Dec. 29, 1959 G. C. DEVOL 2,918,864

RANDOM PRINTING METHOD AND MEANS

Filed June 7, 1951 4 Sheets-Sheet 1

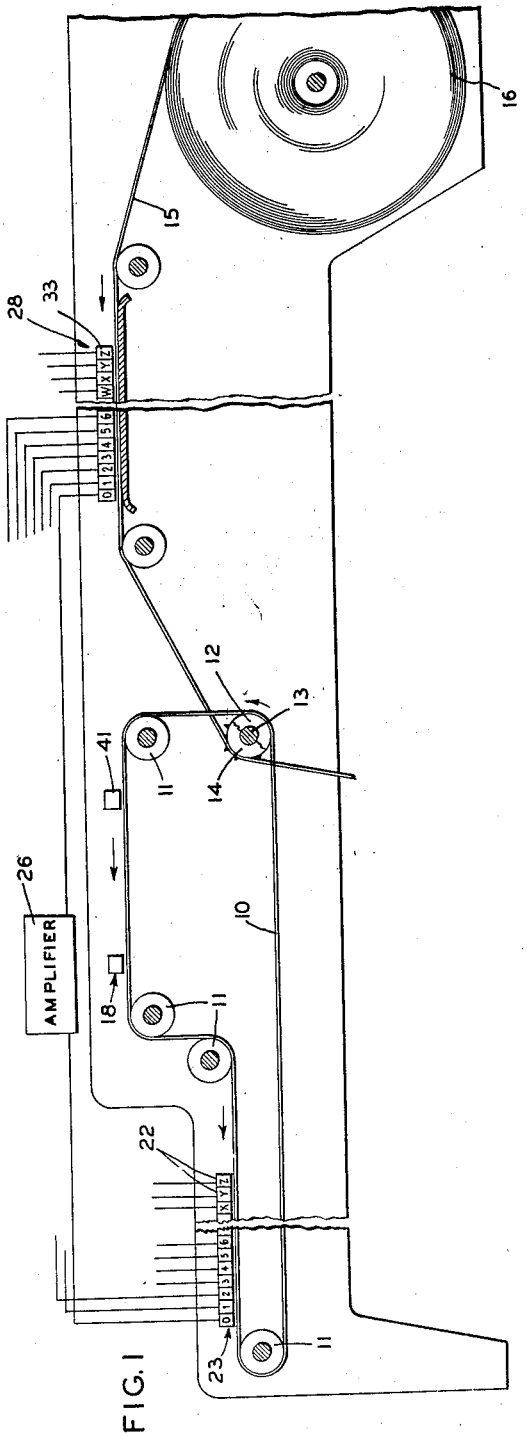

FIG. 1

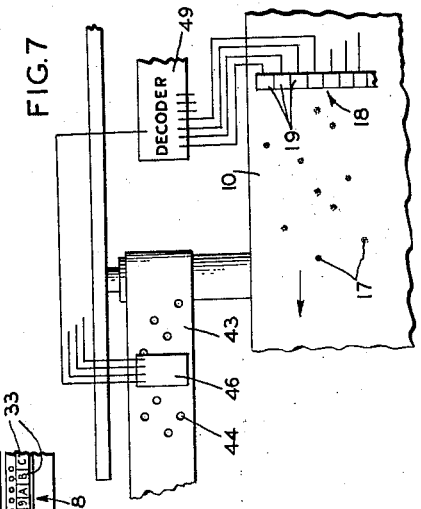

FIG. 7

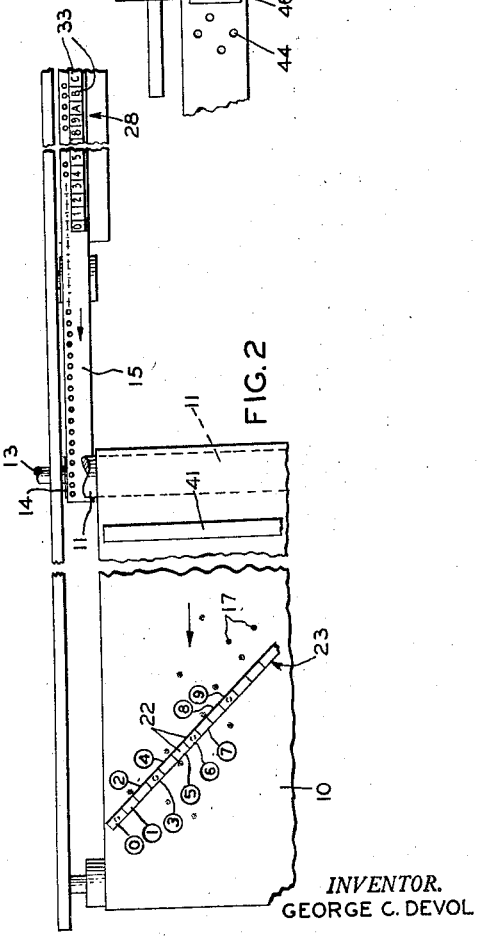

FIG. 2

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Dec. 29, 1959 G. C. DEVOL 2,918,864

RANDOM PRINTING METHOD AND MEANS

Filed June 7, 1951 4 Sheets-Sheet 2

FIG. 3

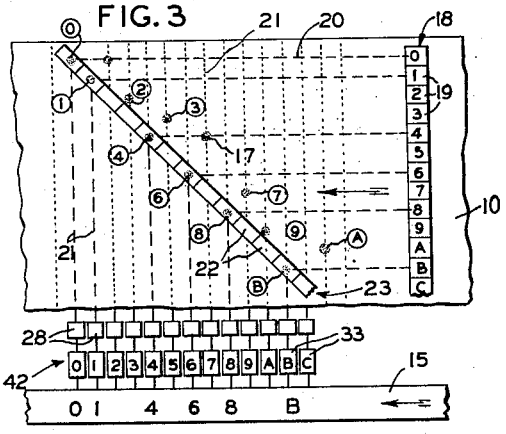

FIG. 4

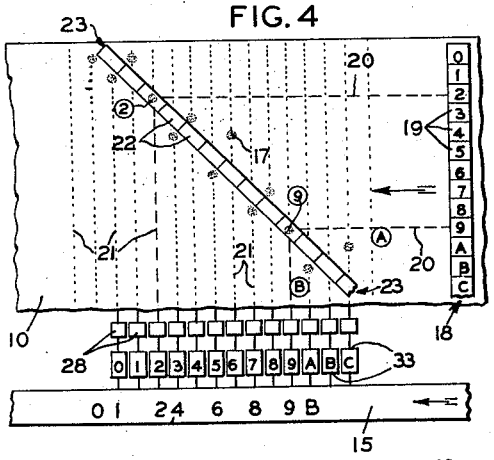

FIG. 5

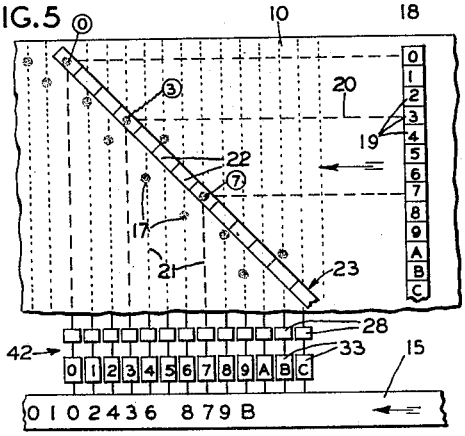

FIG. 6

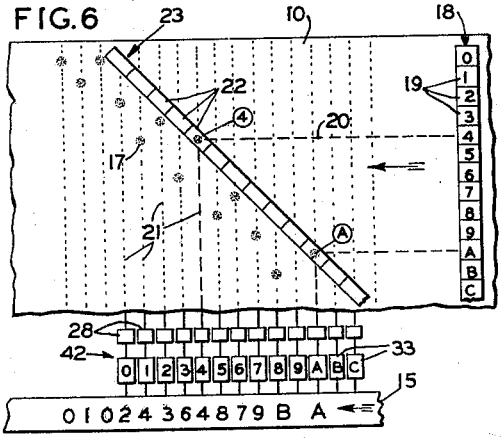

FIG. 10

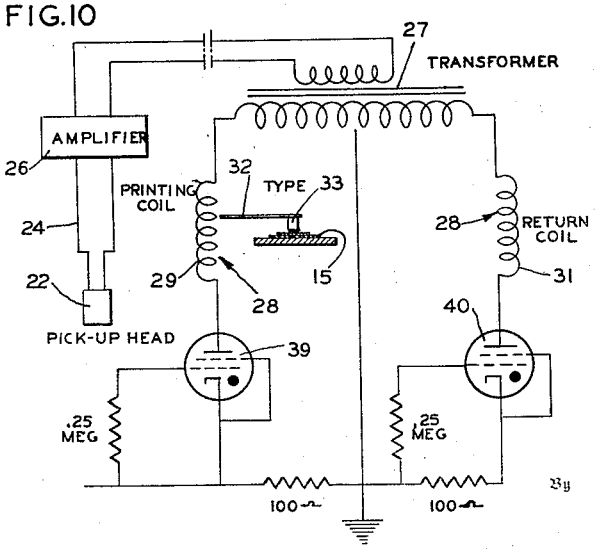

FIG. 8

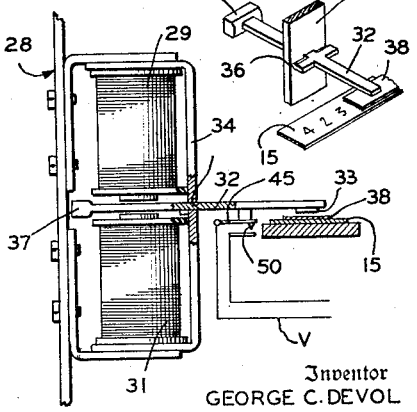

FIG. 9

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Dec. 29, 1959 G. C. DEVOL 2,918,864

RANDOM PRINTING METHOD AND MEANS

Filed June 7, 1951 4 Sheets-Sheet 3

FIG. 11

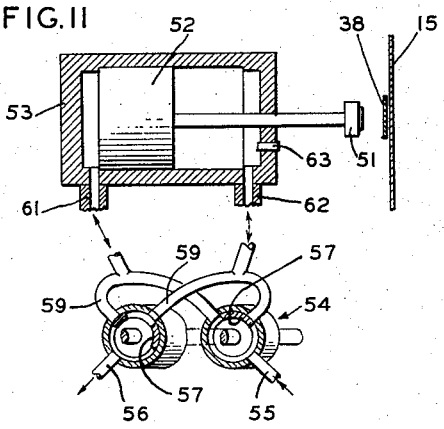


FIG. 12

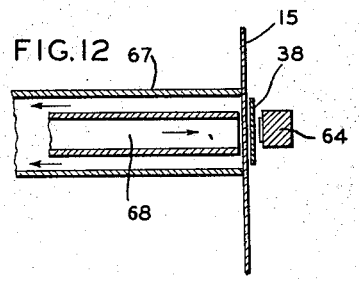


FIG. 13

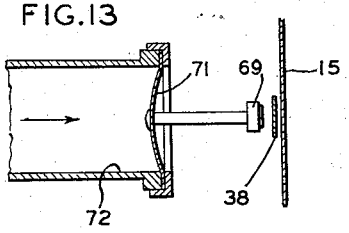
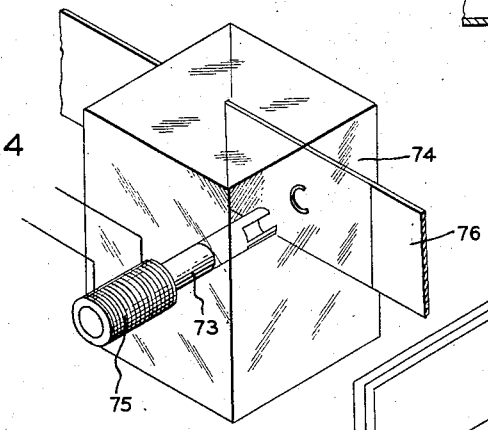


FIG. 14



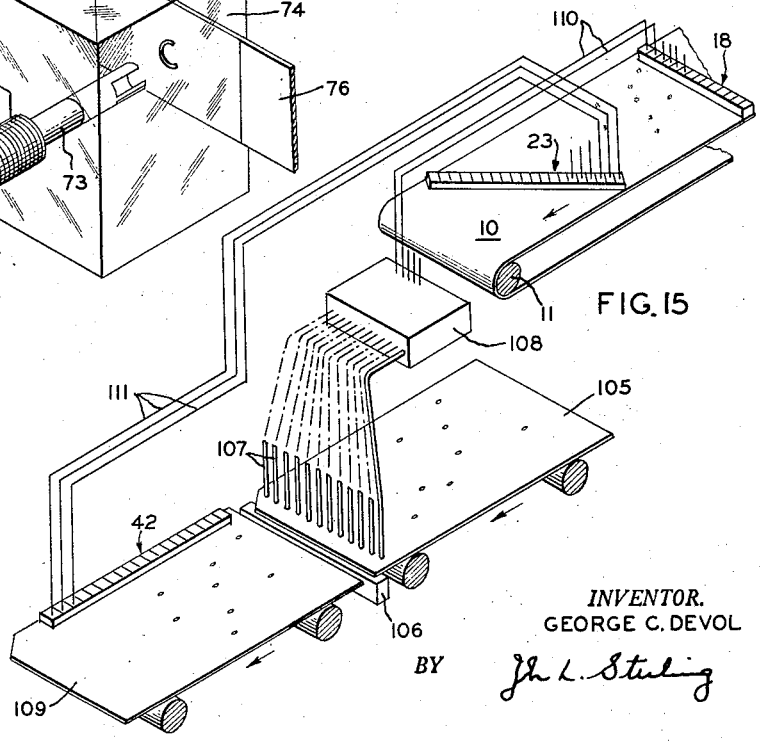


FIG. 15

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RANDOM PRINTING METHOD AND MEANS

Filed June 7, 1951 4 Sheets-Sheet 4

FIG.16

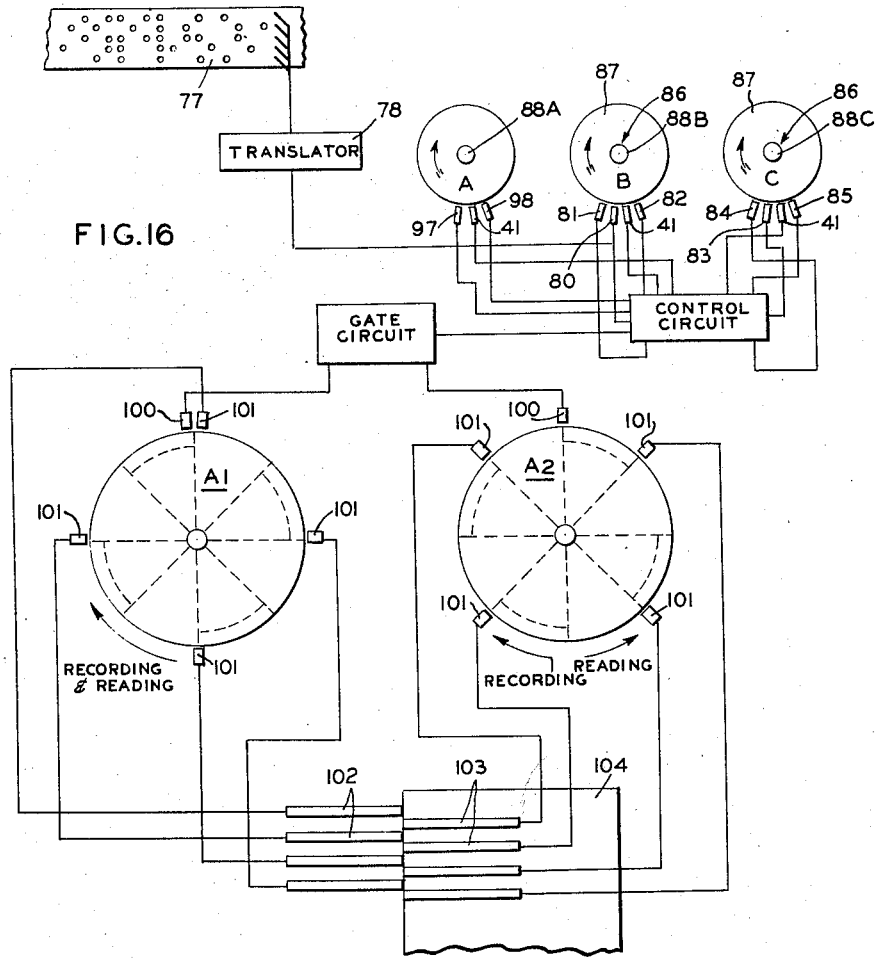


FIG.18

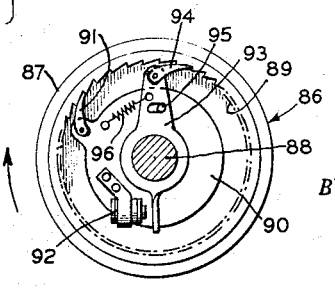
SIGNAL POSITIONS
59 60 61

COND. 1	r	e		l	i	n	
" 2	o	r	e		l	i	UNJUSTIFIED
" 3	m	o	r	e		l	
" 4		m	o	r	e		JUSTIFIED
" 5	e	a	d		B		

MARGIN

TRANSFER-ADD 2 SPACES.
RETRANSFER-ADD 1 SPACE.
TRANSFER-ADD 2 SPACES.
TRANSFER-ADD 1 SPACE.

FIG.17



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United States Patent Office 2,918,864 Patented Dec. 29, 1959

2,918,864

RANDOM PRINTING METHOD AND MEANS

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Application June 7, 1951, Serial No. 230,345

20 Claims. (Cl. 101—93)

This invention relates to printing, and in particular to a method and means for accomplishing printing at high speed.

In various electronic and other high speed calculating and business machines in use at the present time, the need for printing the output of the machines, as well as the printing of information received at high speed from other sources, has presented a problem that has not been solved by the use of ordinary mechanical printing mechanisms, due largely to the time required in the movements of the mechanical parts, the transmission of motion, and the restoration of the parts after each printing action. This problem is also present due to the rapid sensing of data now possible, such as in the use of a magnetically spotted tape, or a perforated tape, or cards, which can be fed at high speed past a sensing station where the data is sensed, translated from the code in which it may be punched, spotted or otherwise recorded, and to this end one object of the present invention is to print the data as fast as it is received by an arrangement of mechanisms that can carry out the printing operation at an extremely high speed.

A further object of the invention is to so arrange recording, pick-up and printing means with respect to each other that data can be recorded, read, and printed at sufficiently high speeds to keep pace with the imposition of data in a recorder from a source producing the data at extremely high speed.

A still further object is to make use of a single set of type from which the matter is printed in random fashion and in which type a minimum amount of means is employed whose movement, to produce the printing, may be very rapid so that two like characters can be printed successively by the same type piece.

Another object of the invention is to bring about the printing of all characters needed, from a single set of type, by the use of various means which will reduce type movement to a minimum or eliminate any movement of the type entirely so that printing can be accomplished at high speed and with a negligible amount of wear to the parts.

Other objects of the invention include the use of the invention to print pages of matter in a novel line grouping action; to justify the matter so that the finished page has even right and left hand margins; to apply a magnetostrictive action to printing so that type does not have to be employed to produce the printing effect; to interpret perforated records and print the characters represented by the coded arrangement of perforations, on the same record; to make unnecessary the use of type wheels, type racks and other type or paper carriers which require adjustment in order to carry on the printing action, and to verify the correctness of the printing automatically as it is being done.

A more clear conception of further objects and the operation of the invention may be had from the following specification when read in the light of the drawing, in which

Fig. 1 is a view in longitudinal elevation of the method and means for printing at high speed in accordance with the invention;

Fig. 2 is a fragmentary view in plan of the invention illustrated in Fig. 1;

Figs. 3, 4, 5, and 6 are plan views of the recording, reading and printing means shown in diagrammatic relation to each other to illustrate the random printing of characters of an exemplary group;

Fig. 7 is a plan view of the invention as employed in connection with one form of a perforated data carrying medium;

Fig. 8 is a view in side elevation of a type actuator used in the high speed printing mechanism of the invention.

Fig. 9 is an enlarged view in perspective showing the mounting of the type carrier illustrated in Fig. 8;

Fig. 10 is a circuit used in controlling a type actuator as illustrated in Fig. 8, the circuit also including diagrammatically a pick-up head and current amplifying means;

Fig. 11 is a view in sectional elevation showing diagrammatically the means for rapidly projecting and retracting a piece of type by the use of high pressure air and vacuum;

Fig. 12 is a view in longitudinal section showing the means for employing alternately a high air pressure and a vacuum to project the paper and ribbon against the face of the type;

Fig. 13 is a view in section taken through a pressure cylinder, an end diaphragm of which actuates a type element;

Fig. 14 is a view in perspective showing the use of a magneto-strictive effect in producing printing;

Fig. 15 is a fragmentary view in perspective showing how a moving perforated record card can be sensed and printed upon by the application of the invention;

Fig. 16 is a diagrammatic view showing how page printing is accomplished by the method and means of the invention;

Fig. 17 is a view in sectional elevation showing justifying means used in connection with the invention; and

Fig. 18 is a chart showing how justification of matter is carried out in connection with the page printing means of Fig. 16.

Referring to the drawing in detail, and particularly Figs. 1–7, inclusive, in which the invention has been shown in various methods of use, **10** indicates an endless magnetic recording tape which may be fed over suitable rollers **11**, in the direction indicated by the arrow, by a drive roller **12** mounted on a shaft **13** which is driven by any suitable source of power. The shaft also carries a drive roller **14** of similar diameter to roller **12** so that the peripheral speed of the rollers **12** and **14** will feed a paper tape **15** from a supply source **16** at the same speed of travel and in the same direction as the recording tape **10**. The tape **10** may be mounted on a drum instead of being passed over rollers, if desired, and is arranged to receive the characters, of matter to be thereafter printed, in the form of magnetic spots **17** which are applied in the well known manner by a recording head **18** employing the usual pulsating direct current or as disclosed in my copending application S.N. 659,223, filed April 3, 1946, now Patent No. 2,590,091, granted March 25, 1952, to cause each character unit **19** thereof to magnetically spot the recording tape **10**.

The impulses for the magnetizing units **19** of the recording head **18** are derived from the sensing of a perforated teletype tape or any other source of data such as the output of an electronic calculator and may include, in the circuit in which the recording head is included, any type of decoding means, the use of which is well known in the art. The data spotted on the tape in

Figs. 3–6, inclusive, is 01024364879B A, each character spot having been imposed on the tape in the sequential order in which it will appear on the printed tape when the printing action for the foregoing example has been completed. As an example of the arrangement of the magnetic spots 17, the tape 10 may be compared to any machine controlling card or tape in which data designations are arranged in vertical columns and longitudinal rows and are located at the intersections of said columns and rows at what are designated as data index positions. As the data being fed to the recording head is taken from a tape or card whose columns of data are equally spaced, the spots 17 will be imposed on the tape 10 at equally spaced intervals lengthwise of the tape by the units 19 of the recording head 18 which units are spaced equal distances apart widthwise or laterally of the card in a single row. This will result in spots 17 being imposed on the tape at the right angled intersections of imaginary horizontal and vertical, or lateral, lines 20 and 21, respectively so that the sensing units 22 of the pick-up head 23, horizontally aligned with the character units 19 of recording head 18 will lie obliquely across the intersections or data index positions and will sense the spots 17 as they pass under the head 23. This sensing may not occur in the order in which the spots have been imposed on the tape as it will be noted in Fig. 4 that spots "4," "6," and "8" are sensed at the same time as spots "0" and "1" which latter were imposed on the tape in advance of the "4," "6" and "8."

When the magnetized spots 17 pass beneath their respective sensing units 22 of the pick-up head 23 they will produce a pulse in the line 24, Fig. 10, which is increased by the amplifier 26 employing the usual vacuum tube and transformer combination, and fed to the centrally tapped transformer 27 for operation of a printing unit 28 (Fig. 8) including printing and return coils 29 and 31, between the poles of which is loosely positioned a metal strip or armature 32 carrying at its outer end a type character 33. The strip 32 is imprisoned in the frame 34 of the coil holder and preferably includes knife edges 36 and a counter-weight 37 so that free action of the printing type is insured to produce printing at extremely high speed, through the ribbon 38, on the paper tape 15 with a minimum of wear to the parts. The concerted action of the printing and return coils occurs on the positive and negative alternations of the pulse cycle as controlled by the 2050 type Thyratron tubes 39 and 40, in the respective printing and return coil circuits.

The printing head 42 includes one complete set of numeral printing units 28 from zero to nine and one complete set of units 28 from A to Z together with enough additional units to print other indicia such as periods, commas, and the like, but only one type element bearing any character need be employed. Hence, as shown in Fig. 3, with the tapes 10 and 15 being fed at the same speed; and the character units 19, the sensing units 22 and the printing units 28 all being arranged in the same relative order to each other; and the sensing units 22 being disposed obliquely with respect to the direction of travel of tape 10; it will be observed that to print "01024364879B A" these characters will be entered on the tape 10 in this order by the recording head 18, the units 19 of which receive their impulses from a remote source such as a teletype mechanism. As the spots 17 representing the characters 01468B in the first sensing action are simultaneously sensed by the respective sensing units 22 the corresponding printing units are simultaneously actuated to print these numerals on the tape 15 at the same time, so that their printing on the tape 15, as seen in Fig. 3, appears to be at random. This is also true of the manner in which the spots are sensed by the head 23 and is identified by the term "random printing" in that, while the character spots 17 are imposed on the tape 10 by the head 18 in successive order and in the order that they will appear on the tape 15 after printing has been completed, they are not sensed by the pick-up head or printed by the printing units in this order. In the second sensing action of the head 23 (Fig. 4), the numerals "2" and "9" are simultaneously printed on tape 15, the tapes 10 and 15 having advanced one increment or a space equal to the distance between the lateral lines 21. In the third sensing action of the head 23 (Fig. 5) the characters "0," "3" and "7" are simultaneously printed on tape 15, the tapes 10 and 15 having advanced one more increment. In the fourth sensing action of the head 23 (Fig. 6) the characters "4" and "A" will be printed, the tapes 10 and 15 having advanced one increment. It will be noted that a space occurs on the tape 10 between the spots representing "A" and "B" which space also occurs in the matter as finally printed. While the tapes are fed at high speed and continuously, the word increment does not indicate any step by step action of the tapes although in other forms of the invention this may be done if desired. It is evident that the spots are in thirteen different positions lengthwise of the tape 10 but by a longitudinal movement of the tape 10, embracing only four lateral column spaces, thirteen characters have been sensed and printed. The oblique position of the sensing head will depend upon the speed with which the spots are applied to the tape 10 and by varying the relative speed between the travel of the tapes 10 and 15 the spacing of the characters as they are printed on the tape 15 can be varied. The tape 10 is cleared by the well known action of a demagnetizing head or eraser 41.

Referring to Fig. 7, a tape 43, perforated in code arrangement as at 44, may be sensed by a unit 46 whose impulses are transmitted to the recording head 18 through a decoder 49, the operation of which is similar to that explained in U.S. Patent No. 2,160,152 to W. F. Kelley. Such a decoder may be also utilized in connection with a device of the character shown in Fig. 15 in which a movable perforated record card 47 of the type used for controlling business machines may be sensed by light conducting Lucite rods 48 and photocell equipment included with a decoder 49 as set forth in U.S. Patents 2,224,761 and 2,224,762 for operating the recording head 18 to magnetize the tape 10, which can be read by the pick-up head 23 to print on the card 47 through the printing head 42, the decoded matter of said card.

Verification of the correctness of the printing can be done through the use of a printing element circuit V (Fig. 8) which may be closed by a contact 50, the spring arm 45 of which, actuated by printing action of the respective type strip 32, also serves to retract the latter. The circuit V from each printing unit 28 may be used to operate mechanism to print a verifying record at a remote point where the information supplied to the recording head originated.

The obstacle that has stood in the way of fast printing has been the mechanical projection or retraction of the type, it being quite obvious that typewriting speed is limited by the speed with which the type can be projected and retracted and to this end there is shown in Fig. 11 a type carrier 51 having a piston 52, in a cylinder 53 which is reciprocated by the alternate injection of air, under very high pressure, and application of vacuum at both ends of the piston. This is accomplished by a valve 54 having an air inlet 55 and a vacuum outlet 56 controlled by an internal rotor 57, the walls of which form a valve for alternately controlling the flow of air and vacuum through pipes 59 to ports 61 and 62 respectively. The rapid coaction of high air pressure and high vacuum alternately at opposite ends of the piston results in high speed projection and retraction of the type element. A blast of highly compressed air is admitted at port 61 at the same time that vacuum is applied to the port 62. This results in the almost instantaneous and free movement of the piston 52 to which is secured the type mem-

ber. The right hand end of the cylinder is provided with a vent or relief valve **63** which permits the bleeding of an air cushion formed in that end of the cylinder thus permitting the controlled cushioning of the type action.

In Fig. 12 a further method of printing using highly compressed air and vacuum is disclosed. The type **64** are stationary with an ink ribbon **38** positioned between the type and paper **15**. A chamber **67** extends the full length of the row of type and located in alignment with each type is an air tube **68**. A vacuum is maintained in the chamber **67** at all times thus holding the paper away from the ribbon and type. When it is desired to print, a short or quick blast of highly compressed air is admitted to tube **68** associated with the desired print character, which force drives the paper against the ribbon and type. At the end of the blast of air the vacuum again withdraws the paper.

In Fig. 13 is disclosed a still further method of operating type. Each type **69** is secured to a spring metal diaphragm **71**. A blast of highly compressed air of short duration admitted to a tube **72** surrounding the diaphragm will cause the type to print.

In Fig. 14 the printing is done by utilizing the magnetostrictive action on a nickel rod or tube **73**. It has been found that an air column built up by the vibrations or pulsing of the rod will take the shape of the end cross-section of that rod or an opening therein. It is proposed to form the end of a nickel tube or rod in the shape of a printing character. This tube will then be positioned in a cloud chamber **74** containing ink or a magnetic substance in finely suspended particles. When current is applied to the operating magnet or coil **75**, the air column built up on the end of the rod will solidify the ink in the cloud into the shape of the character, thus printing it on a paper **76** located in the chamber, or moving therethrough. A rod of any form or having a small opening on the end may be used to print a magnetically conductive spot of like shape on the material **76** where the cloud bank is impregnated with a magnetizable element.

Through the use of the invention, which is termed "random printing," line justification as well as page printing may be accomplished and using the basis of the invention as shown in Figs. 3 to 6, page printing is accomplished through receipt of signals for controlling the printing from any suitable source such as a telegraph tape **70** or any medium which will give a signal of constant spacing. These signals are decoded by any suitable circuit or mechanism.

In order to perform page printing it is necessary to justify each of the lines of data received. A page is printed by printing alternate lines thereon as it moves from right to left and then printing the remaining lines as the page is moved from left to right. In order to accomplish this the entire data for the page must be stored in two magnetic storage drums; one, from which the data is read in its correct readable form and the other from which it is read in a reversed form. In order to justify the lines of printing before placing them on the storage drums, the signals are received and recorded on a testing drum of which there are two provided. As the signals and spaces are received they are counted by an electronic commutator, until the correct number of signals have been entered, plus one, to fill a line across the page. As the signals are received they are tested, particularly the last three signals, to determine whether the data at the end of the line ends in the middle of a word, a space, or the end of a word. Should the sensing disclose that the line ends in the middle of a word, a control circuit will cause the data on the first drum to be read off on to a second drum and as the data is read off and a space between words sensed by the testing head a clutch causes the drum to be advanced one quarter of a word space thus advancing the signals by that amount at each word space until two or less complete character spaces have been used up. The end of the line is again tested to determine whether the line is justified and if not, the data is read back to the first drum and the necessary spaces added to complete justification. When the data from the first drum was read on to the second drum, any signals beyond a certain predetermined point are switched by the control circuit to a third storage drum where they remain until the lines are completely justified.

When a line has been justified the signals composing said line are read off and passed by a control circuit through a gate circuit which guides the signals to one of two storage drums. The two storage drums are provided so that alternate lines may be stored therein until the data for a complete page has been stored.

Referring to Fig. 16, signals from a telegraph tape **77** pass through a translator **78** and are entered by a recording head **80** on the drum B as magnetic spots. An electronic counter, forms of which are well known, count the number of lines until sixty-one signal positions have been received. At that time the feed tape **77** is stopped. Continued rotation of drum B passes the signals in the last three signal positions, i.e., **59**, **60** and **61** pass the test head **81** and if it is found that there are three characters; a space and two characters; or a character, a space and a character; in these three positions, the control circuit then causes the reading head **82** to read the data from drum B and enter it by means of recording head **83** on drum C. As the data is recorded on drum C and passes test head **84** of that drum, each word space is sensed and a supplemental drive **86** (Fig. 17) is actuated to advance the drum one-quarter of a word or signal space. Should it be found upon testing the data on drum B that a "character, space, character" condition exists only the one-quarter increments necessary to add the equivalent of one space will be entered between words, thus justifying the line. Should a "space, character, character" condition be sensed then the increments equivalent to two spaces will be added between the words to justify the line. Should the condition "character, character, character," be sensed, then two spaces will be added as the data is placed on drum C but this will result in a condition of "character, space, character" being sensed by the test head **84** associated with drum C which will cause the control circuit to read data through reading head **85** of drum C and back on to drum B during which feeding the space equivalent to one word space will be added between words.

Reference to Fig. 18 will show the different combinations of character and space which may occur in justifying a line which ends "print more lines." The drum B only received the letters "lin" of the word "lines" when the tape **77** was stopped. This results in the testing head **81** of drum B finding a "character, character, character" condition which as described above necessitates the transference of the data from drum B to drum C and then back to drum B. It will be obvious why three test spaces are used, as a condition such as that shown in condition 5 may arise wherein a single character such as reference letter "B," the article "a," or a pronoun "I" may occur.

Each of the drums B and C carries a supplemental drive **86** as shown in Fig. 17 which is composed of a rotating member **87** loosely mounted on individual shafts **88**. One end of the member **87** has formed thereon an internal ratchet **89**. Secured to shaft **88** is a disc **90** lying within the plane of the ratchet **89** and having a drive pawl **91** and an electromagnet **92** secured thereon. Loosely mounted on shaft **88** is a bell-crank **93** one arm of which is an armature for the magnet **92** and the other of which carries a pawl **94**. Both pawls **91** and **94** are spring pressed into engagement with the teeth of ratchet **89**. The bell-crank **93** is connected to disc **90** by a pin **95** thereon and a slot in the bell-crank. The bell-crank is held in the normal position as shown by a spring **96**.

As the data to be justified is transferred from drum B

to drum C the test head 84 thereof senses each word space and the magnet 92 is energized to rock bell-crank 93 clockwise to advance the element 87 one quarter of a word space with respect to shaft 88. The pawl 91 ratchets idly into a new driving position and continues to drive the drum after the magnet 92 is deenergized. The spring 96 then rocks bell-crank 93 to a new position preparatory to the next signal. In this manner space is added in increments between the signals comprising words until the line is justified.

It is obvious that, as the data is transferred from drum B to drum C during justification, certain signals representing the characters "l, i, n," are to be dropped such as in condition 1 of Fig. 18. When data is transferred from one drum to another and sixty-one signal positions have been counted by the electronic commutator, any signals still remaining on the drum will be transferred through the control circuit and recording head 97 to a drum A where they will remain until the line is fully justified. After a full line has been justified and transferred from either drums B or C to storage drums A1 and A2, the leftover signals are then transferred by reading head 98 from drum A to drum B and the feed for tape 77 is again restarted to enter a new line on drum B for testing.

Each drum A, B and C, is provided with an erasing head 41 which is under control of the control circuit. Drums A1 and A2 are provided with one recording head 100 and as many reading heads 101 as are necessary to complete a page of printing. In the diagram four reading heads per drum are shown. The arrows L indicate the area covered by a line of printing. Each reading head 101 of drum A1 is connected to a printing unit 102 and each reading head 101 of drum A2 is connected to a printing unit 103. The drum A1 after having received all of the justified lines is rotated in the same direction as during recording and the lines are read simultaneously by reading heads 101 to actuate the printing units 102 as the page 104 is fed from right to left. When the page 104 has completed its travel and the alternate lines are printed drum A1 is stopped and drum A2 is rotated in a direction opposite to that during recording and the reading heads 101 read the lines in reverse order to actuate the printing units 103 as the page 104 is fed from left to right, thereby printing an entire page in two movements of the paper.

It is obvious that by providing the necessary printing units one under the other and not staggered as above that complete pages may be printed as a web of paper is fed lengthwise from right to left in a continuous motion. The web may then be cut into pages.

Because the operating impulses set up in the system are handled in circuit form, it is evident that the various units of the mechanism can be remote from each other. For instance, the source of the data impressed on a recording head can be distant from the recording station and likewise a printing unit can be remote from a sensing unit. While the linear order of these units coincide, any order of characters may be used as desired and not the numerical and alphabetical order as illustrated in the drawings. The method herein disclosed is susceptible of many variations, such for instance as; by providing a take-up in the feed of either of the tapes, intermittent in-put and constant out-put may be attained or one or more magnetic tapes and plural recording heads may be used with different spacings between a related recording head and reading head of a set so that printing may be done on a single tape by mechanically actuated printing mechanisms spaced apart a distance corresponding to the distance separating the reading heads so that a time lag is provided that allows for the mechanical operation of printing mechanisms such as used in a typewriter. The printing could be done on the same tape from which the data was read, if desired, and while magnetically recorded spots are employed because of the extremely high speed with which they can be imposed on the tape, it is within the scope of the invention to employ punched holes if desired, whose sensing could be accomplished in any of the known ways, such for instance, as by electrical contacts or brushes or light conveying tubes. Also the detection by photocell of spots and configurations of indicia other than spots which may be employed with or without code translating means is within the prevision of the invention.

As an example, Fig. 15 shows diagrammatically how the method of the invention may be used to interpret perforated tabulating cards. The punched card 105 is being sensed by passing light from light bank 106 through perforations in the card and then by way of Lucite rods 107 to a photo-electric and decoding sensing device 108 which is well known. After being amplified in the decoder the signals are carried by circuits 110 to a recording head 18 which records the data as magnetic spots on the tape 10 as above. A reading head 23 is spaced from the recording head 18 a distance equal to the travel of a card such as 105 from a position under the Lucite rods 107 to that shown for a card such as 109 under the printing unit 42 where the data previously sensed is printed. The printing unit and reading head are connected by circuits 111 which control the type to print the data above the column from which it was sensed. In Fig. 15, the card 105 is being sensed simultaneously with the printing of previously sensed data on card 109.

While I have described what I consider to be highly desirable embodiments of my invention, it is obvious that many changes in form could be made without departing from the spirit of my invention, and I, therefore, do not limit myself to the exact form herein shown and described, nor to anything less than the whole of my invention as hereinbefore set forth, and as hereinafter claimed.

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

1. In a device of the class described, a moving record medium, means for magnetically recording code representations of matter to be printed on said medium in column by column order, sensing units disposed obliquely of said medium and past each of which matter in one code position in different columns passes for activating a plurality of the sensing units simultaneously, a printing element for each sensing unit, and circuit means controlled by said sensing units for actuating the respective printing elements simultaneously with the activation of the corresponding sensing units.

2. In a device of the class described, the combination with a movable record medium having representations of matter to be printed arranged thereon in column by column order, of a reading head extending across said record medium and positioned obliquely to the direction of travel of said medium adapted to sense matter in different columns simultaneously, a printing head disposed longitudinally of the direction of travel of the record medium to record the data in a line, and circuit means controlled by said reading head for operating the printing head to print said matter in random order simultaneously with the sensing thereof.

3. In a device of the class described, means for recording on a moving tape in column by column succession code representations of data to be printed, sensing units disposed obliquely of said tape and past each of which matter in one code position in different columns travels for activating a plurality of the sensing units simultaneously, a printing element for each sensing unit comprising a printing and a return coil and a type carrier between said coils, said printing elements being disposed longitudinally of the direction of travel of said tape to record the data in a line in random order, and circuit means controlled by each sensing unit for successively energizing the coils in each printing element simultaneously with the activation of the respective sensing unit.

4. In a device of the class described, means for re-

cording on a moving tape in column by column succession code positioned representations of matter to be printed, sensing units disposed obliquely of said tape and past each of which matter in one code position in different columns travels for activating the sensing units simultaneously, a printing element for each sensing unit, said printing elements being disposed longitudinally of the direction of travel of said tape to record the data in a line in random order and each element comprising a printing and a return coil and a type carrier between said coils, circuit means controlled by each sensing unit for energizing the coils of each printing element on the positive and negative alternating phases of a current surge on each activation of a respective sensing unit, and a verify circuit closing means actuated by movement of said type carrier.

5. The combination with sensing means for reading matter perforated in code in a first movable record, the perforations being arranged in each column of the record to represent one character of matter to be printed, means for translating the coded matter and circuit means including said sensing and translating means; of recording means included in said circuit means for magnetically imposing the translated matter on a second movable record successively in single columns, a reading head for said second record disposed obliquely to the direction of travel of said record for simultaneously sensing at random the imposed matter disposed in different columns, a printing head disposed longitudinally of the direction of travel of the record to print the data in a line in random order, and circuits including said reading and printing heads for printing said imposed matter simultaneously with the sensing thereof by said reading head.

6. The method of printing which consists in applying data designations column by column to a movable record medium at index positions equally spaced in the direction of travel of the sheet, detecting said data designations with sensing means arranged obliquely to the direction of travel of the record medium to overlie a plurality of said columns and then activating printing means disposed longitudinally of the direction of travel of said record medium to print in a line, in random order all of the data detected by said sensing means in said plurality of columns simultaneously with the sensing thereof.

7. The method of printing which consists in feeding matter to be printed past means for sensing in random order one or more characters of said matter simultaneously, feeding material past sequentially arranged printing means controlled by said sensing means for printing in random order said one or more characters on said material simultaneously with the sensing thereof and feeding said matter and said material at the same rate of speed past their respective sensing and printing means.

8. The method of printing at high speed, which consists in sensing in random order one or more characters of matter to be printed and printing in random order said one or more characters simultaneously with the random sensing thereof.

9. The method of printing at high speed, which consists in simultaneously sensing in random order from moving material one or more characters of matter to be printed that have been recorded on said material one at a time in a predetermined sequence and printing said characters in random order simultaneously with the random sensing thereof.

10. In a digital information handling system, first and second adjacently disposed devices, apparatus displacing a record receiving member past said devices, said first device being disposed obliquely to the direction of said receiving member to read the digits in random order and said second device being disposed longitudinally of the direction of displacement of the receiving member to record the digits in a line in random order, and apparatus for entering on the record characters controlling said first device.

11. In record sensing apparatus adapted for use with a record bearing member embodying information in a plurality of substantially adjacent parallel channels in which a predetermined nominal distance lengthwise of said channels is assigned to receive each information entry, when present; driving apparatus for displacing said record bearing member; and a plurality of record sensing members embracing a plurality of said channels, said sensing members being mutually displaced along a first direction line a distance substantially corresponding to the spacing between channels, and mutually displaced along a second direction line a distance substantially corresponding to said nominal lengthwise entry spacing, for simultaneously sensing one or more of said information entries, and a single set of type controlled by said sensing members extending in a direction corresponding to said second direction line for printing said entries simultaneously with the sensing thereof.

12. In record sensing apparatus adapted for use with a record bearing member embodying information in a plurality of substantially adjacent parallel channels in which a predetermined nominal distance lengthwise of said channels is assigned to receive each information entry, when present; driving apparatus for displacing said record bearing member, and a plurality of record sensing members embracing a plurality of said chanels, said sensing members being mutually displaced in monotonic sequence along a first direction line a distance substantially corresponding to the spacing between said channels, and mutually displaced in monotonic sequence along a second direction line a distance substantially corresponding to said nominal lengthwise entry spacing, for simultaneously sensing one or more of said information entries, and a single set of type controlled by said sensing members extending in a direction corresponding to said second direction line for printing said entries simultaneously with the sensing thereof.

13. In a printing device, a plurality of character impressing stations, each capable of printing a different character, apparatus displacing a character receiving member past said character impressing stations in cooperative relationship therewith serially, apparatus for sensing in random order information entries characterized by a predetermined information sequence, and apparatus connecting said sensing apparatus with said character impressing stations and modifying the distribution of information to said character impressing stations to enter said characters on said character receiving member in sequence corresponding to said predetermined information sequence.

14. The method of recording information which comprises; recording single data designations in a first time sequence, sensing one or more of said data designations simultaneously in a second time sequence, entering said sensed information on an information receiving medium in a time sequence corresponding to said second time sequence and a space sequence corresponding to said first time sequence.

15. The method of recording information which comprises; recording single data designations in a first space sequence, sensing one or more of said data designations simultaneously in a second time sequence, and entering said sensed information on an information receiving medium in a time sequence corresponding to said sensing sequence and in a space sequence corresponding to said first space sequence.

16. The method of printing which consists in applying data designations column by column to a movable record sheet at index positions equally spaced in the direction of travel of the sheet, detecting said data designations in random order with sensing means arranged obliquely to the direction of travel of the sheet to overlie a plurality of said columns, and activating printing means arranged longitudinally of the direction of travel of the sheet to

print all of the data detected by said sensing means in said plurality of columns in sequence corresponding with the sensing thereof and simultaneously with the detection thereof by said sensing means.

17. In a device of the class described, means for recording in a movable record medium one at a time and in predetermined order, representations of matter to be printed; a reading head positioned obliquely with respect to said medium for sensing simultaneously one or more of said recorded representations presented to said sensing head in haphazard order; printing means arranged longitudinally of the direction of travel of said medium including one each of alphabet and numerical type; and means controlled by the reading head for actuating the printing means to print the matter sensed on a movable record medium simultaneously with the sensing thereof by said reading head.

18. A high-speed printing system for printing in linear space sequence on a printing medium information characters stored as signals in a nonlinear space sequence on a storage member, said storage member having a plurality of equally spaced transverse sections and a plurality of parallel longitudinal signal tracks for storing the signals, each track representing a different character, only one track per section being energized in accordance with the space locations of the characters to be printed, said printing system comprising: a plurality of signal sensing devices positioned adjacent the storage member and responsive to the stored signals for producing output signals corresponding to the stored informational characters, each signal sensing device being positioned to sense a different transverse section during any one time interval for converting the stored nonlinearly spaced signals into linearly timed output signals; first means for moving the storage member and each of said signal sensing devices relative to each other; a corresponding plurality of printing means linearly disposed adjacent the printing medium and coupled to said plurality of signal sensing devices, respectively, each of said printing means including actuating means for engaging the printing medium with said printer means in response to an output signal from the associated signal sensing device to print on the printing medium the informational character corresponding to the output signal; and second means for moving the printing medium continuously past said printing means.

19. A high-speed printing system for printing in linear space sequence on a printing medium informational characters stored as signals in a nonlinear space sequence on a storage member, said storage member having a plurality of equally spaced vertical column positions and a plurality of parallel longitudinal row positions providing column and row intersections constituting data designation positions for storing the signals, said printing system comprising: a plurality of signal sensing devices positioned adjacent the storage member and responsive to the stored signals for producing output signals corresponding to the stored information, each signal sensing device being positioned to sense different data designation positions during any one time interval for converting the stored nonlinearly spaced signals into linearly timed output signals; a corresponding plurality of printing means linearly disposed adjacent the printing medium and coupled to said plurality of signal sensing devices, respectively, each of said printing means including actuating means for engaging the printing medium with said printer means in response to an output signal from the associated signal sensing device to print on the printing medium the information corresponding to the output signal; and means for moving the storage member and the printing medium.

20. The method of printing which consists in applying character indicating signals to a moving record at spaced data designation positions defined by the coincidence of longitudinal row and vertical column locations on the record and then sensing one or more of said signals at different locations at the same time for simultaneous printing on a moving record from one font of type.

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