically illustrated in Fig. 9 can now be outlined. The normally closed card position microswitch S–4 mounted on platen **114** is employed to trigger the card feed mechanism when the machine is first started. That is, assuming that there is no card in the card carriage **111**, the card feed control circuit to be later detailed will be energized when the machine is started and cause the linkage **205—207** to feed a card from the hopper **105** to the card carriage **111**. As will be described the pressure roller solenoid R–610 will be energized at such time to separate the rollers **601, 602** and permit entry of the card therebetween. After a card has been positioned in the card carriage, a portion thereof will project on the platen **114** and will therefore engage the operating lever of the card position microswitch S–4 to open and de-energize the card feed control circuit. The card is in continuous engagement with such switch during all perforating and positioning operations and therefore the card feed mechanism is de-energized until a completed card is ejected from the platen. At such time, the switch S–4 will be released to normally closed position and will re-energize the card-feed control circuit and thereby initiate another card-feed cycle.

After a card has been fed into the card carriage, the roller solenoid R–610 is de-energized and the card is firmly gripped by the rollers **601** and **602**. Instructions transmitted as signals from the tape reader **106** are then memorized by a translator mechanism (not shown in Fig. 9) which automatically causes the machine to execute any one of the following six control operations, namely stencil-cutting of a character, word spacing, line spacing, card eject, code stop and code delete.

If a stencil-cutting operation is called for by the program tape, the machine will automatically position the character punch magazine **702** so that the desired character or symbol punch is aligned with the perforating punch **710**. Concurrently, as will be described, the motor M will actuate the arm **724** to perforate the card with a selected character punch and the transmission of such power stroke through links **714***a* and **635** will reciprocate the carriage index shaft **635***a* to shift the card carriage one letter space. If one or more word space instruction signals are sensed on the program tape, the word-space solenoid R–29 is energized the requisite number of times to

also reciprocate the carriage indexing shaft 635*a* through pawl 636*a* and ratchet 640.

Line spacing, which is synonymous with a carriage-return operation, is also accomplished in accordance with a signal from the program tape and causes energization of the carriage-return solenoid R–24 which, as described, releases the clutch finger 621 and allows the carriage return drum 632 to shift the card carriage 111 to its initial (right-hand) position. When the carriage is in such position, the line-space solenoid R–23 is energized to cause the rocker 617 and pawl 613 to rotate the rollers 601, 602 one or more line-space increments and thereby advance the portion of the card lying on platen 114 with respect to the perforating punch.

Upon completion of a card, both the card eject mechanism 109 and the card feed mechanism 205—207 are energized in sequence. When a card is completed, a proper instruction signal will energize the card eject solenoid R–12, the roller-pressure solenoid R–610 will be energized to release the rollers 601 and 602 and the eject roller 628 will then engage with and propel the completed and freed card into the collection hopper. Simultaneously, the card position microswitch S–4 is released to closed position to activate the card feed solenoid R–21. The remaining sequenced control functions will be described in connection with the control circuit.

The above-described mechanisms are specifically implemented in the construction now to be described in connection with Figs. 2–8 and 11–14, the electrical controls for articulating the functions of such mechanisms being described in connection with Figs. 10A—10B.

The card handling mechanism

The card handling mechanism comprises means for feeding a card from the storage hopper 105 into the card carriage 111, carriage control means for manipulating the card in various rectilinear positions with respect to a card perforating station, and means for removing the card from the carriage and ejecting it into the collecting hopper 108. The above operations are divided among (1) the card feed mechanism and (2) mechanisms controlled by the translator in response to instructions from the program tape. Referring to Figs. 3 and 6 the rollers 601, 602 on the card carriage 111 serve the dual purposes of (1) gripping the card to hold it while it is being punched and (2) displacing the card with respect to the carriage to perform line-spacing functions. Once the punch-card is positioned between the rollers in the roller carriage it is firmly gripped thereby in a position such that a portion of the card is positioned on the platen 114 in proximity to the card perforating station defined by operating punch 710. The card carriage 111 is then indexed in typewriter-like fashion one letter-space consequent to a perforation action and, upon completion of a line, the carriage is returned to an initial position at which time the rollers 601, 602 are actuated in a line-spacing operation to advance the card one or more line spaces. Upon completion of a perforating operation, the rollers are separated and the ejection roller 628 propels the completed card into the collector bin 108.

The card carriage 111 is shown in Figs. 3 and 6 as being slidably mounted directly to the rear of the card feed magazine 105 adjacent the upper portion of frame member 101. The construction of the card carriage is more clearly explained in the isometric view of Fig. 6. As shown in this figure, the carriage comprises a U-shaped frame 600 in which a first lower roller 601 and a second upper roller 602 are rotatably mounted. The axis of rotation of the lower roller 601 is fixed, with respect to the frame 600, but the pintles forming the rotational axis of the upper roller 602 are mounted in bearings provided in a pair of similar vertically shiftable carriers 603. Each of the carriers is suspended from the ends of a pair of lifting links 604, 605 which are fulcrumed to the frame 600 and pinned together and to the medial portion of an actuating link 606 at point 607. Link 606 is in turn fulcrumed to the frame 600 by means of a bracket 608.

A roller release solenoid R–610 is fixed to one side of the frame 600 as shown in Fig. 6 and the solenoid is provided with an armature 611 which is pivotally engaged with one end of link 606. In the position shown in Fig. 6, the rollers 601, 602 are normally in engagement, the proximity between the two being sufficient to firmly engage a perforated card which has been positioned therebetween as will become apparent. Energization of the roller-release solenoid R–610 will result in a downward displacement of the armature 611 and the resulting fulcruming of links 606, 605, and 607 will produce elevation of both the carrier plates 603 to separate the upper roller 602 from the lower roller, thereby providing a clearance space to accommodate a card.

The lower roller 601 is provided with a ratchet wheel 612 cooperably related with a ratchet pawl 613 pivotally mounted on the carriage frame 600 by means of a slide 614. It will be apparent that vertical displacement of the slide will cause pawl 613 to engage with and advance the ratchet wheel 612 a distance equal to one line space by means to be described. The carriage frame 600 is provided with a guidebar extension 615 which is slidably mounted in suitable guides 615*a* fixed to the main machine frame 101. A portion of the lower edge of the guidebar is machined to provide a toothed rack 615*b* which is engaged by a pinion 616 forming part of the carriage indexing mechanism to be described.

As is conventional, the initial position of the card carriage is to the right as viewed from the front in Fig. 6, and, as each letter is perforated in the punch-card by the perforating mechanism, the carriage is indexed space by space to the left until a selected line is completed. Line spacing of a card carried between the rollers 601 and 602 is accomplished in a manner similar to the action of a typewriter by shifting the card carriage bodily back to its initial right-hand position. Upon completion of such carriage displacement, the lower portion of the slide 614 will be in position to engage against the nose of a pivoted rocker 617 pivotally secured to the main machine frame by means of a pintle 617*a*. The slide 614 is slidably mounted on the frame 600 of the card carriage and will be displaced upwardly when engaged by the rocker 617.

A line space solenoid R–23 is mounted on the main machine frame below the card carriage (see Fig. 2) and its armature 618 is connected to the bell crank 617. When a line space is called for by a coded representation of the program tape T, the solenoid R–23 will be energized to pivot the rocker 617 which will raise the slide or pawl carrier 614, thus causing the pawl 613 to advance the ratchet 612 and roller 601 one line space. Should a line space not be called for, however, the solenoid R–23 will not be energized so that no line spacing will occur upon return movement of the card carriage.

An end-of-line space microswitch S–3 is disposed adjacent the rocker 617 as shown in Fig. 6 and is adapted to be actuated by an extension ledge 617*b*. As will be later made apparent, the microswitch S–3 is articulated with the line-space solenoid energization circuit to as to de-energize the circuit upon completion of a line-space operation. If repeated line spacings are called for by the programming tape, the line-space solenoid R–23 will be repeatedly energized while the card carriage is in its initial right-hand position and the consequent pivoting of the rocker 617 will actuate the carrier slide 614 to cause pawl 613 to advance the roller 601 a requisite number of times.

Figs. 6 and 3 further show the carriage-return solenoid R–24 which is affixed to the main machine frame below the hopper in the position shown in Fig. 3. The armature 619 of such solenoid is operatively connected to a special clutch comprising sleeve 620*b*, and clutch plate

620*a* which cooperates with the pinion **616** and a further related control linkage to regulate the indexing of the card carriage. A carriage-return tape **631** is provided which connects the slidable card carriage **111** to a carriage-return reel **632** mounted on the machine frame.

The carriage indexing mechanism is constructed to permit indexing of the card carriage **111** (1) following a card perforating operation, (2) upon receipt of a programmed (word space) instruction from the program tape and (3) to permit carriage return movement to its initial right-hand position upon receipt of a line space or other special control function instructional signal from the program tape. To permit such mode of operation, the indexing shaft **635***a* is made in two sections; a rear section to which the reciprocating lever **635** and the pawl driver **636** are secured, and a forward portion on which the sleeve **620***b* is slidably but nonrotatably mounted and to which the ratchet wheel **640** is secured.

The carriage indexing pinion **616** and clutch plate **620***a* comprise a unitary assembly which is rotatably mounted on the forward part of indexing shaft **635***a*. It will be apparent that, as the rear portion of the shaft **635***a* is reciprocated by lever **635**, the pawl driver and pawl **636***a* will step the ratchet wheel **640** and transmit stepwise motion in a counterclockwise direction to the forward portion of the shaft. Assuming that the sleeve **620***b* is in a position wherein the clutch pin is in engagement with a hole **620***c* in clutch plate **620***a*, such step by step motion will be transmitted to the pinion **616** which, in turn will index the card carriage **111** the distance of one letter space at a time in conventional typewriter-like fashion.

It will be noted from Fig. 6 that the indexing pawl is co-laterally connected to the space solenoid R–**29**. Because of such connection, energization of such solenoid will actuate pawl **636***a* independently of the driver **636** and lever **635**. As will be described, the word-space solenoid is energized by an instruction signal from the program tape and imparts sufficient motion to pawl **636***a* and ratchet **640** to index the carriage the equivalent of a word space.

The sleeve **620***b* is normally urged in a direction in which the connecting pin **621** is engaged with the holes **620***c* in the clutch plate **620***a* and the sleeve, pinion **616**, ratchet **640** and the tape are thereby operated in unison as the carriage is indexed. Upon completion of a line of perforations, the carriage-return solenoid R–**24** is energized under instruction of the program tape, displacing the sleeve **620***b* and pin **621** from operative engagement with clutch plate **620***a*. Since the pinion **616** and clutch plate **620***a* are now freely rotatable on shaft **635***a*, the carriage-return spring drum **632** will then retract the card carriage to its initial, right-hand position at which time de-energization of the carriage-return solenoid R–**24** will release the connecting pin into engagement with clutch plate **620***a*.

When a perforated card is positioned between the rollers **601**, **602** in the card carriage **111**, the portion of the card which projects over the platen **114** is adapted to engage and open the normally closed card-position microswitch S–4 (see Fig. 9) which is mounted directly over the platen. The operating arm of the switch is continuously engaged by a card so long as it is held in such position. One function of microswitch S–**4** is to de-energize the card-feed control circuit so long as a card is positioned in the card carriage and thus prevent multiple feeding. After a completed card is ejected from the card carriage, the microswitch S–**4** is closed and thus permits subsequent energization of the card-feed control circuit which then functions to automatically feed a card into the card carriage.

When a card is held in the card carriage, a portion thereof extends over the platen **114** as described. A portion of the platen is provided with a slot **624** (Fig. 6) which gives access to an idler roller **625**, the periphery of which is substantially flush with the upper surface of the platen.

A card-ejection roller **628** is suspended immediately above the slot **624** shown in Fig. 6. The ejecting roller is continuously driven by card ejecting motor **627** secured to the main machine frame **101**. Referring also to Fig. 3, the ejecting roller is shown rotatably mounted on a spindle **628***a* which is eccentrically mounted with respect to the motor shaft **629**. Such eccentric mount comprises a radius arm **630** which is pivotally secured to the motor concentrically with the motor axis by a bracket **631**. A drive pulley **629***a* is also affixed to the shaft of eject motor **627** and is drivingly associated with the eject roller **628** by a belt **632**. The radius arm **630** is normally suspended in an elevated position with respect to platen **114** by a spring (not shown) and is adapted to be pivoted downward by means of a shifter **633** (see Fig. 6) which is pivoted to the frame and connected to a control shaft **634**.

A card-eject solenoid R–**12** is secured to the rear of the motor **627** as shown in Figs. 3 and 6. The armature of the solenoid R–**12** is connected to a crank arm **634***b* (see Fig. 5) which is keyed to the shaft **634**. The shaft **634** is rotatably mounted in bearings **634***a* (Fig. 6) fixed to the machine frame and is therefore subject to rotation when the card-eject solenoid R–**12** is energized. Rotation of such shaft will obviously cause the shifter **633** to depress the radius arm **630** and ejection roller **628** into contact with the guide roller **625** mounted below the platen. As is apparent, when the card carriage has been shifted to its initial right-hand position, and upon receipt of a completion signal from the program tape, energization of the card eject solenoid R–**12** will cause the roller **628** to engage the surface of the card and propel the completed card along the platen **114** and into the collection bin **108**.

The carriage indexing shaft **635***a* also has secured thereto a pair of circuit breaker operating cams **637**, **638** adapted to co-act with a first and second set of circuit breaker contacts S–**12** and S–**13** as shown in Fig. 9 for a purpose to be described.

Fig. 6 also shows the orientation with respect to the card carriage of the end-of-carriage-return microswitch S–**5**. The operating lever of such switch is disposed in the path of the frame of the card carriage **111** so as to be actuated thereby when the card carriage is returned to its initial right-hand position. Actuation of such switch acts to disenable the carriage-return solenoid (R–**24**) energization circuit as will be described.

Card feed mechanism

The card-feed mechanism comprises a card-feed hopper **105** (Figs. 3, 4, and 7) and a motor driven automatic card-feed linkage which is detailed in Figs. 3 and 7. The hopper **105** comprises a rectangular storage box suitably dimensioned to accommodate a standard Hollerith type punch-card. The front wall of the hopper as shown in Fig. 7 is provided with a slot **105***a* adjacent the bottom surface through which a bottommost card may be projected into the card carriage **111**. As noted in Fig. 7, the bottom of the card hopper, the space between the card holding rollers **601** and **602** in the card carriage **111** and the top surface of the platen **114** lie on a common horizontal plane. A portion of the platen **114** is provided with a guide plate **114***a* made of spring material and which forms a card receiving pocket. The guide plate also includes an opening **114***b* for accommodating the character punch.

As best shown in the top view of Fig. 4, the bottom surface of the card hopper **105** is provided with a pair of slots **105***b*, extending the width of the hopper, and a guide bar **105***d* is suitably mounted in the center of each slot. A card feeding finger **105***e* is slidably mounted in each of the slots on a respective one of the guide bars. Each feeding finger **105***e* comprises a plate hav-

ing a machined edge which is so proportioned as to be engageable with the thickness of a single one of the cards in the hopper.

Referring to Figs. 2, 3, 7, and 8, the card feeding mechanism further includes an eccentric **204**, a connecting rod **205**, a bell crank **206** and a reciprocating card-feed lever **207**. The eccentric **204** is rotatably mounted on the motor driven tape-reader drive shaft **200** and is provided with an eccentric strap **204***a* connected to one end of the connecting rod **205**. The other end of the connecting rod is connected with one arm of bell crank **206** by means of a pin **206***a* (see Figs. 3 and 7) while the other arm of the bell crank is connected to a medial portion of the reciprocable card-feed lever **207** at **206***b*. The center of the bell crank and the lower end of the reciprocable lever are connected to the main machine frame by pillow blocks **206***c* and **207***a* respectively (Fig. 3). The upper end of the reciprocable card-feed lever is connected to the described card-feed fingers **105***e*.

The eccentric **204** is normally freely rotatable on the motor driven shaft **200** and is adapted to be operatively engaged therewith by means of a one-cycle clutch which is clearly detailed in Fig. 8. The clutch comprises a ratchet wheel **210** fixed to the shaft **200**, a pawl **210***a* rotatably mounted on the eccentric and a latch **211**. The latch **211** is connected by means of a shaft **212** to an operating lever **213** which is operatively engaged by the described card-feed solenoid R–**21** (see also Figs. 2 and 9).

As is apparent from Fig. 8, the latch **211** normally holds the pawl **210***a* in a retracted position with respect to the ratchet **210**. Energization of the card-feed solenoid R–**21** will rock lever **213** and latch **211** to undog the pawl **210***a*, the nose of which is thereby projected, by a spring (not shown), into engagement with the teeth of the ratchet wheel **210**, thereby establishing a connection between the rotating shaft **200** and the eccentric **204**. An end-of-card-feed microswitch S–**14** is mounted on the machine frame adjacent the eccentric **204** and the arm of the switch is positioned to lie within the path of an operating projection **200***a* mounted on the shaft. Such projection is oriented with respect to the shaft **200** so that it will engage the operating arm of the microswitch S–**14** after a card-feed cycle has been initiated and will therefore act to de-energize the card-feed solenoid R–**21**, to prevent more than one cycle of the card-feed mechanism. The card-feed solenoid R–**21** is energized when operation of the machine is initiated as will be explained in connection with the description of the control circuit.

Referring to Figs. 3 and 7, when the eccentric **204** is rotated, it will rock the bell crank **206** about its fixed fulcrum **206***c* and thereby reciprocate the card-feed lever **207**. The consequent shifting of the card-feed fingers **105***e* (Fig. 4) causes the lowermost one of the cards in the hopper **105** to be projected through slot **105***a* (Fig. 7) and into the space between the rollers of the roller carriage **111**.

Card perforating mechanism

The card perforating mechanism employed with the automatic stencil cutter is similar in construction to that employed in the conventional Elliott Stencil Cutter but has been suitably modified for automatic operation in connection with the sequence controlled operational features of the present invention.

Fig. 7 is a vertical section taken partially through the center of the machine and clearly shows the operative elements connected with the perforating mechanism. Inasmuch as many of the components employed form part of the referred to Elliott machine, only those portions will be described in detail which have been modified for use in connection with the present invention.

A character-punch magazine **702** in the form of a drum is mounted for rotation about a vertical axis defined by the shaft **703** as shown in Fig. 7. The magazine includes a plurality of peripherally arranged pockets each of which contains a character-perforating punch P corresponding to any desired number, symbol, letter or other intelligence. Each of the character-perforating punches is normally held retracted in its respective pocket by a spring **702***a* which is anchored to the character punch and to the cylinder **702** respectively as is conventional in the Elliott machine.

The magazine **702** is normally constantly rotating while the machine is in operation and indexing of a selected character punch is accomplished by abruptly stopping the magazine at a position in which the selected character is aligned with the fixed perforating station defined by the position of the operating punch **710**. The magazine is supported for rotational movement by a bearing **703***a* fixed to the main machine frame **101**.

A selector pin assembly **704** comprising a cylindrical housing is provided directly below the magazine for indexing the magazine. The assembly is fixed to the machine frame and is provided with a plurality of peripherally arranged pockets corresponding in number to the number of character punches carried by the magazine **702**. A character-punch-selection stop pin **705** is slidably mounted for movement in a vertical direction in each of the pockets in the cylindrical housing. The upper end of each stop pin is normally flush with the upper surface of the housing **704** but each stop pin is adapted to be selectively projected beyond the housing surface against the action of a coil spring **707**. In accordance with the present invention, a plurality of solenoids R–**30** of the general type detailed in Fig. 15 are nested between a pair of supporting plates **706**—**706***a* below the stop pins and fixed to the machine frame. The solenoids R–**30** are arranged in alignment with and are operatively connected to each of the stop pins **705**.

A sensing arm **708** is shown in Fig. 7 as being rotatably mounted above the upper surface of the stop pin assembly housing **704** and is provided with a pair of oppositely disposed pin sensing fingers which are not detailed in the drawing. The sensing arm rotates conjointly with the magazine **702**. The fingers are pivoted to the opposite ends of the sensing arm. A pair of clutch operating levers **709** are pivotally mounted on the sensing arm and are each operatively connected to the inner ends of each of the sensing fingers, respectively. Such construction except for the solenoids R–**30** is characteristic of the referred to Elliott perforating machine and is not further described in detail. It is apparent however from Fig. 7 that when the sensing fingers on the rotating sensing arm **708** come into contact with a selected one of the stop pins which has been projected by energization of one of the selection solenoids R–**30**, the sensing finger will be pivoted and thereby actuate the clutch operating levers **709**. These levers are pivoted about a horizontal axis and will function to project downwardly an internal clutch operating plunger **703***b* which is slidably mounted within the vertical spindle **703**. The plunger **703***b* causes translation of a clutch operating bar **711** slidably mounted in a guide **711***a* secured to the machine frame. The purpose of the clutch operating bar is to initiate the one-cycle clutch forming part of the eccentric drive **712** for the punch operating mechanism which provides a connection between the main drive flywheel **713** and the vertically reciprocable connecting rod **714**.

The rotating sensing arm **708** is further provided with a plurality of friction fingers **715** which extend downwardly into engagement with the internal face of an annular friction ring **716** which is supported for rotation by the referred to hollow spindle **703**. The magazine **702** is united to the sensing arm **708** by means of a hub **730** and, because of the frictional contact beween the friction fingers **715** and the annular ring **716**, it will be apparent that, as the spindle **703** is continuously rotated by the drive shaft **717**, the sensing arm **708** and the magazine will rotate in unison. The drive shaft **717** is

connected to the motor driven pulley **713**, and to spindle **703** by bevel gears **718**, **719**.

When the rotating sensing arm **708** is intercepted by a projected one of the stop pins, both the arm and the magazine will be abruptly stopped in a position so that the desired character punch is in alignment with the power-driven actuator punch **710**, the friction fingers **715** permitting the spindle to rotate continuously after the magazine is stopped in indexed position.

The actuating punch **710** is carried at the end of a pivoted lever **720** which is pivotally mounted on the machine frame by shaft **721**. A curved track **722** extends from the free end of the lever **720** and is connected to the machine frame by an expansion spring **723**. An operating ram comprising a lever **724** is pivoted to the machine frame as indicated at **727**. The ram includes an extension **725** which carries a roller **726** adapted to engage with the curved track **722**.

The portion **724** of the ram extends to the rear of the machine as shown in Fig. 7 where it is connected to the vertically extending connecting rod **714** by means of a suitable coupling **728**. The connecting rod is connected to the power shaft by means of an eccentric strap **712***a* straddling an eccentric which is secured to the motor driven power shaft **717**. The eccentric mechanism which forms part of the conventional Elliott machine includes a single-cycle clutch of standard design and the eccentric therefore normally idles with respect to the power shaft **717**. When the plunger **703***b* has been actuated in the described manner as a result of a character-punch selecting operation, the clutch operating bar **711** will energize the clutch, and the connecting rod **714** and ram **724** will be driven by the eccentric **712**. The consequent displacement of roller **726** will depress the lever **720** and cause the selected character punch to perforate a card positioned at the perforating station of the machine.

Timing mechanism

The tape reader drive shaft **200** as shown in Figs. 4 and 9 includes a plurality of operating cams **221**, **222**, **223**, and **224** associated with (1) the clutch circuit breaker contacts S–8, (2) timing circuit breaker contacts No. 2 S–9, (3) timing circuit breaker contacts No. 3 S–10, and (4) the delete circuit breaker contacts S–11. The purpose of these cam operated circuit breakers is to enable and disenable specified portions of the control circuit at predetermined periods during the operating cycle of the machine as indicated in the timing diagram of Fig. 13. The above-referred to timing cams are also designated symbolically in the circuit diagram of Figs. 10A and 10B and their specific functioning will be further detailed in connection with the description relating thereto.

The carriage indexing shaft **635***a* which is reciprocatively driven by the card perforating mechanism or the word space solenoid as described carries a plurality of operating cams **637** and **638** as indicated in Fig. 6. (See also Figs. 3 and 4.) The cams **637** and **638** are operably associated with the drop out circuit breaker No. 1 contacts S–12 and the drop out circuit breaker No. 2 contacts S–13. These cams are symbolically indicated in the circuit diagram of Figs. 10A and 10B in relation to the contacts S–12 and S–13 which are shown in operative relation with the control circuit in the circuit diagram. The purpose and function of these switches will be discussed in connection with the description of the circuit diagram.

Electrical control system

The electrical control system which governs the automatic sequencing of all of the described mechanisms in response to instructions obtained from the programming tape is illustrated in circuit-diagram form in Figs. 10A and 10B which, considered together, form a single diagram. The various control solenoids, relays and switches which are operatively related to the various mechanisms as has been established in connection with the description of Figs. 1–9 are indicated in the circuit diagram in the relationship which they have in the control circuit.

In general, the portion of the circuit shown in Fig. 10A comprising the card-feed relay R–**10**, roller pressure-release solenoid R–**610**, card-eject solenoid R–**12**, card-feed solenoid R–**21** and card-eject relay R–**13** comprise the card-feed control function circuit while the portion of the circuit illustrated in Fig. 10B mainly comprises the details of the translator and the remainder of the control circuit.

The character punch selecting pin solenoids R–30_1 . . . R–30_{42} described in connection with Fig. 7 are diagrammatically shown in part in Fig. 10B. There are 42 of such pin selection solenoids circumferentially arranged according to the diagram of Fig. 11. As will be noted from Fig. 11, the solenoids are divided into two groups marked as Section A and Section B respectively for purposes of identity. The 21 solenoids in each group or section are similarly designated as **1**, **2**, **3**, etc., being numbered through **21**. Adjacent the solenoid identifying number, the character symbol associated with each solenoid respectively is indicated. Thus solenoid number **9** in Section A (i. e. A**9**) corresponds to the letter "A" while the like numbered solenoid in Section B (B**9**) corresponds to letter "S." Similarly solenoid **6** in Section A (A**6**) identifies a "minus" symbol, etc. The table below tabulates the various character punch symbols with a respective pin selecting solenoid for reference purposes.

Solenoid Number (Fig. 11)	Section A Character	Section B Character
1	6	5
2	7	4
3	8	3
4	9	2
5	0	1
6	-	E
7	L	D
8	P	W
9	N	S
10	½	Q
11	M	A
12	O	R
13	K	F
14	I	T
15	J	G
16	U	Y
17	H	Z
18	&	X
19	'	C
20	.	V
21	,	B

The solenoids R–**30** are indicated in Fig. 10B by the identifying number and section as tabulated in the above chart. Each of the pin selecting solenoids is operatively associated with the translator mechanism as will be described.

Control circuitry

The power requirements are obtained from an A.-C. source to which the machine is connected through a main switch S–**1** as shown in Fig. 10A. The three motors employed as the operative drive elements namely the perforator motor M, the tape reader drive motor **104**, and the card eject motor **627** are each continuously operated from the A.-C. source when switch S–**1** is closed.

The control circuit is D.-C. energized from a power supply of conventional construction employing rectifier **1001**, choke filter **1002** and filter condenser **1003**. When the main switch S–**1** is closed the machine is in idling condition in which start switch S–**2** is open, start-stop relay R–**9** is de-energized and start-stop contacts C–9_1 and C–9_2 associated with relay R–**9** are open. Contact C–9_2 is shown in Fig. 10B.

To initiate action of the machine, push-button type start switch S–**2** is momentarily closed which completes an energization circuit from the positive line **1004** through

R–9 to ground. C–9_1 is thereby closed to complete a hold circuit for R–9. The normally closed card position microswitch S–4 is mounted adjacent the card platen as already described so as to be held open during the time a punch-card is present in the card carriage, and is therefore normally closed at the beginning of a card-feed operation. The above-described actuation of the start switch S–2 will therefore result in the completion of a circuit through such microswitch S–4 with consequent energization of the following circuits which are paralleled to terminal **1005**: (1) card-feed relay R–**10**, (2) the roller pressure-release solenoid R–**610**, (3) the card-eject solenoid R–**12**, and (4) the card-feed solenoid R–**21**. These four parallel connected relays R–**10**, R–**610**, R–**12**, and R–**21** control operation of the card-feed mechanism. Thus, as previously described, energization of the roller pressure-release solenoid R–**610** separates the card gripping rollers **601**, **602** (Fig. 6) on the card carriage **111**, the card-eject solenoid R–**12** causes the card-eject roller to engage a card on the platen while the card-feed solenoid R–**21** (Fig. 8) in conjunction with card-feed relay R–**10** initiates the action of the card-feed mechanism. Referring to Fig. 8 energization of the card-feed solenoid R–**21** pivots the lever **213** causing latch **211** to undog pawl **210***a*. The pawl is thereby caused to engage with the ratchet **210** which is being constantly rotated by tape reader drive motor **104** and the consequent reciprocation of feed lever **207** (Fig. 7) expels a bottommost card from hopper **105**. Energization of the roller pressure-release solenoid R–**610** will have provided a gap between the rollers **601**, **602** to receive a card and the card is thereby positioned between the carriage rollers with a portion thereof lying on platen **114** under the guide leaf **114***a* (Fig. 7). By the same instrumentalities a previously completed card will have been released from engagement with the rollers **601**, **602** and energization of the eject solenoid R–**12** will cause the eject roller **628** shown in Fig. 6 to engage with and propel a completed card into the collection bin as described.

Energization of card-feed relay R–**10** closes contact C–10_2 to complete a hold circuit therefor and thus provides a continuing positive potential at terminal **1005** after the normally closed card-position microswitch S–4 is actuated to an open position and kept open by a card when it is in position on platen **114**. As previously described, operation of the card-feed mechanism through one cycle causes actuation of the normally closed end-of-card-feed stroke microswitch S–**14** (see also Fig. 8) and such switch is therefore opened after a card has been fed from the hopper to the card carriage. Therefore, as soon as a card is in place, the card-feed relay R–**10** is immediately de-energized to release its hold contact C–10_2. Since terminal **1005** is also de-energized thereby, all three of the card-feed control elements R–**610**, R–**12**, and R–**21** are inactivated. In other words, the card gripping rollers **601**, **602** on the card carriage are thus reengaged to hold the feed card, the card-eject roller is restored to inactivated position and further card feeding is cut off.

Upon completion of a card-feed cycle in the manner described, the elements and control circuits which perform the 6 described control functions are automatically readied for operation by the programming tape as follows.

Energization of the card-feed relay R–**10** will have opened the normally closed card-feed relay contacts C–10_1 (Fig. 10B) but, after a card is in place in the card carriage, the resultant opening of the card-position microswitch S–4 and consequent de-energization of R–**10** will now cause C–10_1 to assume its normally closed condition. A circuit is thereby completed from positive terminal **1004** through C–9_2 (which has been closed by energization of start-stop relay R–**9**) and the normally closed end-of-line microswitch S–**3** and conductor **1006** to the translator network illustrated in Fig. 10B so that the reader clutch coil R–**8** is energized at a predetermined time in the cycle of the machine defined by the closing of the clutch circuit breaker contacts S–**8** by the described cam **220**.

Such clutch coil is associated with the standard Flexowriter tape reader mechanism **106** (Fig. 1) and functions to release the sensing pins P–**1** . . . P–**6** (Fig. 10A) of the reader mechanism in order to sense the perforated code on the programming tape. In the event no perforations are present on the portion of the tape then being passed through the reader, all circuits remain the same and the reader clutch coil R–**8** will be re-energized cyclically by the cam operated circuit breaker S–**8** with each revolution of the tape reader drive shaft **200** until a line of information in the form of a perporated code on the tape is sensed.

The pertinent portions of the Flexowriter tape sensing mechanism which are integrated into the control network shown in Figs. 10A and 10B are indicated in Fig. 10A by the pin contacts designated as P–**1** . . . P–**6**, respectively. Such designated contacts represent the six code sensing pins provided on the conventional Flexowriter tape reading mechanism to sense the standard six-column coded information representation provided on the programming tape.

The four circuit breaker contacts S–**8**, S–**9**, S–**10**, and S–**11** and associated operating cams **220**, **221**, **222**, **223** mounted on the tape reader drive shaft as described in connection with Figs. 4 and 9 include the timing circuit breaker contacts S–**10** shown in Fig. 10A adjacent the sensing contacts P–**1** . . . P–**6**. A conductor **1006** connects the source of positive voltage with such contacts so that when S–**10** is closed by its operating cam **222** during the portion of the cycle of the tape reading mechanism drive shaft indicated in the timing chart of Fig. 13, an energization path is completed through the lock switch LS–**1** forming part of the reader mechanism and to any combination of the sensing contacts P–**1** . . . P–**6** which are closed by the coded perforations on the tape. It will be noted from Fig. 13 that the period allowed for energization of the reader pins P–**1** . . . P–**6** occurs between 185° and 5°. Therefore, since the contacts S–**10** are closed in the period between 203° and 283°, it completes its cycle of operation within the time period defined by the reader pins. Accordingly, there will be established a definite pattern of energized relay coils R–**1** . . . R–**20** in the translator portion of the control mechanism now to be described.

As described, the tape reader drive shaft **200** carries a plurality of timing cams **220**, **221**, **222**, and **223** (Figs. 4 and 9) which are each cooperatively arranged to operate a like number of timing circuit breaker contacts S–**8**, S–**9**, S–**10** and S–**11**. The respective cams are shown adjacent each timing circuit breaker in the circuit diagram of Figs. 10A and 10B. The first timing circuit breaker contacts S–**8** are identified as the clutch circuit breaker since, as indicated in Fig. 10B, it forms part of the energization circuit for the reader clutch coil R–**8** comprising a part of the Flexowriter tape reading mechanism and functions to actuate the program tape reading or sensing pins P–**1** . . . P–**6**.

The second circuit breaker contacts S–**9** (Fig. 10A) determine energization of the lead relay R–**22**.

The third timing circuit breaker contacts S–**10** (Fig. 10A) are in the energization circuit of the tape reader mechanism and provide a timed energization path for the sensing pins P–**1** . . . P–**6** as well as the relays of the translator mechanism to be described. As previously set forth, the circuit breaker contacts S–**10** go through an operative cycle within the time period during which the tape sensing pins P–**1** . . . P–**6** may be actuated.

The fourth timing circuit breaker contacts S–**11** (Fig. 10B) are in the energization circuit for delete relays R–**26**, R–**27** which, as will be described in connection with the description of the translator, function to prevent punch

card perforating when an error exists on the programing tape.

The construction of the translator can now be described following which the various components of the entire electrical control mechanism can be detailed as an integral unit.

The translator **107** which is generally indicated in Fig. 1 as lying within the cabinet, comprises a relay memory device and a corresponding matrix which translates signals sensed by the Flexowriter tape reading contacts, P–1 . . . P–6 as each six-row column of coded information on the program tape is sensed, into a particular control effect determining the manner of energization of the control circuit shown in Figs. 10A and 10B according to a particular programmed operation determined by the coded instruction represented by the referred to line of perforations. The various typical operational patterns contemplated are embodied as coded instructions on the program tape. As will be described in connection with Fig. 12, each perforated row on the tape provides coded instructions which will result in any one of the following specific operations:

Table of control functions:

1. Card perforating
2. Word spacing
3. Line spacing
4. Deletion (ignoring of instruction when error is indicated)
5. Stop code
6. Ejection of completed card

The translator circuit comprises (1) a relay (R–1 . . . R–20) system as shown in Fig. 10A which will function to memorize the instructions represented by a single row of coded perforations on the programming tape, and (2) a decoding matrix represented by the circuit-pattern-forming contacts shown in the upper portion of Fig. 10B which will select a particular control circuit pattern capable of performing any one of the above-itemized operations. The relay instruction storing system includes a plurality of relay coils R–1 . . . R–7, R–11 and R–14 . . . R–20 arranged as shown in the lower portion of Fig. 10A in columnated alignment with the respective sensing contacts P–1 . . . P–6 of the tape reader mechanism. A holding circuit contact CH–1 . . . CH–5 is provided for each bank of relays to keep the selected relays energized until dropped out. The translator in this manner memorizes the instruction sensed from a row of perforations on the tape since actuation of one or more of the sensing pins P–1 . . . P–6 will result in continuing energization of a corresponding number of the translator relays R–1 etc. until released.

The various operative contacts of the matrix associated with the instruction storing relays are indicated in the upper portion of Fig. 10B bearing like designation numerals but prefaced with the letter "C" to denote a contact member. The translator matrix contacts are shown arranged in accordance with six discrete channels corresponding to the six sensing pins P–1 . . . P–6 and to the columns indicated on the programming tape in Fig. 12. In this manner, the relays R–1, etc., of the translator memory are energized in groups or patterns according to which of the sensing pins P–1 . . . P–6 have been closed.

Depending upon the particular code sensed on the program tape, one or more of the sensing pins P–1 . . . P–6 will become actuated. Fig. 12 shows a typical program tape as prepared on a Flexowriter together with the significance of certain types of exemplified coded instructions. That is, each row of perforations corresponds to a particular character to be perforated or a particular control function to be performed. Each row includes a six-place or channel code and the nature of the instruction provided by a particular row depends on the pattern of perforations in each row. For example, the following typical instructions can be interpreted from the coding arrangement shown in Fig. 12.

Control function:	Channel on program tape
Word space	3.
Alphabet character "S"	1 and 3.
Carriage return	3, 5, and 6.
Code delete	1, 2, 3, 4, 5, and 6.

In the standard Flexowriter reading head the row of six sensing pins P–1 . . . P–6 which are diagrammatically illustrated in Fig. 10A are arranged transversely with respect to the direction of motion of the program tape and are adapted to be periodically projected against the surface of the tape in synchronism with the movement of the tape. The tape is provided with a row of equidistant sprocket holes as shown in Fig. 12 and is driven by a sprocket connected to the tape reader drive shaft to provide incremental feeding of the tape in exact timed relation with the projection of the sensing fingers. In this manner, as each information row on the tape is read, one or more of the sensing pins P–1 . . . P–6 will be caused to make contact with the common contact of the reader mechanism indicated in Fig. 10A.

As is apparent from Fig. 10A, a particular pattern of translator memory relays R–1, etc., will be energized depending upon the number of the sensing pins actuated and consequent thereto, the corresponding translator matrix contacts shown in the upper portion of Fig. 10B will be closed.

The referred to matrix contacts when closed do not immediately complete an operative circuit to perform the particular control function designated by the instruction on the program tape. The necessary energization circuit is completed only at a designated time occurring during a cycle of the tape reader drive shaft as determined by the closing of the previously described timing circuit-breaker contacts S–8 . . . S–11. Specifically, when circuit breaker contacts S–9 are closed during the 255°–345° period indicated in Fig. 13, the lead relay R–22 (Fig. 10A) is energized and is held energized by hold contacts $C–22_1$. The resulting closure of lead relay contacts $C–22_2$ shown in Fig. 10B completes the described energization path from the common connection **1008** of the pin selection solenoids $R–30_1$ . . . $R–30_{42}$.

It will be noted from Fig. 10B that each of the character pin selecting solenoids $R–30_1$, etc., is connected in circuit between designated leads from the translator contacts matrix $C–1_1$, etc., to the common terminal **1008** included in a ground return circuit with the lead relay contacts $C–22_2$, normally closed delete-relay contacts $C–26_2$ and normally closed drop-out circuit breaker contacts S–12 which as previously described, are actuated by the cam **637** on the card carriage indexing shaft **635***a* as shown in Fig. 3.

Depending upon the pattern of translator solenoids R–1 etc. which are energized as a result of a code reading operation, corresponding selected translator contacts $C–1_1$, etc., of the matrix will close to define a particular energization path for the various function control elements indicated in the circuit diagram, by which one of the six previously enumerated control functions of the machine can be obtained. In brief, the program tape instructs the translator to obtain any one of the 6 distinct operations enumerated in connection with the description of the translator, the translator memorizes and decodes each such instruction in the form of the energization of a distinct pattern of the referred to translator solenoids and matrix contacts and then energizes the necessary control elements to perform the required control function. The operation of the translator and the associated control circuits can best be described by following through each of the 6 referred to control functions, namely, (1) card perforating, (2) word spacing, (3) line spac-

ing, (4) code delete, (5) stop code, and (6) card ejecting.

Control function No. 1—card perforating or recording

A card perforating or recording operation requires actuation of a single one of the character punch selecting stop pins **705** shown in Fig. 7. Assuming that the coded instruction on the program tape requires the perforating of the letter "S" on the punch card, in accordance with the code indicated in Fig. 12, sensing pins P–**1** and P–**3** of the tape reader will be actuated. Referring to the memory portion of the translator circuit shown in Fig. 10A, the columns of translator relays, R–**11**, R–**16**, R–**17**, R–**18**, R–**19**, and R–**20** and the column comprising relays R–**3** and R–**4** will be energized and the respective matrix contacts of the translator associated with the relays identified with channels 1 and 3 shown at the top of Fig. 10B will be closed. It will be noted from Fig. 10B that contacts C–3_2, C–3_3, C–4_1, C–4_2, and C–4_3 associated with channel 3 and all the contacts associated with channel 1 will be closed. With the translator network contacts in such exemplified position, the effects resulting therefrom will become apparent by following the previously described control circuit.

Specifically, with the above translator matrix contacts closed, potential will be applied from positive terminal **1006***a* (Fig. 10B) through the actuated translator contacts C–4_3, C–20_3 and through the character selecting pin solenoid R–30_{40} corresponding to the character letter "S" to the common contact **1008**, the now closed lead relay contacts C–22_2, the normally closed delete-relay contacts C–26_2, and normally closed drop-out circuit breaker No. 1 contacts S–**12** to ground. Energization of the "S" character selection pin solenoid R–30_{40} is therefore timed to occur at a particular point in the cycle as indicated in Fig. 13 and as determined by the closing of timing circuit breaker contacts S–**9** by the cam **221** on the tape reader drive shaft **200**. This results in the required closing of contact C–22_2 when R–**22** is energized as above noted.

Energization of a character punch selection solenoid R–**30** in such described manner results in indexing of the character punch magazine **702** and in the implementation of the card perforating mechanism in the manner described in connection with Fig. 7.

Clearing the translator

When the referred to card perforating mechanism has operated it will also effect a letter-space movement of the card carriage **111** consequent to the act of perforating a character. To produce such spacing the card carriage indexing shaft **635***a* will be oscillated in the described manner with consequent actuation of the drop-out circuit breaker No. 1 contacts S–**12**. The operating cam **637** for such circuit breaker is indicated in Fig. 10B and, as is apparent from the circuit diagram, opening of such normally closed contacts (S–**12**) when the carriage indexing shaft is oscillated will open the energization circuit for the selected character selection solenoids R–**30**. The second normally closed drop-out circuit breaker No. 2 contacts S–**13** mounted on the carriage index shaft adjacent S–**12** (Fig. 6) and indicated at the bottom of Fig. 10A will also, at the same time, but slightly later, be opened by cam **638** to de-energize those of the translator memory relays R–**1**, etc., which have been energized by the tape reader. The translator is, in this manner, cleared after each instruction and readied for a subsequent instruction.

Control function No. 2—word spacing

As indicated in Fig. 12 the code on the programming tape providing for a word space corresponds to a perforation in channel **3**. If such code is sensed, pin P–**3** will complete a circuit to energize translator memory relays R–**3** and R–**4**. Assuming the translator has been cleared of the previous "S" character key selection instruction, translator contacts C–3_1, C–3_2, C–4_1, C–4_2, and C–4_3, will now be closed. The energization path will now be completed through translator contact C–4_3, and word-space (space-bar) solenoid R–**29** shown in the right-hand portion of Fig. 10B. Since, as previously described, such solenoid is articulated to the carriage indexing shaft **635***a* (Figs. 6 and 9), a word-space operation will be obtained when the timing contact S–**9** completes the energization circuit in the same manner as described in connection with the "S" character selection. As described in connection with Figs. 6 and 9 energization of the space-bar solenoid R–**29** actuates pawl **636***a*, ratchet **640**, and pinion **616** through the clutch **620***a*, **620***b* to shift the card carriage **111** the equivalent of a word space. The resulting actuation of the first and second drop-out circuit breaker contacts S–**12**, S–**13** by cams **637**, **638** will therefore clear the translator following a word-space operation in the same manner as was described in connection with a perforating function.

Control function No. 3—line spacing

The signal for line spacing corresponds to a carriage return instruction code in the program tape which, as indicated in Fig. 12, involves channels **3**, **5**, and **6**. The consequent closing of tape reader sensing pins P–**3**, P–**5**, and P–**6** will enable a circuit through translator contacts C–6_1, C–1_1, and C–2_1 to the carriage-return solenoid R–**24** (Fig 10B) which, as previously described in connection with Fig. 6, will cause return of the card carriage **111** to its initial right-hand position. As previously described, return movement of the card carriage closes the end-of-carriage-return microswitch S–**5** to energize carriage-return relay R–**25** (Fig. 10A). The carriage-return relay contact C–25_1 is thereby actuated and concurrently energizes the line-space solenoid R–**23** and de-energizes the carriage-return solenoid R–**24**. Referring to Fig. 6, the line-space solenoid R–**23** when thus energized will actuate the links **617**, **614**, **613**, and ratchet **612**, to advance the card-gripping rollers **601**, **602** the equivalent of one line space. At the end of a line-space operation, the end-of-line-space microswitch S–**3** shown in Fig. 6 is actuated by the extension **617***b* on link **617**. This switch, as shown in Fig. 10B is normally closed and, when actuated, disconnects the translator from the positive source represented by terminal **1006***a* to clear the translator after such line-space function has been accomplished. Should more than one line spacing instruction be programmed, the same sequencing of control elements is repeated beginning with sensing pins P–**3**, P–**5**, and P–**6**.

Control function No. 4—code delete

In the process of preparing a programming tape, if the operator of the program coding machine should inadvertently inscribe the wrong code on a particular portion of the tape, it is necessary to provide an instruction requiring subsequent deletion or ignoring of such code when the type is subsequently employed to operate the automatic stencil cutter. Such procedure is more feasible than discarding the tape, splicing the tape or otherwise obliterating the incorrect code punched thereon. When such error is detected during the preparation or editing of the program tape, the operator of the coding machine will perforate a six-column cole—that is, punch a hole in each of the 6 channels comprising a column as is indicated in Fig. 12. The presence of a six-channel code therefore always signifies a "delete" instruction.

As is apparent from the translator circuit shown in Fig. 10A, the actuation of all six of the tape reader contacts P–**1** . . . P–**6** in such case will complete a circuit through the translator matrix contacts C–6_1, C–1_1, C–2_1, and C–3_1 to energize the first and second code-delete relays R–**26**, R–**27** (Fig. 10B) which operate the delete relay contacts C–26_1, C–26_2, and C–27_1, respectively. Contacts C–26_1 and C–26_2 are indicated in Fig. 10B above

R–26 and S–12, respectively. Contact C–27_1, is shown at the right side of Fig. 10A. Contact C–26_1 provides a hold circuit for the delete relays while normally closed delete relay contacts C–26_2 when opened disenable the translator circuit by opening the ground return for both the pin selecting solenoids R–30 and the reader clutch coil R–8. It is therefore apparent that no perforation of the punch-card can occur when a six-channel code has been sensed. The opening of the normally closed code-delete relay contacts C–27_1 similarly clears the translator memory relay circuit associated with reader pins P–1 . . . P–6.

Control function No. 5—stop code

The programming tape may contain information requiring the machine to stop at any predetermined time. Referring to Fig. 12 such instruction is coded in channels 4, 5, and 6 of the program tape resulting in energization of the translator relays R–2, R–7, R–1 and R–6. By following a path through the corresponding actuated translator matrix contacts in Fig. 10B, it is apparent that an energization circuit will be established between the potential source 1006*a*, contacts C–6_1, C–1_1, and C–1_1 through the stop-code relay R–28 to ground. Relay R–28 when energized: (1) opens the normally closed stop-code relay contacts C–28_1 (see Fig. 10A) thus de-energizing the start-stop relay R–9; (2) de-energization of R–9 opens the respective contacts C–9_2 (Fig. 10B) to de-energize the entire control circuit placing the machine in idle condition. The reset or stop push button switch S–15 provides a manual control to optimally accomplish the same stop function.

Control function No. 6—card eject

Upon completion of a stencil cutting operation on a card, the programming tape will apply an instruction to the machine calling for the ejection of a completed card. The machine in performing the control effect consequent to such instruction will also function to initiate the card-feed mechanism to supply a new card in readiness for a subsequent perforating operation. A card-eject instruction combines the control function characterising a line space operation as described together with an additional control function which energizes the card-feed mechanism in the following manner.

A card-eject instruction is defined by a coding in channel 4 of the tape as indicated in Fig. 12. By following the translator matrix shown in Fig. 10B of the drawings it will be apparent that a circuit will be defined through contact C–2_5 of the translator matrix to normally open contacts C–25_1 and C–25_2 of the carriage-return relay R–25. Concurrently, the carriage-return solenoid R–24 is energized through lead 1011.

Energization of carriage-return solenoid R–24 will act to shift the card carriage to its initial right-hand position with consequent closing of the end-of-carriage-return microswitch S–5. An energizing circuit for the carriage-return relay R–25 is thereby completed and the normally open carriage-return relay contacts C–25_1 and C–25_2 are thereby closed. Closing of contact C–25_1 de-energizes the carriage-return solenoid R–24 while the contacts C–25_2 when closed establish a potential at terminal 1005 (Fig. 10A) of the card-feed control circuit through conductor 1009.

As previously described, the card-eject solenoid R–12 is paralleled with card-feed relay R–10, pressure roller solenoid R–610 and card-feed solenoid R–21 to terminal 1005 as shown in Fig. 10A. These four electromagnets are the control elements which conjointly operate to perform a card-feed operation. The card-eject solenoid R–12 as previously described is mounted to the rear of the eject motor as shown in Fig. 6 and, when energized, pivots the eject roller 683 downwardly into peripheral contact with the face of a punch-card lying on the platen over the idler roller 625. Energization of the card-feed relay R–10 in the manner already described in connection with a card-feed operation, completes a holding circuit for the card-feed mechanism by closing card-feed relay hold contact C–10_2 and a complete card-feed cycle thereafter occurs independently of the translator circuit. As is apparent from the control circuit diagram, the return of the card carriage 111 to its initial position will necessarily also result in the actuation of the end-of-line space microswitch S–3 which, as shown in Fig. 10B, will break the energization circuit for both the translator memory device and the matrix thus clearing such circuits.

Since the card-eject solenoid R–12 is paralleled with card-feed relay R–10, pressure roller solenoid R–610 and card-feed solenoid R–21 it will be apparent that energization of terminals 1005 and 1010 by the translator matrix through line 1009 will result in a card-feed operation.

As described in connection with Figs. 5 and 9 the end-of-eject microswitch S–7 is actuated as a result of the rocking of the eject roller operating lever 634*b*. As is apparent from the circuit diagram, the closing of switch S–7 (Fig. 10A) will energize the eject relay R–13 thereby opening the normally closed contacts C–13_2 (Fig. 10A). The resulting opening of contacts C–13_1 de-energizes the card-eject solenoid R–12 and thus restores the eject roller to idling position.

It is to be noted that because of the application of positive potential to terminal 1005 as described, the other control elements of the card-feed mechanism are also concurrently energized. Therefore a card-eject instruction also results in actuation of the card-feed mechanism and a new card is automatically fed to the carriage upon ejection just as in the described case when a completed card has been ejected.

Since, in a card-feed operation, a new card is fed into position in the card carriage at the same time a completed card is being ejected, the eject roller 628 must function as follows:

(1) The eject roller must contact a completed card long enough to cause card ejection,

(2) The eject roller must be rapidly withdrawn from contact with the platen as soon as the completed card has been ejected so that the next incoming card may be properly oriented on the platen. In order to produce such result, when the normally closed eject relay contacts C–13_1 are open as described, the discharging action of the capacitor C–1020 shown adjacent such contacts in Fig. 10A holds the card-eject solenoid R–12 energized for a period sufficient to allow the eject roller to eject the completed card. After the capacitor C–1020 has been fully discharged in such manner, the card-eject solenoid R–12 is de-energized, thereby releasing the eject roller from contact with the platen.

The described control functions are timed to occur during specified periods of a machine cycle in accordance with the present invention as indicated in the timing diagram of Fig. 13. The four timing circuit breaker contacts S–8, S–9, S–10, and S–11 which are shown in Figs. 4 and 9 as being operated by the cams 220, 221, 222, and 223, respectively mounted on the tape reader drive shaft 200, are indicated in Figs. 10A and 10B functionally related to the control elements with which they cooperate.

It will be noted that timing circuit breaker contacts S–10 provide a normally open energizing circuit for the memorizing circuit forming part of the translator mechanism associated with the tape reader pins P–1 . . . P–6 and are timed to be closed by cam 222 during the portion of the machine cycle occurring between 203 and 283 degrees as indicated in the timing diagram (Fig. 13). The circuit breaker contacts S–9 provide a normally open energization path for the lead relay R–22 and are closed by cam 221 during 255 to 345 degrees of the machine cycle. Similarly, the normally closed delete circuit breaker contacts S–11 for the delete relays R–26, R–27 are

opened by cam 223 during a 20 to 105 degree portion of a machine cycle, while the normally open clutch circuit breaker contacts S–8 are actuated by cam 220 to complete an energization circuit for the reader clutch coil R–8 during a period from 50 to 130 degrees of the machine cycle.

In addition, it will be noted from Fig. 10B that the normally closed drop-out circuit breaker contacts S–12 on the card carriage indexing shaft are adapted, when actuated by cam 637, to open the energization circuit for any of the selected character selecting pin solenoids R–30, the word-space solenoid R–29, and the reader clutch coil R–8. The second normally closed drop-out circuit breaker contacts S–13 (Fig. 10A) are similarly adapted to open the energization circuits for the instruction memorizing circuit (coils R–1, etc.), the carriage-return relay R–25 and the lead relay R–22. These described energization circuit control elements operate in timed sequence during a machine cycle in the following manner:

(1) At a 50-degree displacement of the tape reader drive shaft 200, the clutch circuit breaker contacts S–8 are closed by cam 220 and remain closed until the drive shaft is rotated to 130 degrees. Closing of S–8 (Fig. 10B) completes the energization path for reader clutch coil R–8 which, as previously described, forms part of the Flexowriter tape reader mechanism and activates the tape reading pins P–1 . . . P–6. Upon completion of a control function such as a character perforating or word-space operation, the drop-out circuit breaker contacts S–12 are opened by cam 617 to clear the translator.

(2) As indicated in Fig. 13, the normally closed delete circuit breaker contacts S–11 remain closed during the period extending from 105 degrees to 20 degrees or a total of 275 degrees. The associated operating cam 223 acts then to hold open such normally closed contacts during the period from 20 to 105 degrees. A delete control function can therefore be performed only during the 20–105-degree period when S–11 is closed.

(3) Following the closing of the clutch circuit breaker contact S–8, the period from 185 to 5 degrees is provided for the tape sensing pins P–1 . . . P–6 to read as indicated by the topmost representation in Fig. 13. Hence, during the interval established for the sensing pins:

(4) Timing circuit breaker No. 1 contacts S–10 will be closed by cam 222 for a 203 to 283-degree period. As previously described, the contacts S–10 complete the energization path for the memory portion of the translator circuit comprising the relay pattern R–1 etc. as shown in Fig. 10B. When one of the control functions defined by the instruction stored in the memory has been carried out as, for example, a data perforating or word-space operation, cam 638 opens the drop-out circuit breaker contact S–13 to clear the memory circuit.

(5) The timing circuit breaker No. 2 contacts S–9 are closed at 255 degrees and remain closed for the period up to 345 degrees, which completes an energization path for the lead relay R–22. As described, lead relay R–22 and its related contact $C–22_2$ provides an energization path for the character selection solenoids $R–30_1$, etc., to permit card perforation.

In this manner the four timing cams and associated circuit breaker contacts mounted on the tape reader drive shaft govern the sequence of energization of the tape reader mechanism, the memory portion of the translator, and the control function section of the translator.

The constructional details of the solenoids employed as the operating elements in various portions of the machine as described are shown in Fig. 15. The character punch stop-pin selection solenoids R–30, the pressure roller solenoid R–610, the carriage-return solenoid R–24, etc., require an electromagnet construction which combines maximum force with compactness of physical size. This is particularly true of the bank of stop pin selection solenoids R–30 shown in Fig. 7 in respect to which 42 solenoids must be mounted in a limited circumferential area. A special electromagnet construction of the type illustrated in Fig. 15 has therefore been employed to achieve the desired results. As shown the electromagnet consists of a pair of relatively flat serially connected solenoid windings 1501, 1502 secured to a base plate 1503. The solenoids are wound on hollow, rectangular shaped cores adapted to slidably accommodate the two legs of a bifurcated armature 1504. A connecting rod 1505 is secured to the armature and serves as the operative connection for delivering power from the electromagnet to the desired utilization means. Such rod may extend through the base plate 1503 so that either end of the electromagnet may be used to apply force. A spring 1506 mounted between the base plate 1503 and a collar 1507 on the connecting rod serves to bias the armature to its initial position.

While a preferred embodiment of the invention has been shown and described, various modifications of the various instrumentalities employed will be readily obvious. While the invention has been disclosed with reference to stencil cutting a standard Hollerith type of punch-card, it could easily be revised to print on, as well as to perforate other types of record material. The invention should therefore not be construed to be limited otherwise than as is defined in the appended claims.

What is claimed is:

1. An automatically sequenced data recording machine having means for inscribing data on a record medium in response to applied programming instructions comprising, means for transporting a record medium to said inscribing means, cyclically operated means for interrogating each of said programmed instructions and defining during each such interrogatory cycle a control period, means energized by said interrogating means during a portion of said cycle-period for memorizing each of said programmed instructions in sequence, means for producing a particular control function affecting said record medium, means responsive to said memory means and energized by said interrogating means during a subsequent portion of said cycle-period for translating each of said memorized instructions into a said control function, means conditioned by said record medium upon completion of said record medium transporting cycle for activating said memory and translating means, and means for clearing said memory and translating means upon completion of each control function.

2. An automatically sequenced data recording machine for inscribing data on a record medium in response to applied programming instructions comprising, cyclically operated means for interrogating each of said programmed instructions and defining during each such interrogatory cycle a control period, means energized by said interrogating means during a portion of said cycle-period for memorizing each of said programmed instructions in sequence, a data inscribing mechanism, means for orienting said record medium with respect to said inscribing mechanism, control means responsive to said memorizing means and energized by said interrogating means during a subsequent portion of said cycle-period for translating each of said memorized instructions into an inscribing or record medium orienting effect and means responsive to said control means for selectively actuating said inscribing mechanism and said orieinting means.

3. The invention as defined in claim 2 in which means are provided for clearing said memorizing and translating means upon completion of each said control function.

4. The invention as defined in claim 3 in which said data inscribing mechanism includes a data inscribing station and said orienting means comprises a record holder for displacing said record medium with respect to said station according to a predetermined pattern.

5. An automatically sequenced data recording ma-

chine for inscribing data on a record medium in response to applied programming instructions comprising, cyclically operated means for interrogating each of said programmed instructions and defining during each such interrogatory cycle a control period, means energized by said interrogating means during a portion of said defined cycle-period for memorizing each of said programming instructions in sequence, a data inscribing mechanism, means for orienting said record medium with respect to said inscribing mechanism, means for automatically feeding a record medium into said orienting means, control means responsive to said memorizing means and energized by said interrogating means during a subsequent portion of said cycle-period for translating each of said memorized instructions into a data inscribing or record medium orienting control function, means for selectively actuating said inscribing mechanism and said orienting means in response to said control means and means controlled by said record feeding means for activating said memorizing and said control means upon completion of a record feeding operation.

6. An automatically sequenced data recording machine for inscribing data on a record medium in response to applied programming instructions comprising, cyclically operated means for interrogating each of said programmed instructions and defining during each such interrogatory cycle a control period, a data inscribing mechanism, means for orienting said record medium with respect to said inscribing mechanism, means for automatically feeding a record medium into said orienting means, first control means for actuating said record feeding means, second control means for controlling said data inscribing and said orienting means comprising means energized by said interrogating means during a portion of said cycle-period for memorizing each of said applied programming instructions in sequence, and means responsive to said memorizing means and energized by said interrograting means during a subsequent portion of said cycle-period for translating each of said memorized instructions into a control function affecting either said inscribing mechanism or said record medium orienting means, and means conditioned by said first control means for activating said second control means.

7. The invention as defined in claim 6 including means for clearing said memorizing means and said translating means upon completion of said control function.

8. An automatically sequenced data recording machine for inscribing data on a record medium in response to applied programming instructions comprising, a data inscribing mechanism having means for selecting data to be inscribed on said record medium, means for adjustably holding said record medium in said inscribing mechanism, means for actuating said holding means for positioning said record medium relative to said inscribing means in at least two directions of movement, means for transporting said record medium relative to said holding means, cyclically operated means for interrogating each of said programmed instructions and defining during each such interrogatory cycle a control period, a first control circuit for actuating said record transporting means and said holding means, means actuated by said record transporting means for deenergizing said first control circuit upon completion of a record medium transporting operation a second conond control circuit energized by said interrogating means during one portion of said cycle-period for actuating said data selecting means, and means actuated by said record transporting means upon completion of a record transporting operation for activating said second control circuit.

9. The invention in accordance with claim 8 in which said second control circuit includes means for operating said record holding means and said record transporting means in response to applied programming instructions.

10. In an automatically sequenced data recording machine having mechanism for inscribing data on a record medium in response to applied programming instructions, a record carrier for adjustably holding a record in said inscribing mechanism, said carrier comprising releasable record medium gripping means operable to index said record medium in said carrier relative to said inscribing mechanism, means on said record carrier for releasing said gripping means, means for operating said gripping means for indexing said record medium in said carrier, a record medium storage hopper, means for transporting a record from said storage hopper to said carrier, record ejecting means for discharging a record from said carrier, means for indexing said record carrier in a second direction relative to said inscribing mechanism, first control means articulating said releasing means, said transporting means and said record ejecting means, second control means for actuating said data inscribing mechanism and for actuating each of said indexing means and means actuated by said first control means for energizing said second control means.

11. In an automatically sequenced data recording machine having means for inscribing data on a record medium in response to applied programming instructions, a record carrier for adjustably holding a record in said inscribing mechanism, said carrier comprising releasable record gripping means operable to index said record in said carrier relative to said inscribing mechanism, means on said record carrier for releasing said gripping means, means for operating said gripping means for indexing said record medium in said carrier, a record storage hopper, means for transporting a record from said storage hopper to said carrier, record ejecting means for discharging a record from said carrier, means for indexing said record carrier in a second direction relative to said inscribing mechanism, first control means articulating said releasing means, said transporting means and said record ejecting means, second control means for energizing said data inscribing mechanism and for actuating each of said indexing means, means actuated by said first control means for energizing said second control means, a memory device for storing each of said applied programming instructions in sequence, translating means responsive to said storing means for conditioning said second control means in accordance with an instruction and means responsive to actuation of said second control means for clearing said memory device and said translating means.

12. The invention as defined in claim 11 in which means are provided in said second control means for energizing said first control means.

13. In an automatically sequenced data recording machine having means for inscribing data on a record medium in response to applied programming instructions, a record carrier for adjustably holding a record in said inscribing mechanism, said carrier comprising releasable record gripping means operable to index said record in said carrier relative to said inscribing mechanism, means on said record carrier for releasing said gripping means, means for operating said gripping means for indexing said record medium in said carrier, a record storage hopper, means for transporting a record from said storage hopper to said carrier, record ejecting means for discharging a record from said carrier, means for indexing said record carrier in a second direction relative to said inscribing mechanism, first control means for articulating said releasing means, said transporting means and said record ejecting means, second control means for energizing said data inscribing mechanism and for actuating each of said indexing means, means actuated by said first control means for energizing said second control means, a memory device

for storing each of said applied instructions in sequence, translating means responsive to said memory device for conditioning said second control means in accordance with an instruction and further means responsive to actuation of said inscribing means for actuating said record carrier indexing means.

14. The invention as defined in claim 13 including means responsive to the actuation of said record carrier indexing means for clearing said memory device and said instruction translating means.

15. The invention as defined in claim 13 in which means are provided in said second control means for energizing said first control means.

16. In an automatically sequenced data recording machine for inscribing data on a record medium in response to applied programming instructions, cyclically operated means for interrogating each of said programmed instructions and defining during each such interrogatory cycle a control period, a data inscribing mechanism having a plurality of selectable character markers, means for selecting a character marker comprising a matrix defining a plurality of separate energizing paths for selectively actuating said character selecting means, means energized by said interrogating means during a portion of said cycle-period for memorizing each of said applied program instructions in sequence, instruction translating means energized by said interrogating means during a subsequent portion of said cycle-period and responsive to said memorizing means for selectively connecting one of said energization paths in said matrix corresponding to an applied instruction to said selecting means and means responsive to actuation of said character marker selecting means for actuating said inscribing mechanism.

17. The invention as defined in claim 16 including first control means for establishing an energization circuit for said memorizing means during a first portion of said control period, second control means complementary to said translating means for completing said selected energizing path for a specified period occurring in a subsequent portion of said control period and third control means responsive to actuation of said inscribing mechanism for opening both said energization circuit and energizing path upon actuation of said inscribing means.

18. The invention as defined in claim 16 in which said character marker selecting means comprises a plurality of energizable members corresponding in number to said character markers and said matrix defines a like number of separate energizing paths.

19. In an automatically sequenced data recording machine for inscribing data on a record medium in response to applied programming instructions, said machine comprising a data inscribing mechanism and a record medium carrier for adjustably positioning said record medium relative to said data inscribing mechanism, means for selectively moving said record carrier relative to said inscribing means in response to an applied program instruction comprising, carrier indexing means, a function selection matrix selectively operable to define one of a plurality of separate energization paths for energizing said indexing means, means for memorizing each of said applied instructions in sequence, instruction translating means responsive to said memorizing means for conditioning said energizing path in said matrix corresponding to an applied carrier positioning instruction, means establishing an energization circuit for said memorizing means during a first portion of the operating cycle of said machine, means complementary to said translating means for completing said energization path for a specified period occurring during a subsequent portion of said machine operating cycle, and means responsive to actuation of said carrier indexing means for opening both said energization circuit and said energizing path.

20. In an automatically sequenced data recording machine for inscribing data on a record medium in response to applied programming instructions, said machine comprising a data inscribing mechanism and a movable record medium carrier having record indexing means, means for positioning said record medium relative to said inscribing mechanism in a first and second dimension respectively, comprising, a first carrier indexing means, a second carrier record-indexing means, a function selection matrix selectively operable to define one of a plurality of separate energization paths for energizing said carrier and record-indexing means, means for memorizing each of said applied instructions in sequence, instruction translating means responsive to said memorizing means for conditioning said energizing path in said matrix corresponding to an applied record-indexing instruction, means for establishing an energization circuit for said memorizing means during a first portion of the operating cycle of said machine, means responsive to said energizing path for actuating said carrier indexing means, means operable upon completion of said carriage indexing movement for energizing said carrier record-indexing means and for concurrently de-energizing said carrier indexing means, and means responsive to actuation of said carrier record-indexing means for opening said energization circuit and energizing path.

21. In an automatically sequenced data recording machine for inscribing data on a record medium in response to applied programming instructions, said machine comprising a data inscribing mechanism, a movable record medium carrier having means for releasably gripping a record medium and means for transporting a record with respect to said carrier; means for moving said record carrier with respect to said inscribing mechanism, means for transporting a record to said carrier, means for releasing said record gripping means, means for transporting a record from said carrier, a function selection matrix selectively operable to define separate energization paths for energizing said record carrier moving means, said record gripping releasing means and said record transporting means, means for memorizing each of said applied instructions in sequence, instruction translating means responsive to said memorizing means for conditioning said energizing paths in said matrix corresponding to an applied record transporting instruction, means for establishing an energization circuit for said memorizing means during a first portion of the operating cycle of said machine, means responsive to one of said energizing paths for actuating said carrier moving means, means responsive to movement of said carrier to couple a second of said energization paths to each of said card transporting means and said record gripping release means and means responsive to actuation of said carrier moving means for opening said energization circuit and said energization paths.

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