Jan. 24, 1967 D. H. ROBBINS ETAL Re. 26,144

JUSTIFICATION INFORMATION COMPUTER AND TAPE PERFORATOR FOR PHOTOCOMPOSING MACHINES

Original Filed Sept. 4, 1956 20 Sheets-Sheet 1

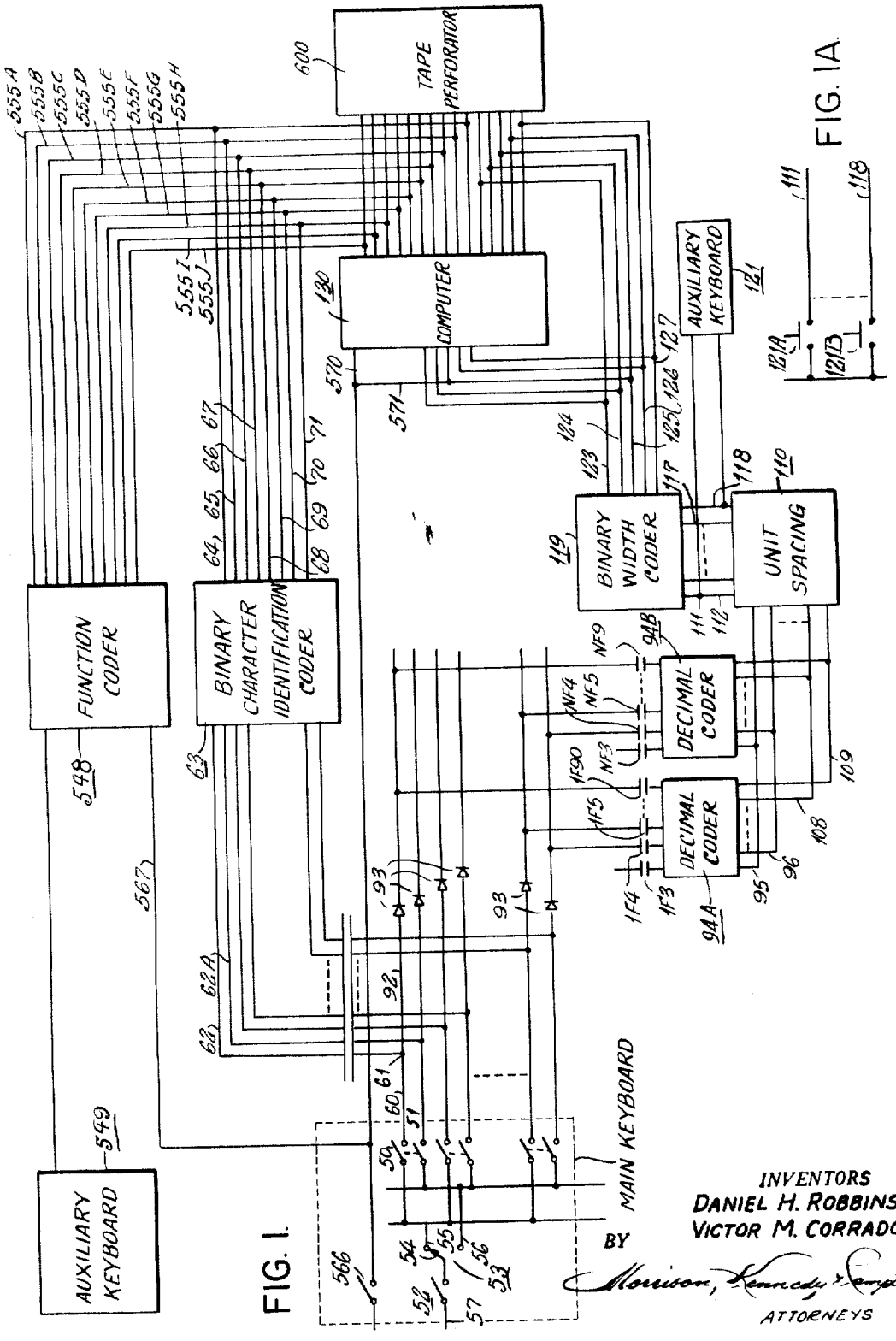


FIG. 1A.

FIG. 1.

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JUSTIFICATION INFORMATION COMPUTER AND TAPE PERFORATOR FOR PHOTOCOMPOSING MACHINES

Original Filed Sept. 4, 1956 20 Sheets-Sheet 2

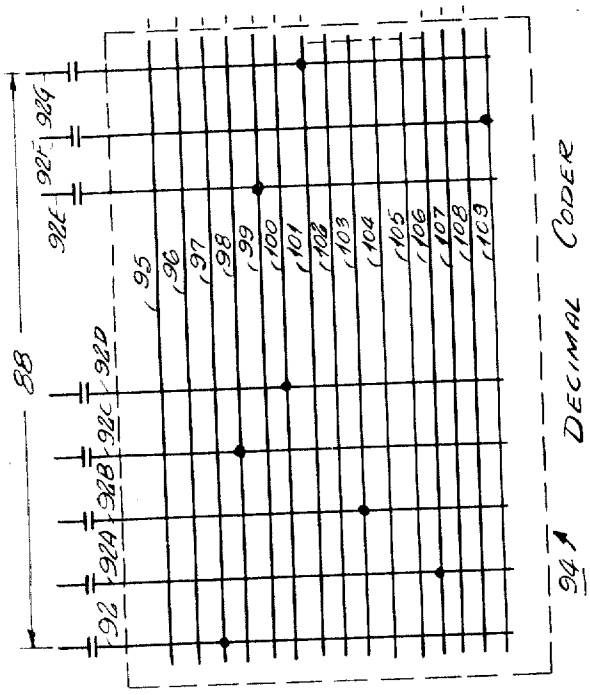


FIG. 3

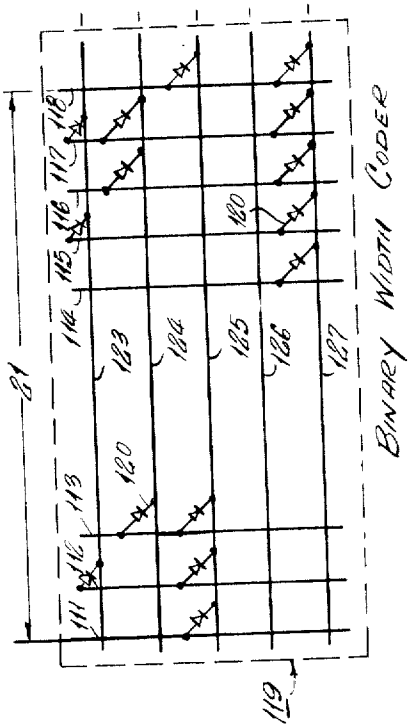


FIG. 4

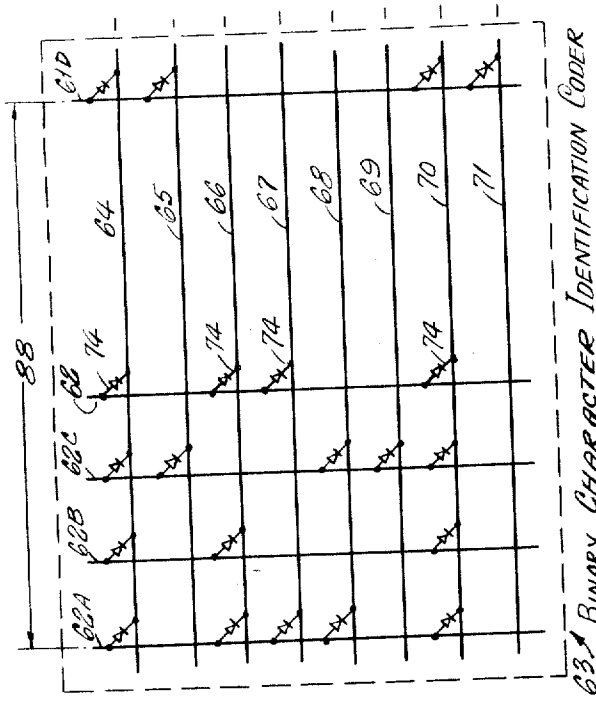


FIG. 2

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FIG. 6

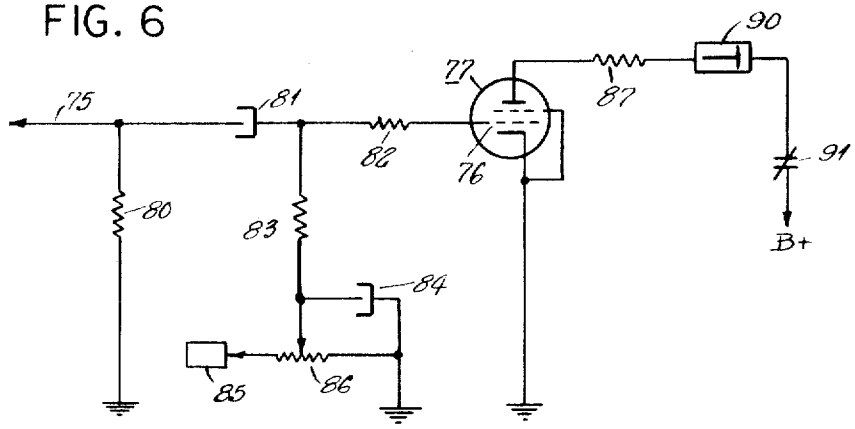
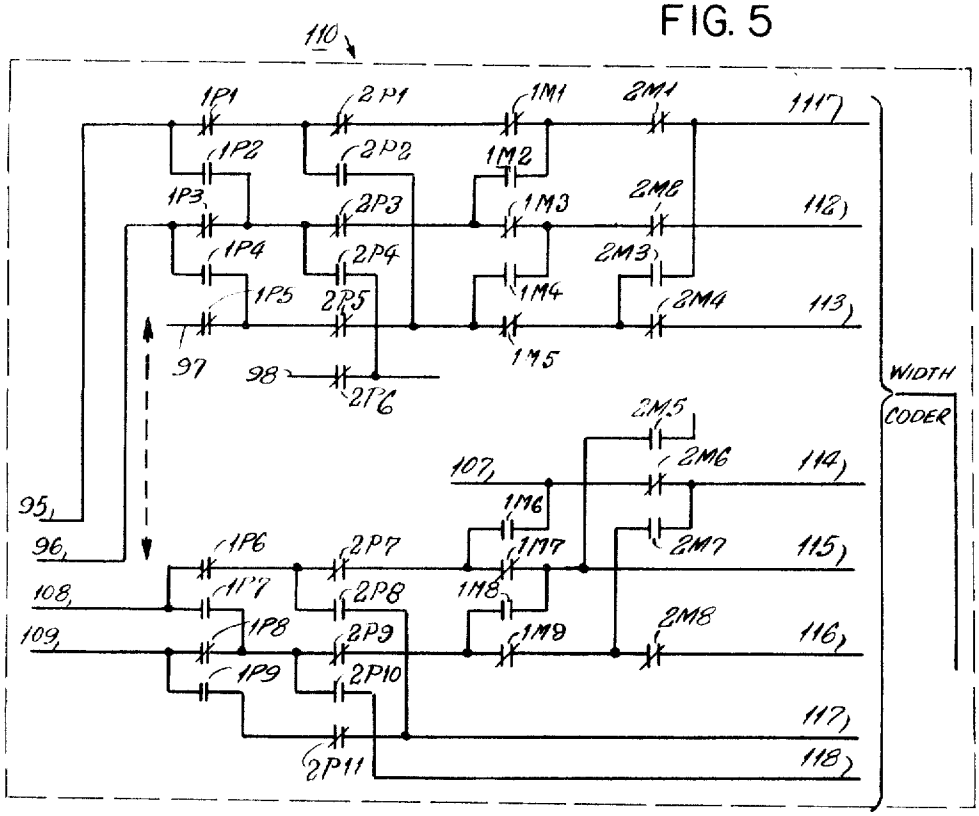


FIG. 5



UNIT SPACING

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JUSTIFICATION INFORMATION COMPUTER AND TAPE PERFORATOR FOR PHOTOCOMPOSING MACHINES

20 Sheets-Sheet 4

Original Filed Sept. 4, 1956

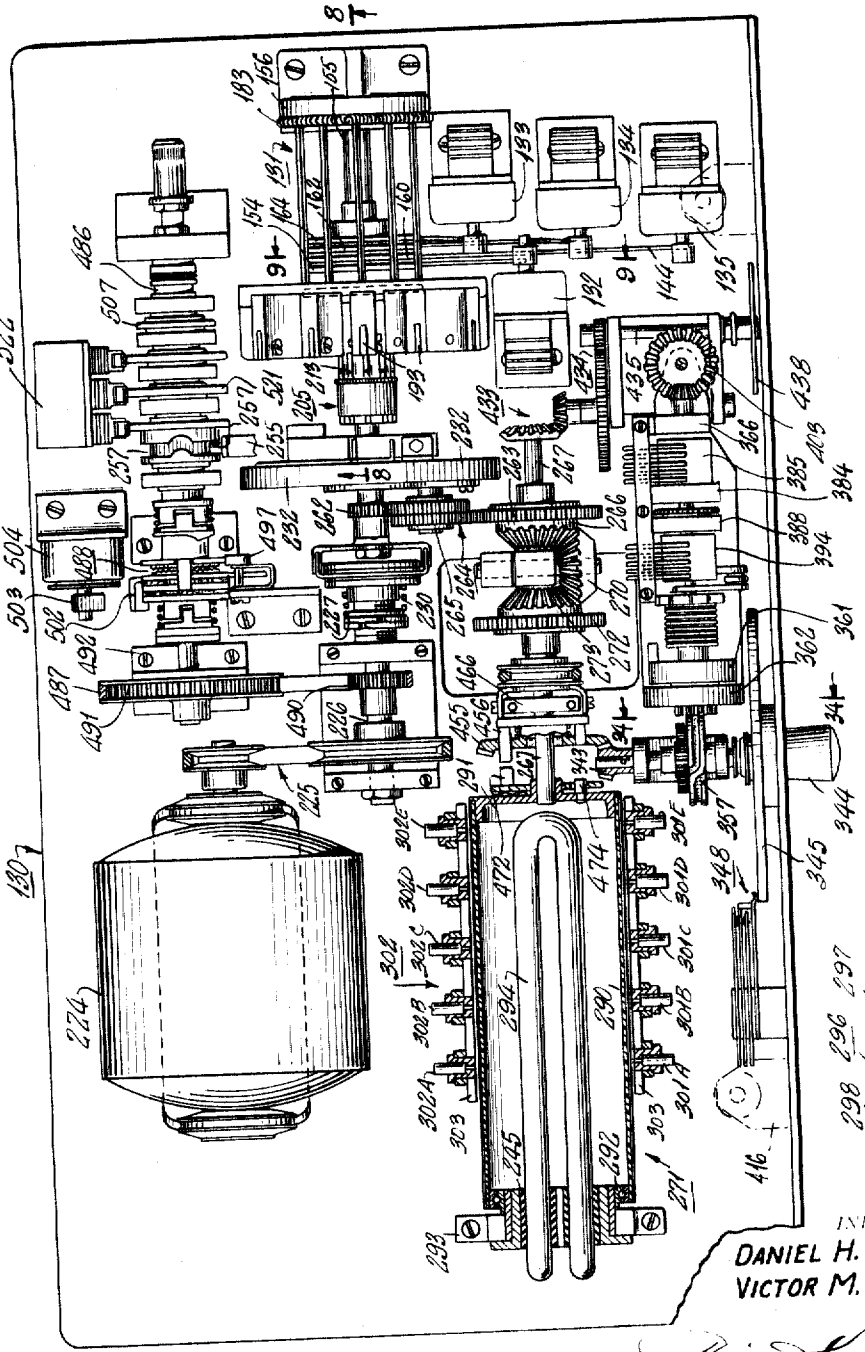


FIG. 7

FIG. 7A

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JUSTIFICATION INFORMATION COMPUTER AND TAPE PERFORATOR FOR PHOTOCOMPOSING MACHINES

Original Filed Sept. 4, 1956 20 Sheets-Sheet 5

FIG. 11

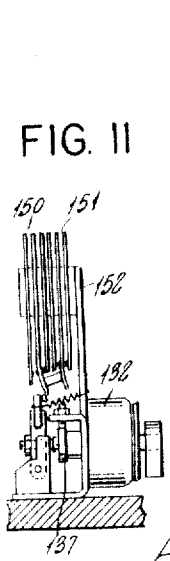


FIG. 8

FIG. 9

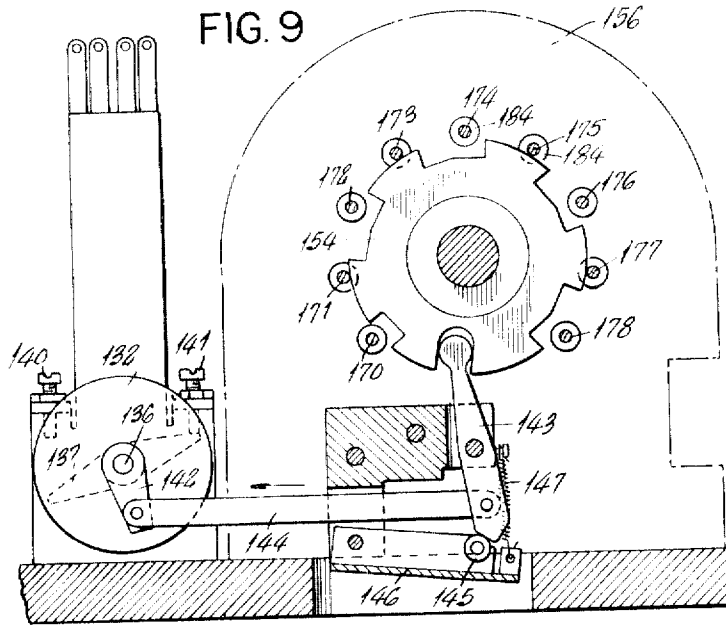
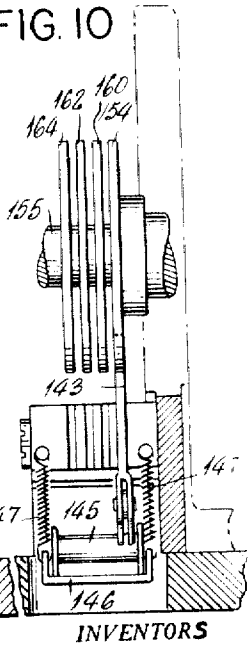


FIG. 10



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FIG. 12

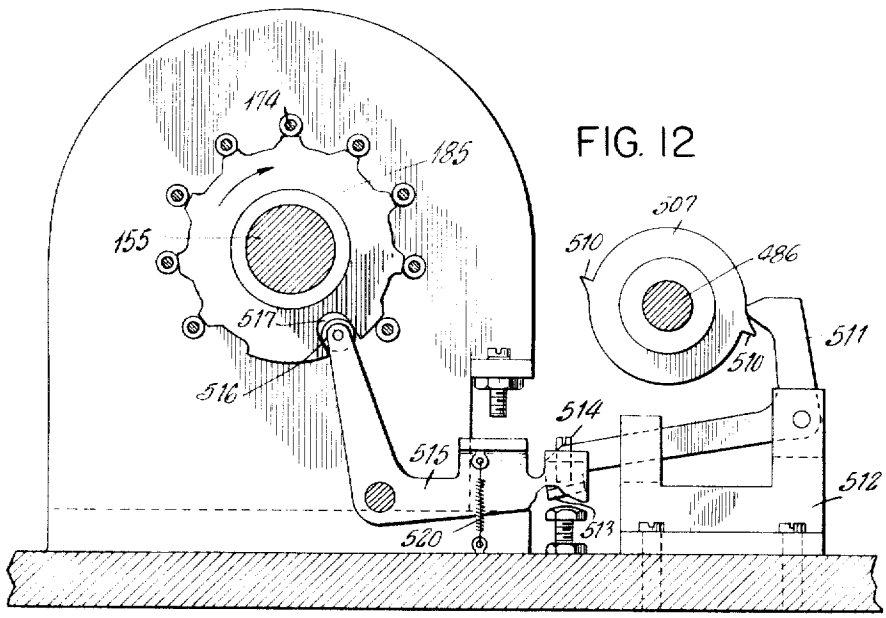


FIG. 13

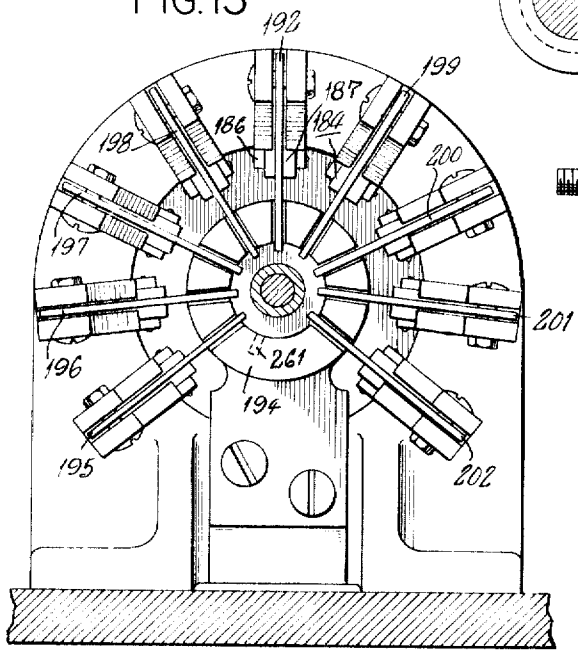
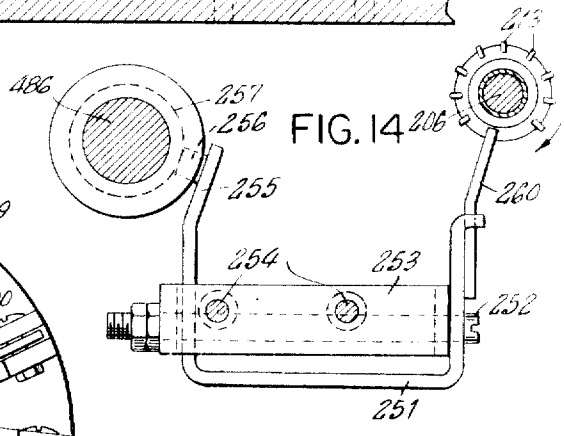


FIG. 14



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FIG. 15

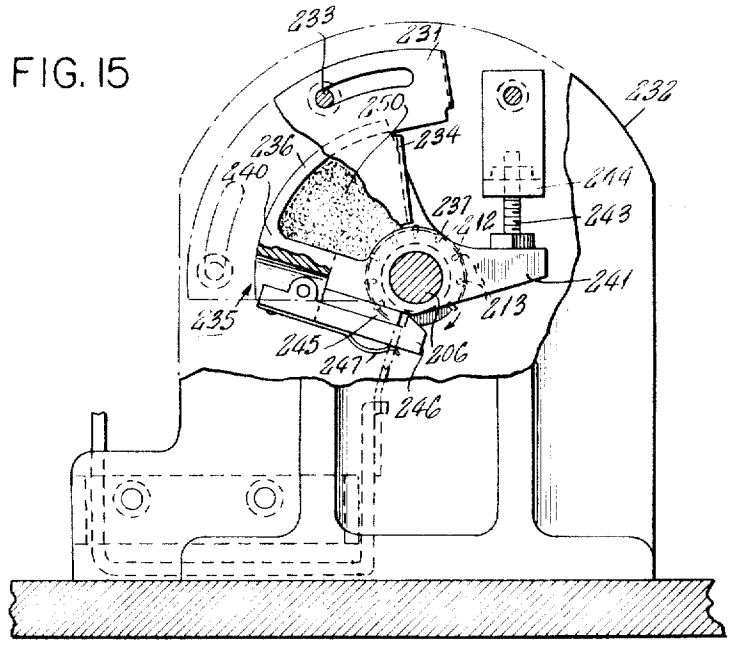
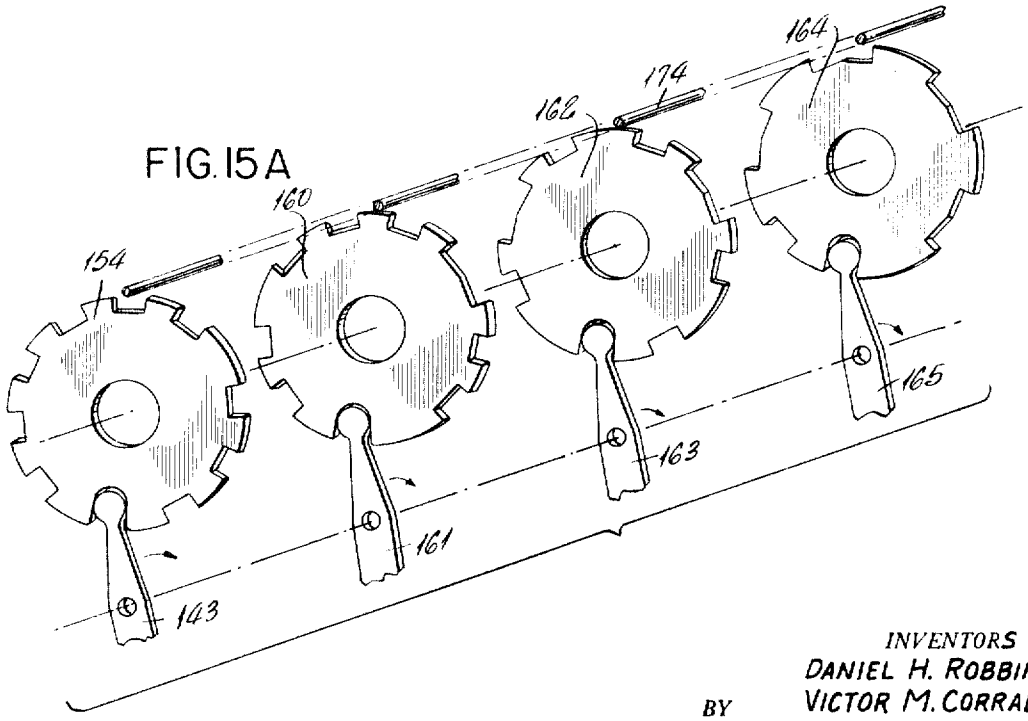


FIG. 15A



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FIG. 16

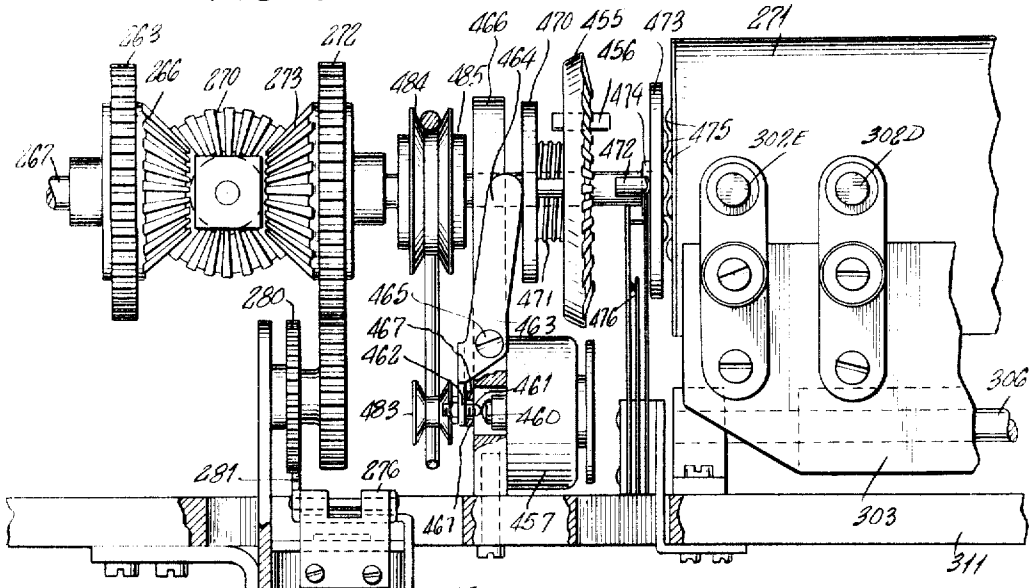


FIG. 19

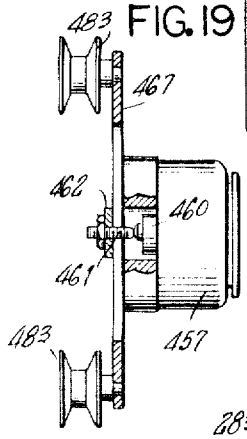
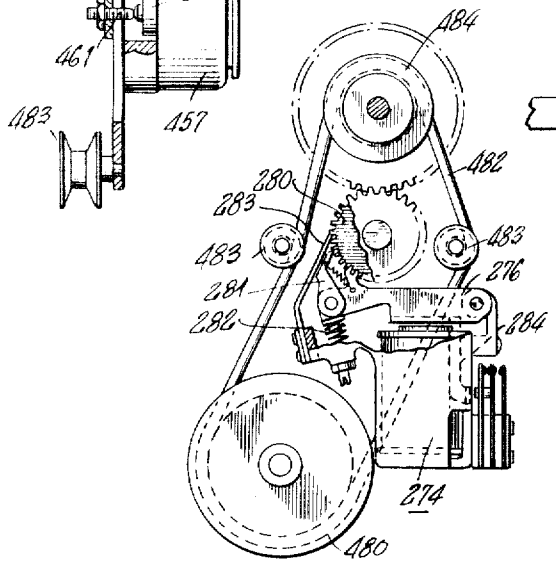


FIG. 18



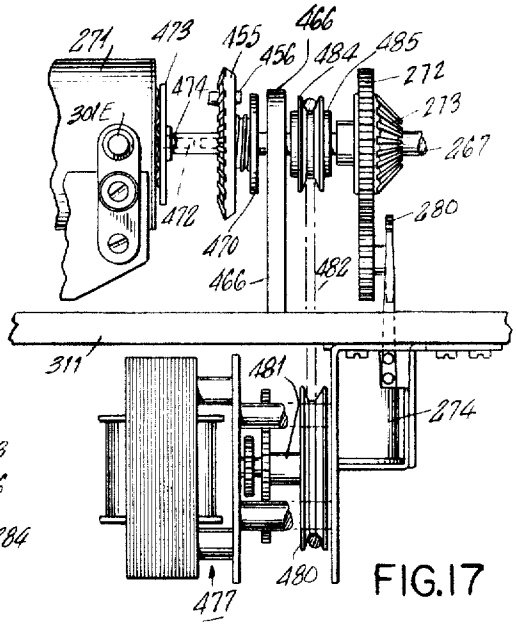
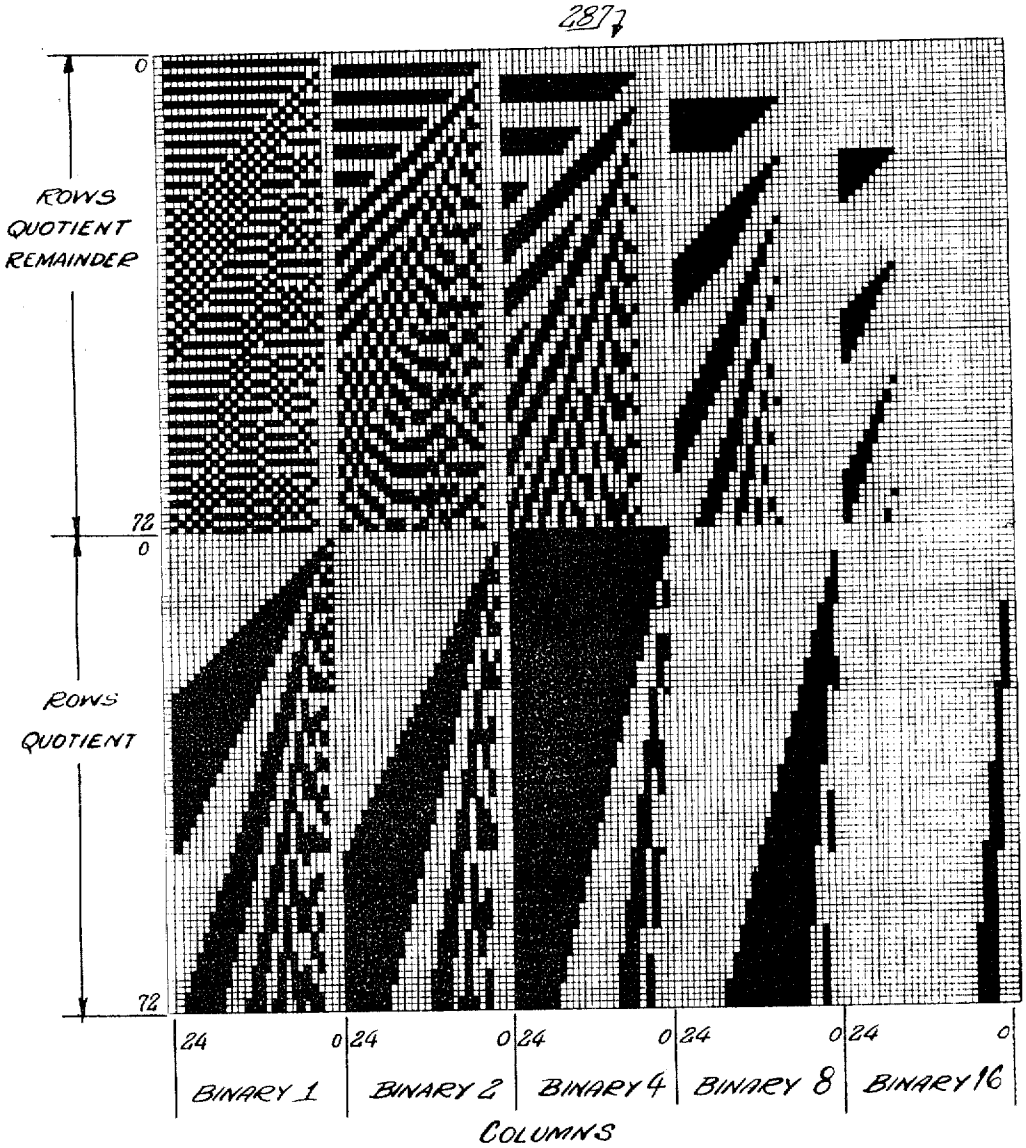


FIG. 17

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FIG. 20



JUSTIFICATION PORTION OF COMPUTER DRUM

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Morrison, Kennedy & Campbell
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FIG. 21

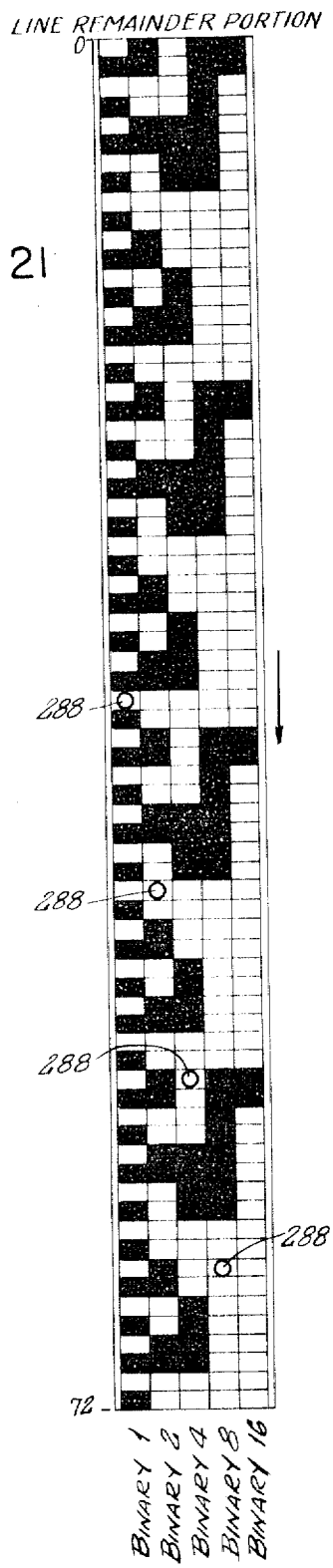
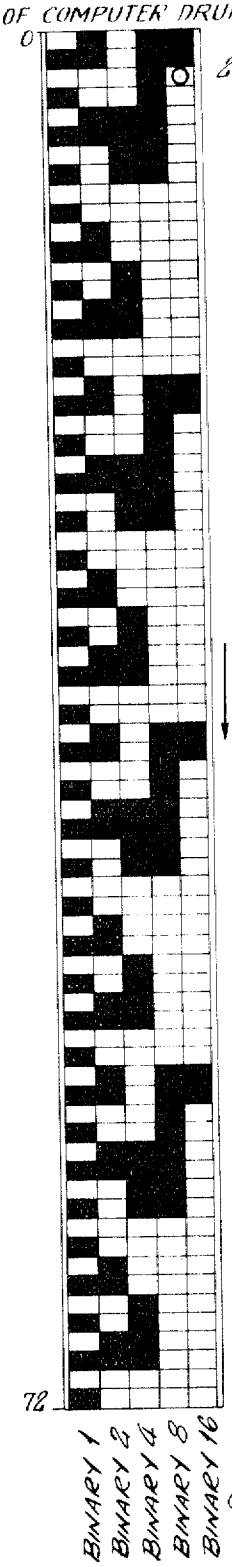


FIG. 22



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JUSTIFICATION INFORMATION COMPUTER AND TAPE PERFORATOR FOR PHOTOCOMPOSING MACHINES

Original Filed Sept. 4, 1956 20 Sheets-Sheet 11

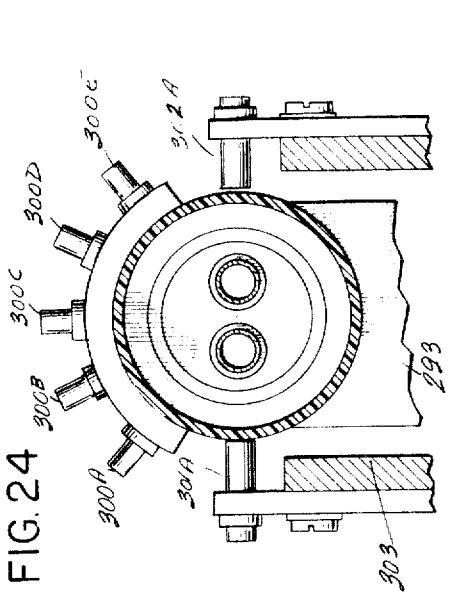


FIG. 24

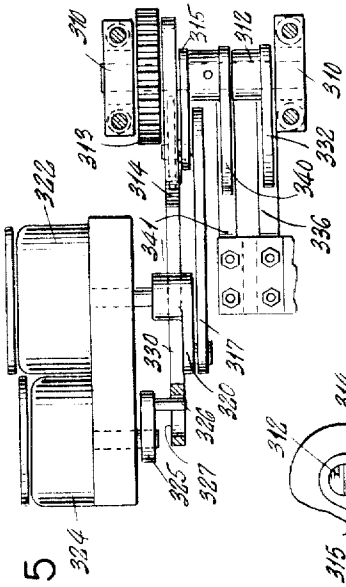


FIG. 25

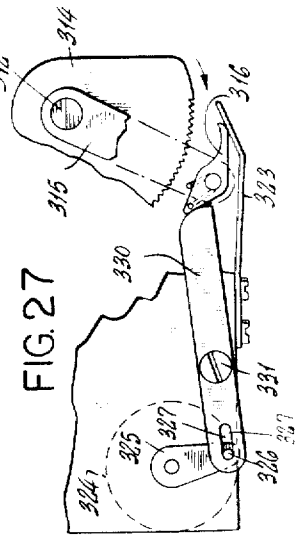


FIG. 27

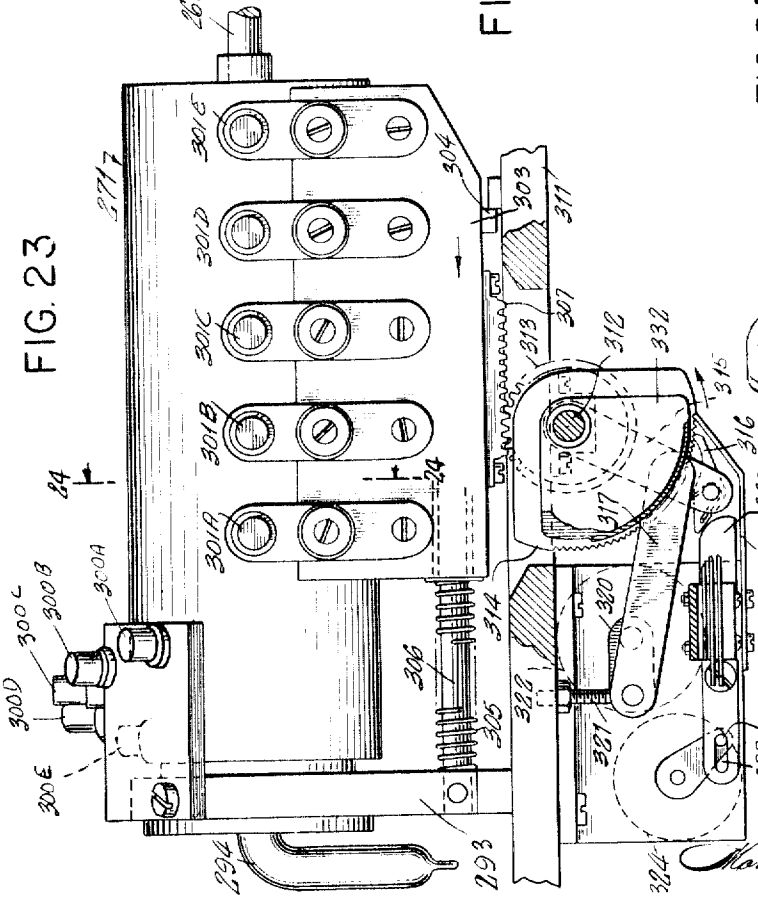


FIG. 23

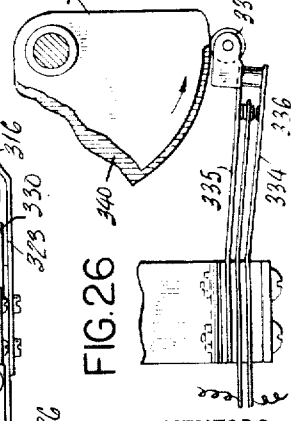


FIG. 26

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VICTOR M. CORRADO

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JUSTIFICATION INFORMATION COMPUTER AND TAPE PERFORATOR FOR PHOTOCOMPOSING MACHINES

Original Filed Sept. 4, 1956 20 Sheets-Sheet 12

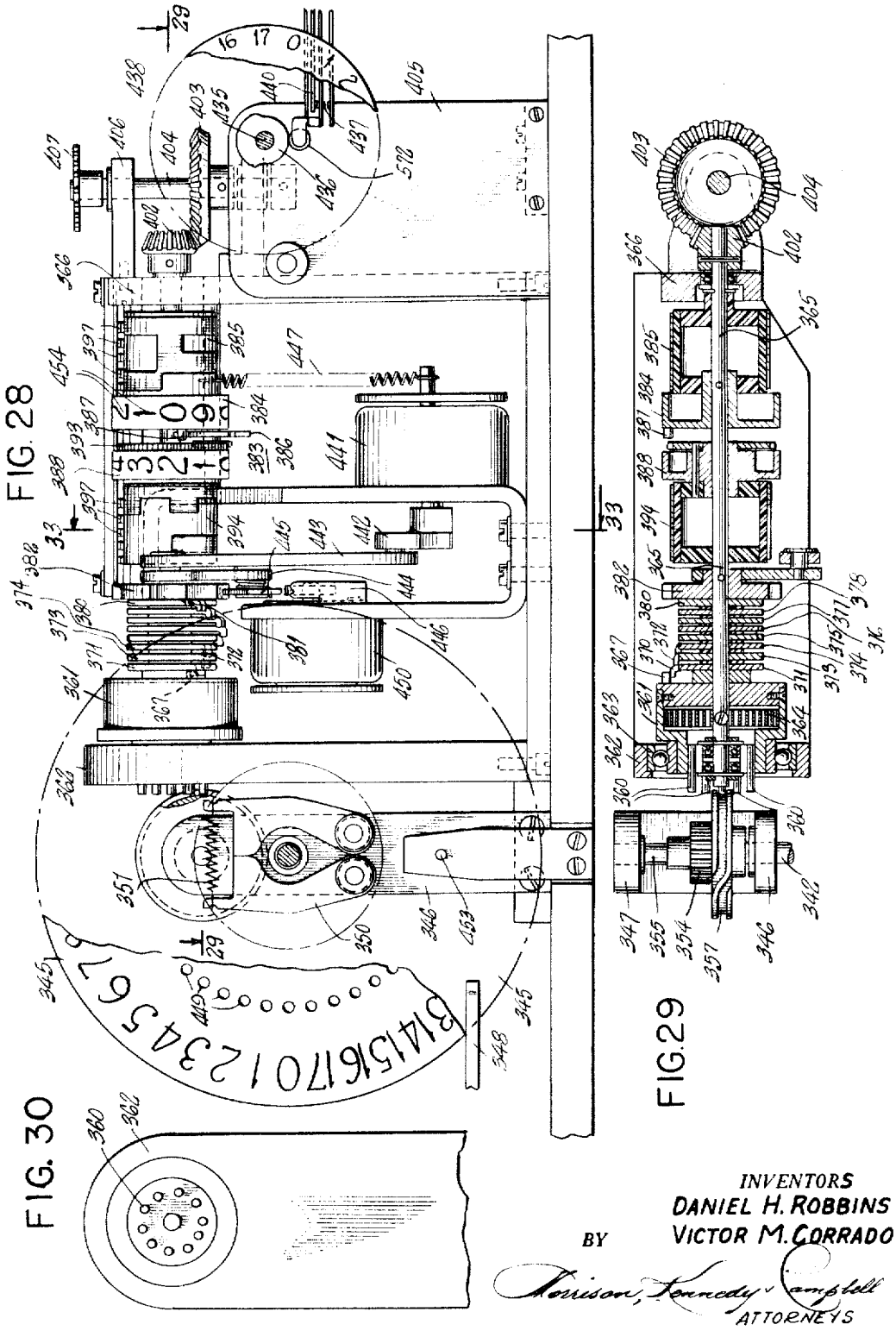


FIG. 28

FIG. 29

FIG. 30

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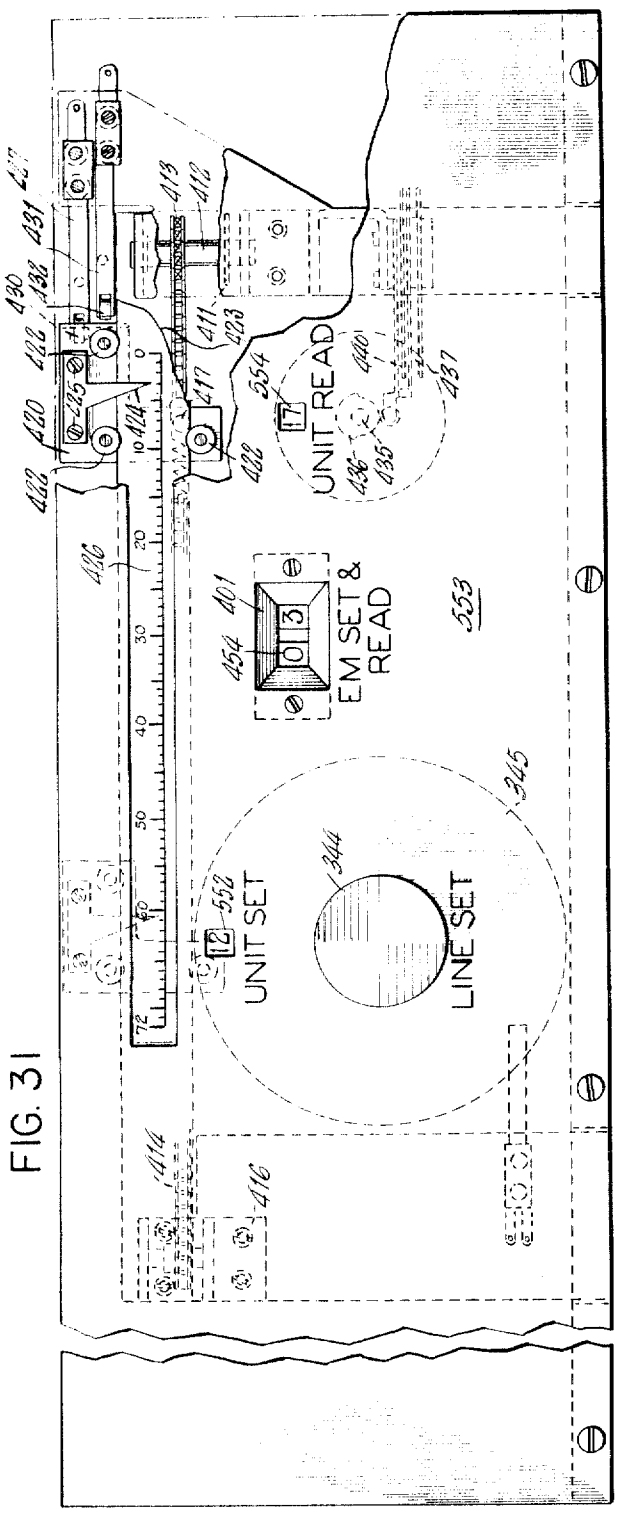


FIG. 31

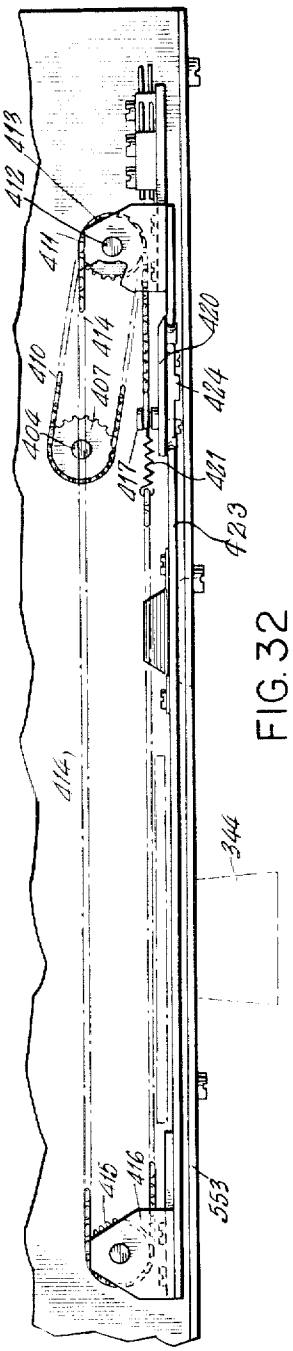


FIG. 32

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FIG. 33

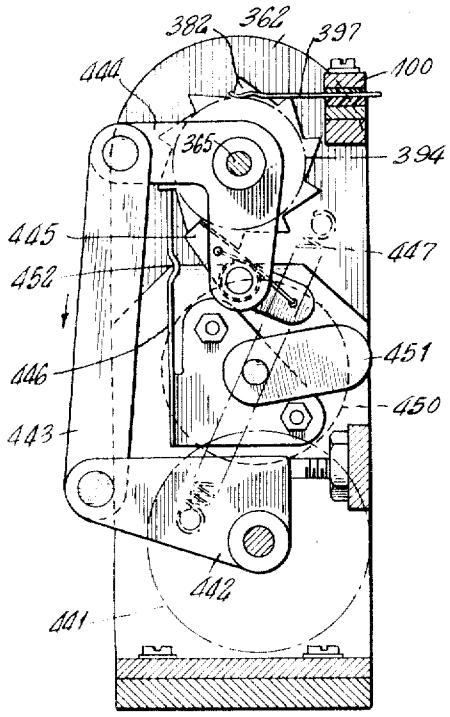


FIG. 36

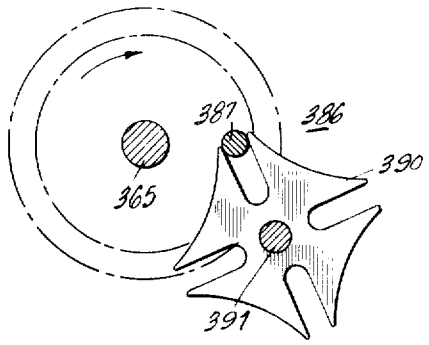


FIG. 35

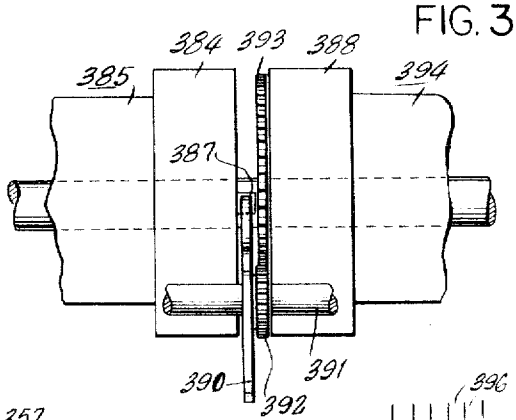


FIG. 34

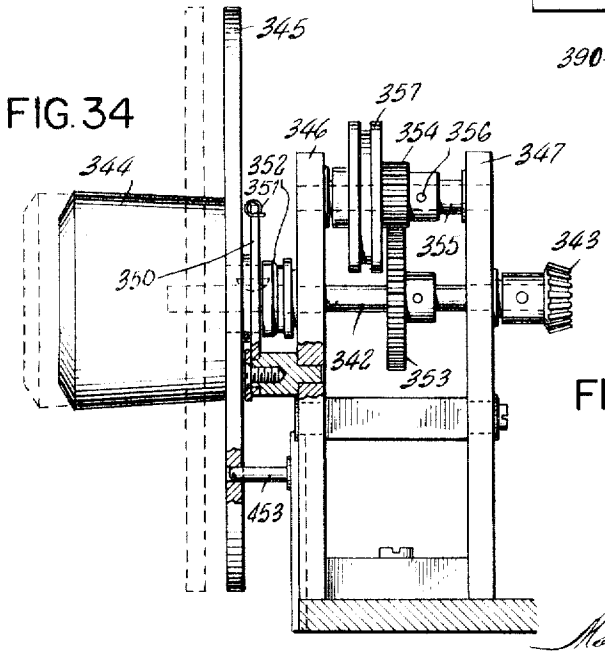
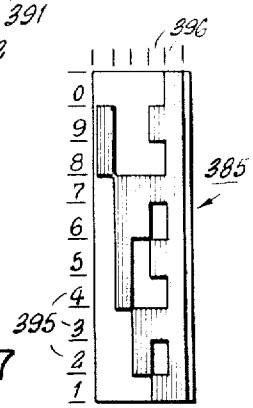


FIG. 37



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FIG. 38

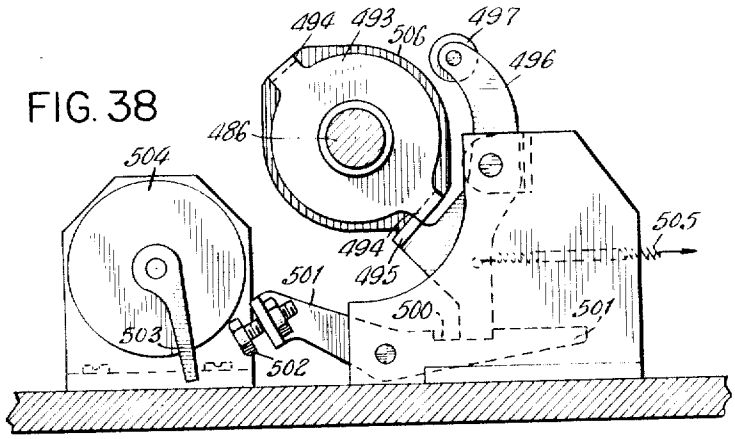
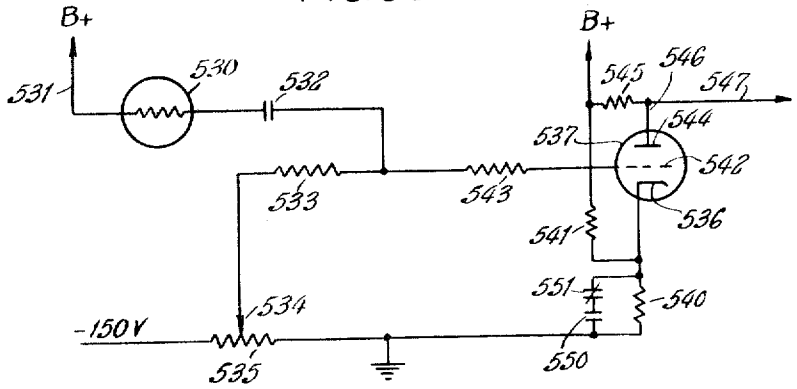


FIG. 39



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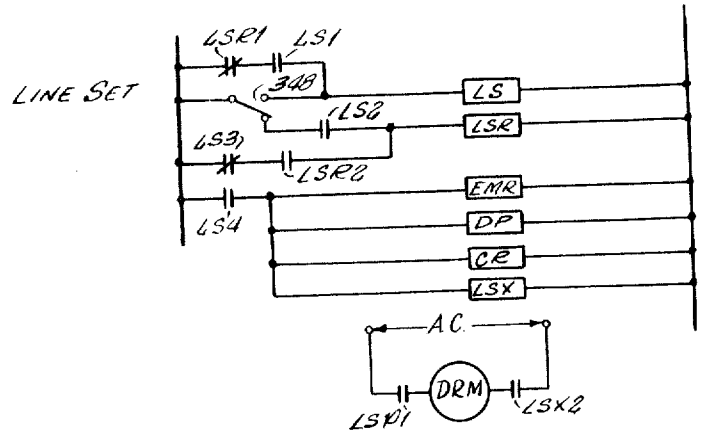


FIG. 40

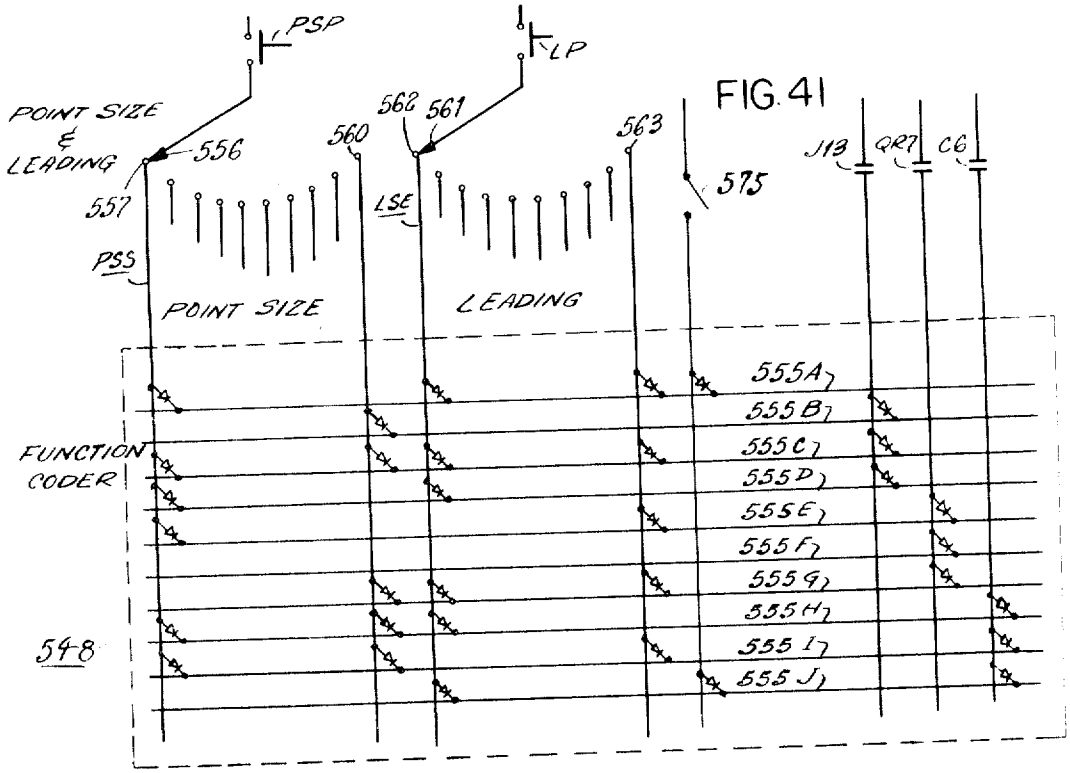


FIG. 41

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FIG. 42

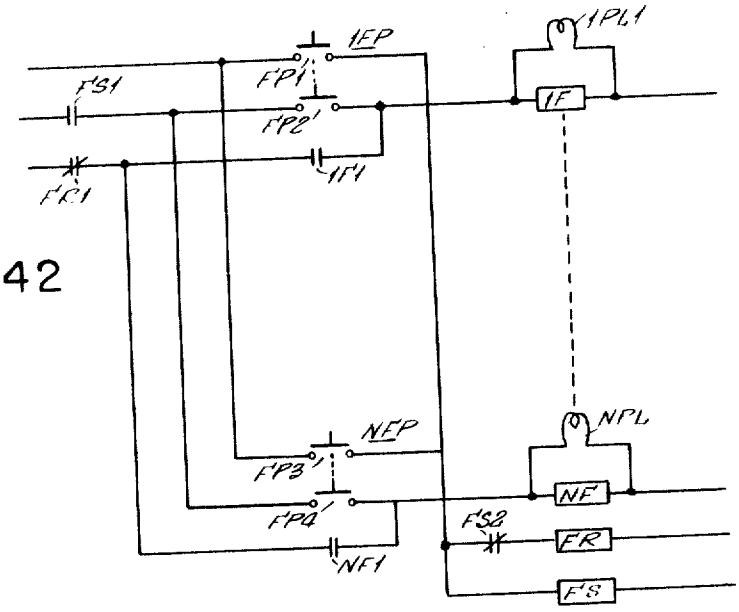
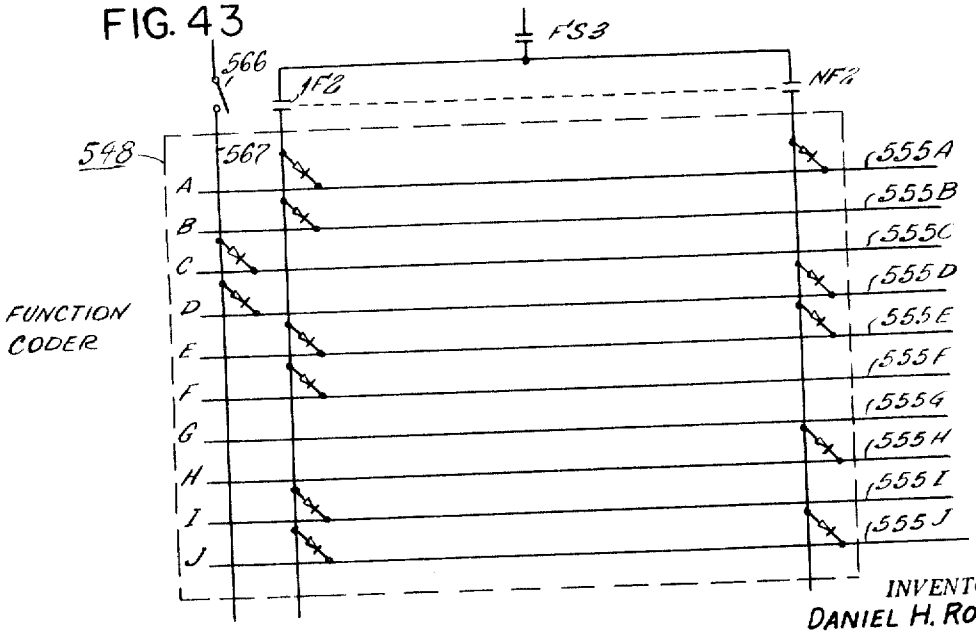


FIG. 43



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FIG. 44

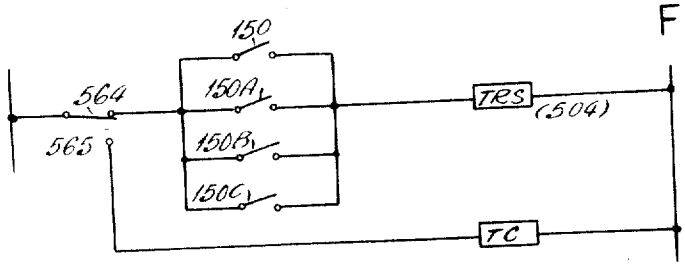


FIG. 45

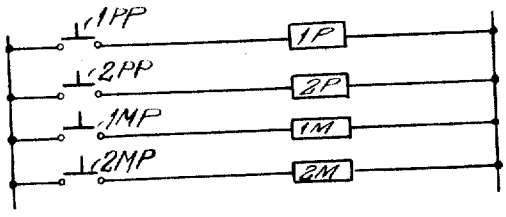
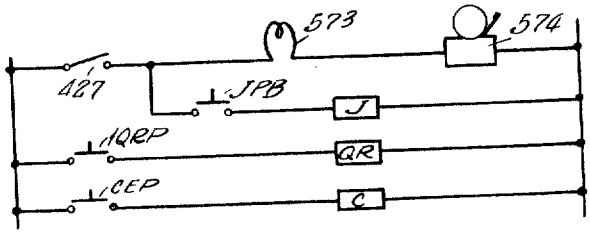
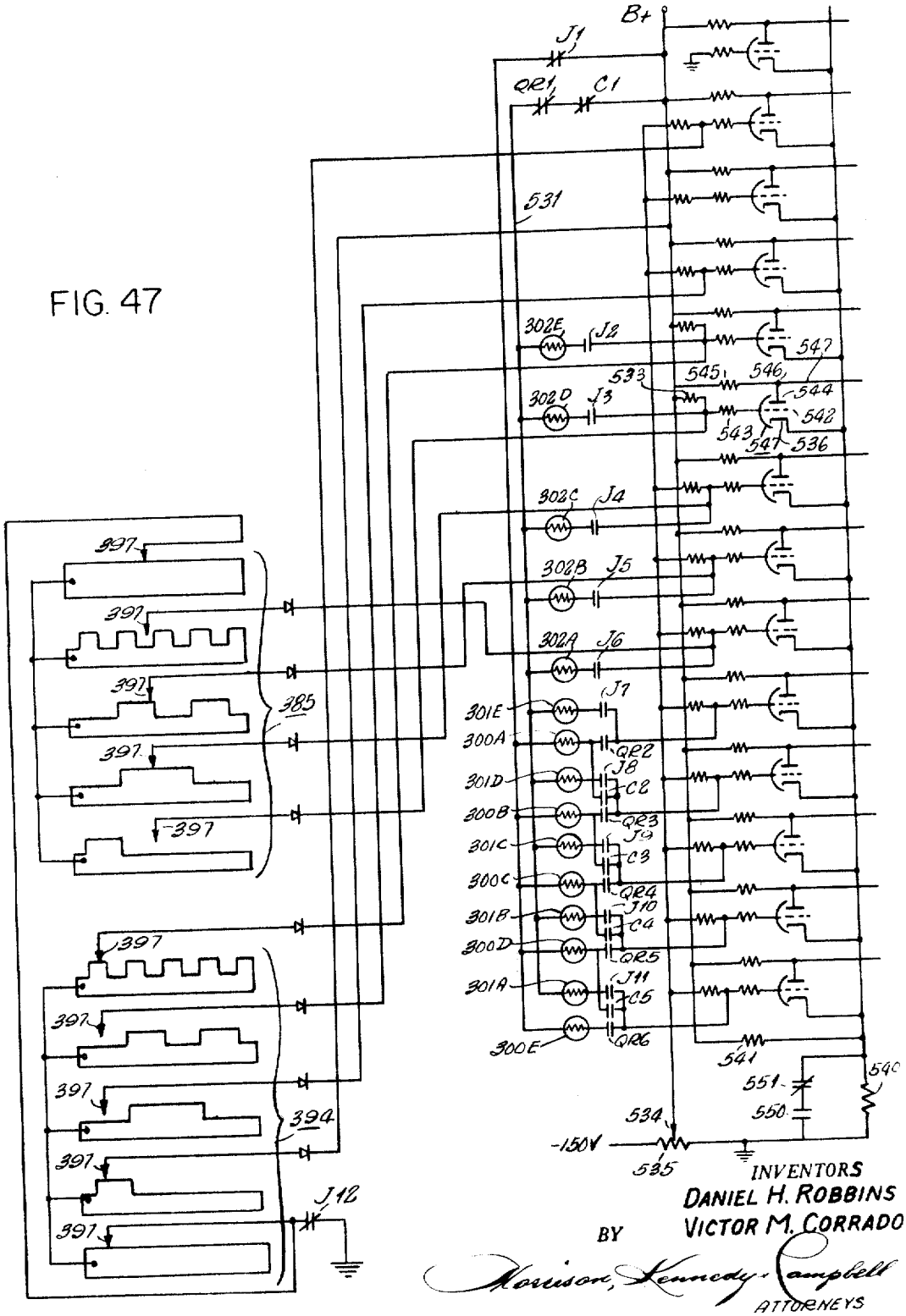


FIG. 46



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ATTORNEYS

FIG. 47



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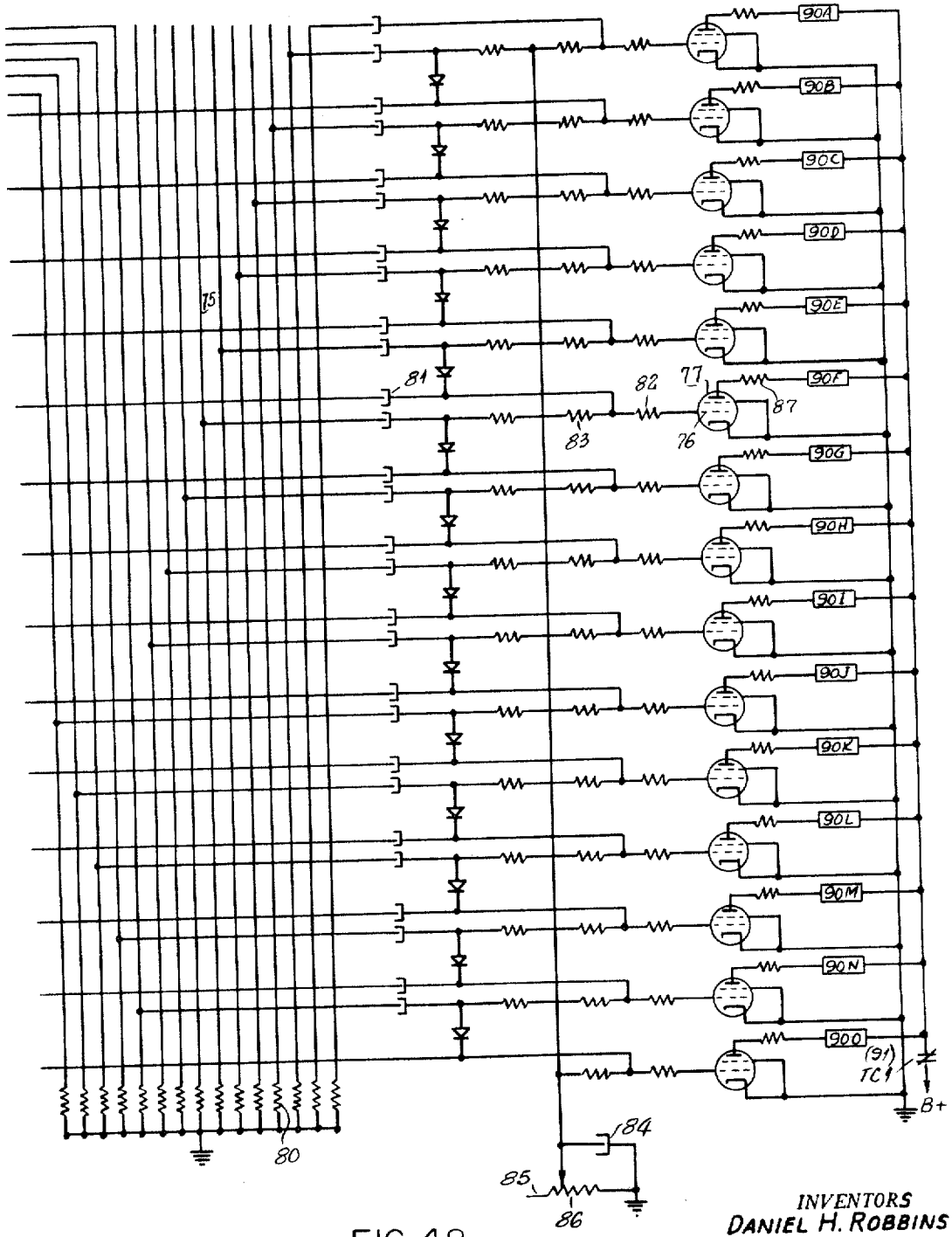


FIG. 48

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ATTORNEYS

United States Patent Office

Re. 26,144
Reissued Jan. 24, 1967

26,144

JUSTIFICATION INFORMATION COMPUTER AND TAPE PERFORATOR FOR PHOTOCOMPOSING MACHINES

Daniel H. Robbins, Rochester, and Victor M. Corrado, Albertson, N.Y., assignors to Eltra Corporation, a corporation of New York

Original No. 2,848,049, dated Aug. 19, 1958, Ser. No. 607,952, Sept. 4, 1956. Application for reissue Sept. 24, 1962, Ser. No. 227,111

63 Claims. (Cl. 234—7)

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

This invention relates to a keyboard or composing unit for preparing a control tape to be used in the photographic unit of a two-unit typographical photocomposing machine.

More specifically, the invention relates to an apparatus, and the actuating means therefore, whereby justifications, quadding or centering information is computed for a keyboarded line of text material and then coded in a control tape adjacent the representations of the individual characters of the line to be composed, the tape to be used in the photographic unit of the photocomposing machine to control composition of the text material as a justified, quadded or centered line depending on the information coded on the tape.

In a two-unit photocomposing machine as herein contemplated (for the general organization of which see copending applications Serial No. 422,526, filed April 12, 1954, now Patent No. 2,816,609, and Serial No. 419,012, filed March 26, 1954), operation of the composing unit keyboard, as by actuation of the character keys, produces character identification signals as well as character width signals which are transmitted direct to a tape coding unit, such as a perforator, where the signals are coded on the tape. Actuation of a space key or space bar similarly results in the transmission of a space signal to the coding unit. The character width signals and the space signal, in addition, are transmitted to the justification, quadding and centering computer where the information is appropriately stored so that when the end of the line is reached and the machine operator depresses *an end-of-line* key, such as the justification or quadding or centering key, a justification quadding or centering signal is coded on the tape following the succession of character signals for the same line. The tape so produced can thereupon be used to control the operation of the photographic unit to provide a photographically composed record of the text material keyboarded in the composing unit. The photographic unit includes a photographic font of type characters and a shutter mechanism which, in response to a tape character signal, exposes the character represented thereby for photographic action. The time of photography is controlled responsive to the width portion of the character signal or the justification, quadding or centering signal so that the line of text material is justified, quadded or centered depending on the end of line operation called for by the composing unit operator.

Each of the characters of the font has a definite set width measured in units of a typographical em. Of course, for typographical refinement, the set widths vary from character to character, but the widths are based on an 18-unit system. That is the em is 18 units wide and all characters have a width of a predetermined number of units. Therefore, if one was to add up the widths of all the characters in a line, a definite number of units would be arrived at indicative of the space in the line actually occupied by the characters. At the same time, the length

of the line in which the characters are to appear is known and this also is given a value in units. Thus, if a justified line is to be 40 ems in lengths, such line can be considered to contain 40×18 or 720 units. The number of units in a predetermined line length will always exceed the number of units allocated for interword spaces. For example, a normal interword space may be 4 units. Even considering the units taken by a normal word space, the units taken by the characters and the word spaces do not generally equal the number of units in the line, but, rather, total a lesser number. The difference between the units of a predetermined line length and the units of a line of characters plus interword spaces is termed the line remainder. The number of units in the line remainder must be apportioned among the interword spaces if the line is to be justified to its predetermined length. On the other hand, the line may be photographed flush left, or quad left, that is the first character coinciding with the left-hand margin, as in the last line of a printed paragraph. In this case, the interword spaces are of normal width and the line remainder is the blank space to right of the line. As another condition, the line may be photographed flush right, or quad right, with the last character in the line coinciding with the right-hand margin. Again, in this case, the interword spaces are of normal width and the line remainder is the blank space to the left of the line. The last condition is when the line is to be centered, or photographed midway between the left-hand and right-hand margins, again with normal interword spaces. Here the line remainder is divided into two parts corresponding to the white space to the left and to the right of the centered line. It is to the coding of signals appropriate to the foregoing situations that the present invention is primarily concerned, although other refinements and improvements of the apparatus disclosed in application Serial No. 422,526 are also presented.

That portion of the input unit which codes the tape, i.e. the perforator itself, will not be described since that one which is disclosed in aforementioned application Serial No. 422,526 will be satisfactory, as will any commercially available perforator if modified to comprise the desired number of punching stations.

In its preferred form, the present apparatus comprises an electric typewriter carrying the character keys normally used in composing copy and an auxiliary keyboard carrying keys for controlling machine functions, such as selecting the typographical font to be used in the photographic unit (this unit having a plurality of fonts, from any selected one of which characters can be photographed), and for controlling point size of the character images recorded on film, as well as auxiliary keys, such as the justification, quadding and centering keys, for causing the information in the computer apparatus to be coded on the control tape. Electrical switches operated by the key levers of the typewriter and the auxiliary keyboard control circuitry which in turn operates the tape coding unit and the computer mechanism.

In general terms, the key operated switch which is closed upon depression of a character key completes a plurality of circuits which may be grouped according to the function performed and, as such, defined. A first group of circuits completed will include diode coding circuits which identify the characters in binary form. The binary circuits in turn, through the intermediary of electronic circuitry and tubes, lead to the tape coding device or in the present case, to punch operating solenoids of a tape perforator. The solenoids will be selectively operated according to the character key depressed and the perforator will therefore code the control tape in a manner corresponding thereto. Such coded representations will be read or decoded in the second or photographic unit of the photocomposing machine to control

the operation of so-called binary shutters in the manner disclosed in aforementioned application Serial No. 419,012.

A second group of circuits energized by depression of a character key will be those which deal with character width information. In the first instance, the circuit will proceed selectively to a decimal coder which represents the width of the character for the key depressed. More specifically, the decimal coder will include a plurality of coding groups, only one group of which will be in operation at one time. Each group represents the width information for the characters of a particular type font, so only that group will be used which corresponds with the character font to be used in the photographic unit for the particular text matter being composed. Selection of the coding group is under the control of the operator. From the decimal coder, the circuit is traced to the unit adding and subtracting circuit where the width value of a character can be modified for reasons of typographical refinement, such as kerning or letter spacing. The circuit thereafter proceeds to the width coder which converts the width information from decimal to binary form. The width coder is a diode coding circuit similar to that provided in the character identification group of circuits. After conversion to binary form, the width information follows two paths, one to the tape coding device whereby it is coded onto the tape adjacent the character identification signal in a manner similar to that of the character identification information. The second path followed by the binary width information is to the computing device wherein the widths of the characters and spaces making up the line of composition are totaled so that upon completion of the line, information as to justification, quadding or centering can be obtained as desired.

The computing device itself will include a computer drum and a line length indicator which are pre-set, before composition is begun, to correspond with the desired predetermined length of a justified line, such setting being made in ems and units-of-an-em. As the operator composes the line of text, the indicator and the computer drum continuously subtract, from the pre-set line length in units, the unit count of the characters and normal word spaces entering into the composed line. Therefore, the line length indicator and the computer drum give a running count of the line remainder. When this remainder falls within a predetermined count from the end of the line (generally 4 ems or in an 18 unit system 72 units), the operator receives a justification signal which simply indicates that he may stop composing the line, depress the justification key and obtain justification information from the computer drum which is thereupon transmitted to the perforator and coded on the tape following the succession of character signals for the line to which the justification signal is applicable. Of course, if the line is to be quadded or centered (and therefore not justified), it is not necessary for the operator to receive the signal before a quad or center key on the auxilary keyboard is depressed. In the latter cases, line remainder information is transmitted to the perforator and coded on the tape.

The control tape thus will comprise, generally, a succession of dual signals representing the characters to be photographed in a line, each signal having what might be considered two parts, namely, a character identification part (which could properly be regarded as an individual signal) and a character width part (which could also properly be regarded as a separate individual signal) and a justification or quad or center signal. The latter signal is read or decoded in the photographic unit to control the composition of the line. Each line to be composed will contain the foregoing signals and the entire control tape will comprise groups of such signals. Other signals may appear in the tape, either to control movement of the tape through the photographic unit tape or to control the performance of the photographic unit as, for example,

to control the point size and leading of the photographed copy.

Having thus briefly outlined the operation of the composing or keyboard unit, attention is directed to the drawings and specification wherein is shown and described a preferred arrangement for effecting the desired results.

In the drawings:

FIG. 1 is a schematic circuit diagram in block form showing the signal circuitry of the keyboard unit;

FIG. 1A is a schematic circuit diagram showing the push buttons for coding width information;

FIG. 2 is a schematic representation of the character identification coder diode circuit;

FIG. 3 is a schematic representation of the character width decimal coder;

FIG. 4 is a schematic representation of the binary character width diode coder;

FIG. 5 is a schematic representation of the unit spacing circuit;

FIG. 6 is a schematic representation of an electron tube circuit used in the present invention;

FIG. 7 is a top plan view of the apparatus for totalizing the width information of the characters in a line of composition;

FIG. 7A is an enlarged sectional view showing a segment of the computer drum;

FIG. 8 is a sectional view with parts broken away taken along line **8—8** of FIG. 7;

FIG. 9 is a sectional view taken along line **9—9** of FIG. 7;

FIG. 10 is a side elevation of the mechanism shown in FIG. 9;

FIG. 11 is a detailed view of a binary solenoid and the switch operated thereby;

FIG. 12 is a view taken on line **12—12** of FIG. 8;

FIG. 13 is a view taken on line **13—13** of FIG. 8;

FIG. 14 is a view taken on line **14—14** of FIG. 8;

FIG. 15 is a view taken on line **15—15** of FIG. 8 with the wall of the end support broken away;

FIG. 15A is an exploded view showing the binary code disk notch arrangement;

FIG. 16 is a partial rear elevation of the differential and coded drum mechanism;

FIG. 17 is an elevation of the mechanism for resetting of the coding drum;

FIG. 18 is a detailed view of the unit count stepping mechanism;

FIG. 19 is a detailed view of the ducking pin solenoid mounting arrangement;

FIG. 20 is a developed view of the justification portion of the computer drum;

FIGS. 21 and 22 are developed views of the quadding code section of the computer drum in enlarged detail;

FIG. 23 is an elevation of the photocell carriage stepping mechanism;

FIG. 24 is an end view on line **24—24** of FIG. 23 showing the relationship of the photocells used to read line remainder information;

FIG. 25 is a plan view of the photocell carriage stepper mechanism;

FIG. 26 is a detailed segmental view of the cam and switch mechanism of the photocell carriage stepper mechanism;

FIG. 27 is a detailed view of the photocell carriage stepper mechanism release device;

FIG. 28 is a front elevation showing the line length setting mechanism;

FIG. 29 is a plan section on line **29—29** of FIG. 28;

FIG. 30 is a side elevation of the pin arrangement for rotation of the line length mechanism setting shaft;

FIG. 31 is a front elevation of the front panel of the present mechanism with parts broken away to show the line length scale and pointer;

FIG. 32 is a top plan view of FIG. 31 to show the driving elements;

FIG. 33 is a side elevation taken on line **33—33** of FIG. 28, showing the line length indicator actuating and reset mechanism;

FIG. 34 is a side elevation taken on line **34—34** of FIG. 7, showing the line length indicator setting knob assembly and associated elements;

FIG. 35 is an elevation of the em counter;

FIG. 36 is a rear view of the operating mechanism for the em counter;

FIG. 37 is a developed view of the counter wheel contact cylinders;

FIG. 38 is a side elevation of the single cycle starting and stopping device;

FIG. 39 is a schematic representation of the photocell circuit used in the computer apparatus;

FIG. 40 is a schematic circuit diagram for several line set and reset solenoids employed in the present apparatus;

FIG. 41 is a schematic representation of one portion of the function coder;

FIG. 42 is a schematic representation of the font selector circuit;

FIG. 43 is a schematic representation of another portion of the function coder;

FIG. 44 is a schematic representation of the control cam shaft tripping switch circuit;

FIG. 45 is a schematic representation of the push button control circuit for the unit spacing circuit;

FIG. 46 is a schematic representation of the composition control circuit;

FIG. 47 is a schematic circuit dirgram of the line remainder and justification read-out apparatus; and

FIG. 48 is a schematic diagram of the perforator solenoid control circuits.

For purposes of simplification, the entire circuit for the apparatus is not shown, but only representative portions thereof are disclosed to illustrate the principle of operation of the various circuits, it being understood, of course, that in all instances the omitted circuits are similar to those shown. However, in FIG. 1, there is shown a schematic circuit diagram of the signal circuitry which is brought into operation when a character key is depressed.

Upon depression of a character key of the typewriter or composing keyboard, the key lever will close the contacts of a pair of switches **50** and **51**, a similar pair of switches being associated with each character key of the keyboard. Similarly closed are the contacts of universal switch **52**, which contacts are closed whenever any character key is depressed. Depending on whether the shift key is in shift or unshift position, single-pole, double-throw switch **53** will be actuated so that common contact **54** engages shift contact **55** or unshift contact **56** respectively. If a key board is used having separate keys for the shift and unshift characters, that is, the upper case and lower case characters as in the typewriter, switch **53** can be eliminated and the circuits to be described traced directly. The provision of switch **53** stems from the fact that in a typewriter a single character key operates switch contacts for two different characters, these generally being the upper and lower case representations of a letter but in some instances totally different characters.

If it is assumed that the character key for actuating switches **50** and **51** is depressed, and that the shift key is in shift position, a circuit can be traced from common line **57**, through contacts of universal switch **52**, and the contact for the particular character selected, to conductor **60**. There will in fact be as many conductors **60** as there are characters to be accommodated in the apparatus. However, a description of the circuitry for a single conductor, or in other words for a single character, will suffice for an understanding of the invention.

Conductor **60** at junction **61** divides into two parallel circuits, one for identification of the character associated with the depressed key, and the other for recording its width. Consideration will first be given to the identification circuits. Conductor **62** is connected to the character diode coder **63** which is more specifically detailed in FIG. 2 to which attention is now directed.

The diode coder is simply a circuit network wherein the signal representing the selected character is transformed to binary form, the reason for such transformation being that the binary signals are decoded in the photographic unit of the photocomposing machine and control the operation of binary shutters in the manner disclosed in copending application Serial No. 419,012.

In the coder, the "binary" wires are designated **64**, **65**, **66**, **67**, **68**, **69**, **70** and **71** and represent the binary values 1, 2, 4, 8, 16, 32, 64 and 128, respectively.

The circuit which was completed, as by depression of a character key, enters the diode coder by conductor **62** and will be assumed to have assigned thereto the value seventy-seven (77) and, therefore, to consist of the binary numbers 1, 4, 8 and 64. The significance of such value is that in the photographic unit, binary shutters having the values 1, 4, 8 and 64 will be operated and the character in position 77 (see FIG. 9 of copending application Serial No. 419,012) will be exposed for photographing, it corresponding to the finger key depressed in the keyboard unit.

In connecting conductor **62** to binary wires **64**, **66**, **67** and **70**, the connection is made through a device for limiting the reverse flow of electricity, such as selenium rectifiers **74**. The connection from each of the conductors leading from the key lever actuated switches of the keyboard unit to the binary wires of the character diode coder is similarly made through rectifier devices. It is understood, of course, that each such connection will be unique in that the conductor **62**, **62A**, **62B**, etc., associated with each character will be connected to a unique combination of binary wires.

The eight binary wires, in turn, lead to the control circuits for the perforator. Since each of the wires leads to an identical circuit, it will suffice to show and describe only a single representative circuit. This will be done by reference to FIG. 6 but see also FIG. 48 which is a complete diagram of the perforator solenoid control circuits, the solenoids being designated **90A** to **90–O**. A binary wire is directly connected to lead **75**. Hence when the binary wire has a voltage impressed therein, as by depressing an associated character key, such voltage is impressed on lead **75** to give a positive pulse to the grid **76** of electron tube **77**. The tube circuitry includes grid resistor **80**, across which the voltage pulse appears, and coupling or isolating capacitor **81** which isolates it from steady state voltages of preceding circuitry. After passing capacitor **81**, the pulse traverse grid leak resistor **82** to grid **76**. Completing the grid circuit is resistor **83** and by-pass capacitor **84**. A negative voltage source biases the grid negative and the particular bias voltage can be adjusted by means of bias potentiometer **86**.

The plate circuit of the tube includes plate resistor **87** and perforator interponent solenoid **90**. Normally engaged contacts **91** complete the circuit to the B+ power supply. The tube is normally non-conducting and hence solenoid **90** is deenergized. If binary wire **64** is energized, however, as by depression of an appropriate character key, a voltage pulse is fed to the grid circuit to trigger the tube and cause it to begin conducting, thereupon energizing solenoid **90**. Energization of the solenoid results in a code signal being impressed on the tape in perforator **600** (FIG. 1). When it is no longer desired to maintain solenoid **90** energized, contacts **91** are separated to disconnect the tube from the B+ power supply, thus causing the tube to cease firing and solenoid **90** to be deenergized.

It will be repeated, for purposes of clarity, that each of the eight binary wires leads to an electron tube circuit as shown in FIG. 6. Thus, any combination of solenoids **90** will be energized depending on the binary wires connected to the character conductor **62**, and a code signal representing that character will be impressed on the tape in a manner similar to that described in application Serial No. 422,526. In that case, interponent solenoids are also provided which when energized result in perforation of the coded tape.

Attention will now be directed to the width information coding circuits. Referring again to FIG. 1, depression of a character key resulted in the completion of a circuit to conductor **60**, which divided into the conductor **62**, leading to the character identification circuits above considered, and conductor **92** which leads to the character width circuits now to be considered.

Conductor **92** immediately leads to a reverse current limiting device or rectifier **93** and thereafter to the decimal coder **94A** through front selector contacts **1F3**, **1F4**, etc. It will be noted that a plurality of decimal coders are provided in the present apparatus, only one of which will be in use at any one time. The purpose of this arrangement is to permit the mixing of type face styles to be accomplished with facility and without the physical modification of the apparatus, as heretofore. In considering alphabetical fonts, the set width of a particular character, e.g. the lower case "a," may differ from one type face style to another and consequently when it is desired to code the width information for the character "a" as when the "a" key is depressed, the width thereof which is coded will be dependent on the font which is selected for photographing.

The provision of electric coding means renders it possible to accommodate width information for a wide variety of fonts conveniently. For example, in prototype models of the present apparatus, as many as eighteen separate width coding devices have been provided. Contacts on font selector relays are furnished to select which of the coding devices will be operatively connected to the key lever contacts at one time.

Referring to FIG. 3, the decimal width coder is seen to be simply a grid network having fifteen output wires **95**, **96**, **97** . . . **109**, having assigned thereto the decimal values 4, 5, 6 . . . 18 inclusive, respectively. Traversing these fifteen output wires are the conductors **92**, **92A**, **92B**, etc. (88 in total, assuming a 44 key character keyboard) from the key lever operated switches. Each of these conductors will be connected to a single output wire, the particular one depending on the width of the character associated with the depressed key. Thus if a key is depressed for a character having a set width of eighteen units, the conductor **92F** from such key will be connected to the output wire **109** having an assigned value of eighteen. As another example, if the key depressed is for a character having a set width of twelve units, the conductor **92B** from such key will be connected to the output wire **103** having an assigned value of twelve.

It is clear that if one font selector switch is deenergized to separate contacts **1F3**, **1F4**, etc. and a second font selector switch is energized to engage contacts **2F3**, **2F4**, etc., then a second width decimal coder unit will be operatively connected to conductors **92**, **92A**, etc., and the conductor, e.g. **92B** (which in the first coder may have been connected to an output wire having a value of twelve) may, in the second coder, be connected to an output wire having a value of eleven.

The fifteen output wires emanating from the decimal coder units then lead to the unit spacing circuitry **110** shown in block form in FIG. 1, but more specifically detailed in FIG. 5. By means of this circuit it is possible to obtain certain typographical refinements, such as kerning, wherein the descender of one letter, e.g. lower case "j," underlies a preceding letter, such as the lower case "n" in "injure," or to increase the normal intercharacter spacing when such may be necessary to fill out a line. The circuit for accomplishing this result is shown as a switching circuit which connects an output wire from the decimal coder to an adjoining wire **111** to **118** having a value of one or two units greater than the original output wire or a value one, two, or three units less than the value of the output unit. Thus, if a character having a set width of six units is to be coded, the conductor **92** leading to the decimal coder will be connected to the output wire **97** thereof having the value six. Now if that character is to be kerned with respect to the preceding character in the photographic unit to the extent that it will be two units closer to the preceding character than when not kerned, the minus two unit button will be depressed to energize a switch and engage contacts **2M3**. It is thus seen that the circuit will be traced from the decimal coder output wire **97**, having the value six, through contacts **2M3** to the unit spacing circuit output wire **111** having the value four. In a similar manner one, two or three units can be subtracted from any width value but, in no event, can the apparatus accommodate final width values of less than four units. Thus, one would not subtract one unit from a character having a set width of four units since in such a case the end result would be to code the character as if it were a three unit character.

To increase the normal intercharacter spacing as might be desired in certain types of composition, the operator simply depresses the plus unit spacing button, e.g. the plus-one unit spacing button, to engage contacts **1P7**. Therefore, if a character having a set width of seventeen units is to be letter-spaced from a preceding character, the width information for the letter-spaced character will leave the decimal coder on the output wire **108** having the value seventeen and then through contacts **1P7** to the unit space circuit output wire **116** having the value eighteen. It will be noted that the circuit for the unit spacing circuit output wire having the value seventeen is interrupted by the separation of normally engaged contacts **1P6**, these contacts separating upon actuation of the plus-one unit spacing button.

From the unit spacing circuit, the width information is transformed from decimal form to binary form in the width binary coder circuit shown in FIG. 4. This circuit is similar to the character identification binary coder circuit except that the input leads (the output wires of the unit spacing circuit **110**) number eighteen for widths of from four to twenty-one units, inclusive, as contrasted to the eighty-eight character input leads, and the output leads **123**, **124**, **125**, **126** and **127** number five since a binary code having maximum value of twenty-one only is used, although with five outputs a maximum binary value of thirty-one can be obtained.

By way of example, if we consider the decimal code of seventeen units, we will see that the unit space circuit output wire **115** having a value seventeen will be connected to the binary coder output wires **127** and **123** having the value sixteen and one respectively, the connection being made through rectifiers **120** to prevent "sneak" circuits. Other typical circuits are shown, but it is believed that these do not require any elaboration.

Each of the five output wires of the width binary coder terminates in an electron tube circuit similar to that shown in FIG. 6, the operation of which was previously explained. Thus five interponent solenoids are provided in the perforator to control the coding of the width information. The interponent solenoid circuits into which the width binary coder output wires terminate are distinct from those provided for the character identification coder so that the character width information or signal can be coded on the control tape adjacent the character identification information or signal, thus permitting a dual character identification and character width signal, as previously mentioned.

In addition to the means described for transmitting

character width information through the various circuit elements to the unit spacing circuit **110** and the width binary coder **119**, it is also contemplated that width information alone be fed into the apparatus and be coded devoid of any character identification information. This is particularly desirable when indentations are to be provided in the photographed copy produced in the photographic unit. In such cases, width information will be coded on the tape which when read in the photographic unit will provide blank spaces in the photographic copy corresponding to the coded width. Such information may be coded as a single signal or as a series of successive signals. In the latter case, the blank space in the photographic copy will correspond to the sum of the individual width signals.

There is a further advantage derived from the ability to code width information alone in that if, in a line of composition which is to be justified, the number of interword spaces exceeds the number which can be accommodated in the justification computing apparatus, the excess number of word spaces can be coded as width signals rather than as word space signals.

To code such lone width information in the perforator **600**, the operator will simply depress one of a group of push buttons located on the width information keyboard **121** (FIG. 1), each of which will be connected to one of the output wires **111** to **118** of the unit spacing circuit **110**. For example, the push button **121A** (FIG. 1A) will represent the width value four and will be connected to output wire **111**. As a further example, push button **121B** will represent the width value eighteen and will be connected to output wire **118**. Of course, a push button can be provided for connection to each wires **111** to **118**, but in practice a limited number of push buttons will be provided for coding the more representative width values.

It has so far been demonstrated that by depressing a character key, information regarding the character associated with the key will be coded on the control tape. Such information is coded at thirteen stations, or in the case of the preferred perforator, at thirteen punch locations, eight of which are devoted to coding the character identification while five are assigned the function of coding character width.

As a composition of a line of text proceeds, information for each character in the line is coded on the control tape as indicated above, as is a signal for each interword space in the line. In addition to the information regarding each character, however, it will be necessary for the control tape to include information as to how the line is to be photographed. That is, should the line be quadded left, quadded right, centered or justified? Also the tape must contain information to permit the carrying out of the desired composing operation. For example, if the line is to be justified, information is provided which when decoded in the photographic unit will control the interword spacing to justify the line. If the line is to be quadded left, the control tape is coded so that normal interword spacing is effected during the photographing of the line in the photographic unit. If the line is to be quadded right, information is provided on the tape which will allow the photographic unit to traverse a portion of the film before photography of the line takes place, to assure that after providing the proper amount of white space preceding the line, the last character of the line will coincide with the right-hand margin. On the other hand, if the line is to be centered, information to control photography of the line so that the white space between the left-hand margin and the first character equals, or approximately equals, the white space between the terminal character and the right-hand margin. The requisite information is received from the computing device which will be considered hereinafter.

However, before describing the particular mechanism, it is believed worthwhile to review the fundamentals of the unit system for character widths. In such a system, the typographical "em" is divided into a discrete number of units, for example, eighteen units as in the present apparatus, and each unit will be one-eighteenth of an em in width. The characters will be assigned widths measured in such units. Thus, the character upper case "A" may have a width of nine units, while the lower case "i" may have a width of four units (the narrowest width of any character) and the upper case "W" may have a width of eighteen units (the maximum width of a character). Of course, the width of a particular character may vary from one type face style to another as previously pointed out, but in any event, the width will still be based on the same unit system. By subdividing the em into a greater number of units, a greater range for differentiating between character widths can be obtained, but experience has shown that an eighteen unit system gives satisfactory typographical results. Even the normal interword space is assigned a width measured in units of an em. For ordinary composition, the interword space is taken as four units. It will be seen later that this value is used only to measure the unjustified length of a line and does not indicate the interword spacing in a justified line, which will be greater than the "normal" value by an amount equal to the line remainder in units divided by the number of interword spaces. Of course in a quadded or centered line, the width of an interword space will equal the normal value of four. However, as a typographical nicety, the "normal" interword space value may be varied under control of the operator and under such conditions may assume a value of six, eight or any other selected number of units. Such selection may be desirable if a line preceding a quadded line has been justified under conditions which rendered the interword spaces rather large, e.g. twelve units. If the quadded line which follows is photographed with interword spacing of four units, it would give a cramped or tight appearance following the line of comparatively widely spaced words. Thus the operator would quad the line using, for example, an eight unit "normal" space.

Since each character and each space which goes to make up a line of composition has a width comprising a fixed number of units, it is possible to total the units in any line of composition. Furthermore, it is known, when doing composing work, that a full line will be of a predetermined length and defined as containing so many ems and units. Therefore, apparatus can be provided which, as a line is composed, subtracts the number of units in each character and space of the line from the predetermined line length. In general, when composition of the line is completed, the number of units taken by the character and word spaces will not equal the number of units in the full line, with the result that there is a line remainder of the excess units. Apparatus is therefore provided which will divide the line remainder by the number of interword spaces in the composed line to give a justification increment which must be added to each normal interword space to expand the line to its full or justified length. The line remainder information may also be used to provide quad right information. In this case the line remainder, instead of appearing at the end of the line, would be placed at the beginning thereof in the photographic unit. The line remainder information may also be divided in half so that the composed line can be centered when photographed. Selection of the form in which the line remainder information is read from the computer and coded on the control tape is under the control of the operator who will determine whether the composed line is to be quadded left, centered or quadded right.

It was heretofore pointed out that when a character key is depressed, a width signal was transmitted through a decimal coder unit **94A**, **94B**, etc. (which one depending on the type face style selected for photographing), the unit space circuit **110**, and the binary coder **119**. After conversion to binary form in coder **119**, the width

signal was fed to circuits such as shown in FIG. 6 and thereby controlled interponent solenoids for coding the width information on the control tape in the perforator unit **600**.

In the same manner that the information was fed from coder **119** to FIG. 6 circuits for controlling interponent solenoids, the information is also fed from the coder to additional FIG. 6 circuits but, in this instance, the circuit solenoids control the operation of the computer apparatus **130** now to be described with reference to FIGS. 7 and 8. More specifically, the width information will be translated into degrees of shaft rotation and such movement used to control the positioning of a read-out device upon which pre-computed information is stored.

A binary indexing device **131** is shown to be operated by binary solenoids **132**, **133**, **134** and **135**, energization of which is controlled as indicated above. Each solenoid is mounted on a bracket with its shaft **136** disposed horizontally. One end of the shaft carries a rocking lever **137** (FIGS. 9 and 11) which engages stop screws **140** and **141** which are adjustable to control the degree of rotation of the shaft upon energization and deenergization of the solenoid. The opposite end of the shaft carries an arm **142** which is pivoted to and fro under control of the solenoid, and which is connected to a pivoting lever **143** by link **144**. The lower extremity of lever **143** is engaged by a roller **145** carried by pivoting member **146**, the member being urged by tension springs **147** so that the roller serves as a detent for lever **143**. As solenoid **132** is energized and arm **142** is swung clockwise, link **144** pivots lever **143** in a clockwise direction. The movement of the lever depresses member **146**, but immediately upon passage of the lever over roller 145, springs **147** urge member **146** and the roller upwardly to detent the lever in its new position. The detent mechanism also serves to prevent "bounce" of the moving parts. Return of the solenoid to its deenergized position and of lever **143** to its non-actuated position, is accomplished by means of a spring internal to the solenoid. Energization of the solenoid and the accompanying linear movement of shaft **136** results in the actuation of a pair of electrical leaf switches **150** and **151** mounted on solenoid bracket **152** (FIG. 11). The function performed by these switches will be considered hereinafter. The rounded uppermost end of lever **143** is fitted into a notch **153** provided in binary code disk **154** so that when lever **143** is pivoted, disk **154** is similarly rotated to and fro on shaft **155**, it being free to turn on the shaft which is fixedly mounted in stand **156** and bracket support **157**.

A similar binary code disk and operating mechanism therefore is provided for each of the binary solenoids (FIGS. 8 and 10). Thus, code disk **160** will be actuated by lever **161**, the movement of which in turn will be controlled by solenoid **135**. Similarly, code disk **162** will be actuated by lever **163**, in turn actuated by solenoid **134**, and code disk **164** will be actuated by lever **165**, the movement of which will be controlled by solenoid **133**. The four code disks are all supported on shaft **155** while free to turn thereon. Spacing washers **166** are provided to prevent any endwise shift in the position of the disks and the whole assembly is locked-up by nut **167** threaded onto a threaded portion of shaft **155**.

If one was to view the disks in front elevation, they would appear as a complete circle, the circumference of which is unmarred by any notches or breaks except for those notches provided for levers **143**, **161**, **163** and **165**. This composite effect is achieved even though each disk is notched according to a predetermined code which will hereinafter be disclosed.

Supported about the edges of the code disks are nine rods **170**, **171**, **172**, **173**, **174**, **175**, **176**, **177** and **178** which, reading clockwise from the lower left side in FIG. 9, have the decimal values 4, 6, 8, 10, 12, 14, 16, 18 and 20. The remote ends of the rods are supported in a slotted collar **181** (FIG. 8) secured to stand **156** by means of threaded bolts **182** and held in place by the annular spring **183**. Passing over the coded disks the rods are threaded into end pieces **184** of enlarged cross section which are supported on sprocket-like disk **185**, one tooth being provided for each of the rods. The end pieces terminate in a bifurcated section **186**, between the arms of which is furnished a camming member **187**. Each end piece and rod is urged inwardly by compression spring **190** which is positioned between set screw **191** and the end piece itself, but the code disks and sprocket-like disk **185** support the rod in the outermost position shown in the drawing. With the rod in this position, camming member **187** is located in an angularly disposed slot **191** notched into depending striker member **192** pivotable at its upper end about pin **193**. The lower extremity of member **192** is guided in the indentures of crenellated member **194**.

There are, of course, as many striker members similar to **192** as there are rods **170** etc. and these may also be considered to represent various decimal values similar to the rods (see FIG. 13). Thus member **192** has a decimal value of 12, member **195** a value of 20, member **196** a value of 18, member **197** a value of 16, member **198** a value of 14, member **199** a value of 10, member **200** a value of 8, member **201** a value of 6, and member **202** a value of 4.

Immediately adjacent the radially disposed striker members is the squirrel cage assembly **205**, comprising a shaft **206** journaled in bearings **207** and **208** secured in bracket **157** (FIG. 8). A rotor **211**, pinned to the shaft for rotation therewith, is provided with a plurality of peripheral slots **212** longitudinally disposed for accommodation of rotor bars **213**. The bars are slidable between two positions as limited by the engagement of inwardly projecting lugs **214** with the annular ring **215** formed on the rotor or by the engagement of the lugs with the shoulder **216** of the rotor. Each bar is provided with two detents, one **220** for retaining the bar in its normal or non-activated position, and the other **221** for retaining the bar in its actuated or active position. A spring member **222** traversing the outer edges of the rotor bars, engages the detents. A circumambient strip **223** is provided to confine the bars to their respective slots.

Rotation of the squirrel cage is effected through shaft **206**, which is driven from the continuously operating motor **224** (FIG. 7) through V-belt drive **225**, shaft **226** journaled in pillow blocks, and the slip clutch **227**, the latter being biased to engaging position by compressing spring **230**.

Referring now to FIGS. 8 and 15, the arresting device for stopping the intermittent advances of the squirrel cage will be described. A stop plate **231** is adjustably secured to one face of bearing stand **232** by means of screws **233**. A portion of the plate is bent up so as to form an L **234** projecting perpendicularly from stand **232**. A movable bracket assembly **235** is mounted on shaft **206** and is free to turn with respect thereto. The assembly comprises the concentric arm **236** joined to the hub **237** by the radial web **240** and arm **241**. An end plate **242** parallel to the face of stand **232** extends from arm **236** to hub **237**. The arm **241** abuts screw stop **243** which is threaded in angle bracket **244** and locked in adjusted position by a lock nut. A rotor bar stop **245** is supported by web **240** and is in position to intercept any rotor bar which is in actuated or active position. A primary arresting member **246** is pivotally supported on web **240** and is urged to its arresting position by the leaf spring **247**. The configuration of the stop **245** and the arresting member **246** is such that between the abutment end of stop **245** and the L-segment of member **246** a slot or opening is formed of a size sufficient to accommodate a rotor bar. The cavity formed by concentric arm **236**, end plate **242** and stop plate **231** is filled with a resilient material **250** such as sponge rubber. Therefore, when the squirrel cage is rotated in the direction of the arrow (FIG. 15), a projected or actuated rotor bar

will first strike the inclined surface of primary arresting member **246** to cam the member downwardly against the action of spring **247** and thereby initially slow down the moving rotor bar. As the bar passes the L it strikes the end of stop **245** and thereby acts to pivot the bracket assembly on shaft **206**. Since stop plate **231** is secured to stand **232**, the resilient material **250** furnished in the cavity of the device is compressed, thereby absorbing all the energy of the moving masses, and bringing the squirrel cage to a halt, whereupon the resilient material returns to its normal expanded condition and bracket assembly restores the actuated rotor bar to its final resting place between stop **245** and member **246**, the absolute position being determined by the setting of adjustable screw **243**.

To return an actuated rotor bar to normal position, a cam actuated pusher is provided. See FIGS. 8 and 14. A U-shaped member **251** is pivotally supported by screw **252** on the angle bracket **253** secured to bearing stand **232** by screws **254**. The rearward arm **255** of the bracket carries a cam follower **256** which rides in the cam groove of reset cam **257**. The cam effects a forward and backward movement of member **251** and, through the intermediary of extension link **260**, restores an actuated rotor bar to its normal position on the forward movement, the projection **261** on link **260** reaching into the slot formed between stop **245** and arresting member **246** to strike the end of the rotor bar. On the backward movement of the U-shaped member, the link projection is restored to its at rest position, free from interference with operation of the rotor bar arresting device.

Having detailed the structure of the binary indexing device and the squirrel cage mechanism, it is believed appropriate to review the operation of the same in more general terms, associating the operation with the receipt of width information from the keyboard.

As has been previously noted, width information is transmitted from the keyboard and associated circuitry to the computer or read-out device in binary form. That is, the width of a character, which may be any number of units between four (4) and eighteen (18) inclusive, a unit one-eighteenth of the width of a typographical em, or considering letter spacing, the upper limit may be twenty-one (21) units, is transmitted as the binary components of a decimal value. For example, a unit width decimal value of fifteen appears as binary information eight, four, two, and one, the sum of which equals the decimal value of width. While all decimal values from four to twenty-one can be represented by the binary components, one, two, four, eight and sixteen, only the even number binary components are utilized in the binary indexing device. The omitted single unit component is utilized in another portion of the computer unit and will be considered hereinafter.

Assume that one rotor bar is projected to active position and in engagement with stop **245**. Next assume that the binary solenoids are energized in response to width information of twelve units. This means that solenoids **135** and **134** will be energized since they represent the binary values four and eight. Code disks **161** and **163** are turned in the manner heretofore explained. These disks, as well as the non-actuated disks, are notched in such a way that the rod **174** having a decimal value of twelve will no longer be supported on the circumference of the code disks. In a similar manner, if only code disk **161** was actuated in response to energization of solenoid **135** having a binary value of four, the code notching of all the disks would be such that the rod **170** having a decimal value of four would no longer be supported by the code disks themselves. It is thus clear that by appropriate notching of the code disks, selective actuation of the disks will permit a single rod to become unsupported by the disks, which rod will have a decimal value assigned thereto equal to the sum of the binary values of the actuated code disks.

Referring again to the specific example wherein rod **174** is no longer supported on the code disks, the rod will not immediately move inwardly since it is still supported on sprocket-like disk **185**. However, when disk **185** is turned to remove the cog supports from beneath all of the spindle rod end pieces, only rod **174** will move inwardly under the urging of spring **190** since this is the only rod unsupported by the code disks.

The time in the cycle of operation at which sprocket-like disk **185** is actuated to permit the inward movement of an indexing device bar, e.g. **174**, preconditioned for such movement by the operation of the binary code disks as hereinabove described, is controlled by indexing cam **507** mounted on cam shaft **486**.

Reference is now made to FIG. 12 wherein is shown index cam **507** and the linkage mechanism controlled thereby to turn disk **185**. The cam itself is formed with two protuberances **510**, one of which is effective during each cycle of operations. Cooperating with the protuberances and actuated thereby is bell crank lever **511** which is pivoted in bracket member **512**. The remote end of the lever is bent into an L **513** which underlies the downward projecting stud **514** provided on crank **515**. A roller **516** is fitted into disk notch **517** so that when crank **515** is pivoted, disk **185** is likewise pivoted or turned. The counterclockwise pivoting of crank **515** is effected by the clockwise pivoting of lever **511** which is in turn effected by the cooperation of lever **511** and protuberance **510**. A tension spring **520** is provided to restore the elements to their normal positions.

As the rod **174** is pivoted inwardly toward shaft **206**, cylindrical member **187** cams the striker member **192** clockwise (FIG. 8), causing it to push a rotor bar to an actuated position. Striker member **192** and rod **174** are immediately returned to their normal positions by the reverse pivoting of disk **185**. Furthermore, since a newly actuated rotor bar is in projected position, U-shaped bracket **251** is cam operated to restore the previously actuated rotor bar to its inactive or normal position. Immediately, shaft **206** rotates a distance until the newly actuated rotor bar engages the stopping member **245**, whereupon clutch **227** (FIG. 7) begins to slip due to the locking up of shaft **206**. The distance or degree of rotation of the shaft prior to its arrest, however, was proportional to the number of width units introduced to the binary solenoids and effective to actuate the indexing device and squirrel cage mechanism. Successive width information signals will result in the intermittent stepping of the squirrel cage mechanism and shaft **206**, with the end result that the shaft rotates an amount proportional to the total of the width information introduced to the unit.

A spur gear **262** (FIG. 7) keyed to shaft **206**, and therefore rotatable therewith, drives differential driving gear **263** through the agency of gear train **264**, the latter supported in cantilever fashion on shaft **265** journalled in bearing stand **232**. The differential driving gear **263** and bevel gear **266** are integrally formed and supported on shaft **267**, there being no connection between the shaft and gears, which are free to turn thereon. Bevel gear **266** engages spider gear **270** which is secured to shaft **267** and consequently shaft **267** is rotated an amount proportional to the width values introduced through the binary solenoids. Shaft **267** is directly connected to computer or read-out drum **271** which therefore is positioned in accordance with the width information fed to the computer unit from the keyboard.

So far, it has been shown that drum **271** is positioned only in response to even width values such as four, six, eight, ten, twelve, fourteen, sixteen, eighteen, or twenty units. Since certain characters will have an odd width value, such as seventeen, it remains to be shown how such information is handled.

Taking the value seventeen, for example, it is clear that this comprises the components sixteen and one. The width component sixteen, being an even number, is transmitted

to shaft **267** through the binary indexing device above described. The component one is transmitted to shaft **267** through differential drive gear **272** and bevel gear **273**. See FIGS. 16 and 18. The gears **272** and **273** are free to rotate on shaft **267**, but since gear **273** engages spider gear **270**, which is connected to shaft **267**, rotation of gears **272** and **273** effects rotation of the shaft to add the width value of one. A stepping switch **274** is provided to actuate gear **272** in response to width values of one and, therefore, the switch may be considered a binary one switch, similar in function to the binary solenoids which have the values, two, four, eight and sixteen.

Energization of switch coil **275** pivots armature **276** counterclockwise in FIG. 18, thus removing locking teeth **277** from engagement with ratchet wheel **280** and drawing pawl **281** into engagement with the next lower tooth of the ratchet. Upon deenergization of the coil, spring **282**, which was placed in compression, returns armature **276** to its normal position permitting pawl **281** to rotate the ratchet one position. Locking teeth **277** engage the wheel after it has been so advanced to prevent any additional movement thereof taking place. A leaf spring detent **283** is provided to prevent reverse movement of the ratchet when armature **276** is energized and pawl **281** moved to the next lower tooth preparatory to an advance of the wheel. The step by step movement of wheel **280** is of course carried over to differential driving gear **272**, with the result that spider gear **270** drives shaft **267** in response to the one unit count introduced by switch **274**. An angle bracket **284**, secured to armature **276**, actuates a pair of electrical leaf switches **285** and **286**, the function of which is similar to that of the binary solenoid actuated switches and will be described hereinafter.

The computer or read-out drum **271**, which is directly driven by shaft **267**, is thus seen to be positioned in accordance with the width information transmitted to the unit from the keyboard. As has been previously indicated, the drum is used to provide code information which will be used in the photographic unit to perform the functions of line justification, quadding, or centering. That portion of the drum which provides justification information is similar in theory to the computer drum disclosed in the aforementioned application Serial No. 422,526 except for certain mechanical improvements made thereto.

Reviewing the theory of the justification drum, it is recalled that the drum is initially positioned, before composition of a line takes place, according to the desired length of a full or justified line. Then as a line is composed, the drum is intermittently stepped as above described in response to the width information for the individual characters transmitted to the binary indexing device. The drum may make many revolutions during line composition but when the total width information supplied thereto reaches within four (4) ems, or seventy-two (72) units in the eighteen unit system, of the originally set line length, the drum will be so positioned that at any time thereafter the operator may depress a justification button on the auxiliary keyboard and read out a justification answer from drum **271**.

The justification portion **287** of the drum will be divided into five sections longitudinally and these will be assigned the binary values one, two, four, eight and sixteen, respectively. See FIG. 20. Circumferentially, the drum will be divided into two segments, one for reading a quotient answer and one for reading a quotient remainder answer. Thus, this portion of the drum directed to justification answers will comprise ten segments, each of which may be considered to be divided by grid lines into seventy-two (72) rows or longitudinal divisions, and twenty-four (24) columns or circumferential divisions. Now, for each of the ten segments there is provided a read-out device, or ten read-out devices in toto. Five of the read-out devices will read quotient answers and five will read quotient remainder answers. The five quotient read-out devices are arranged in a line parallel to the axis of the drum and gang connected. Similarly arranged and connected are the five quotient remainder read-out devices, but these are located on the remote side of the drums from the quotient read-out devices. The devices thus form a reference past which the drum rotates, but they are also themselves moved, as by being mounted on a carriage and stepped longitudinally along the length of the drum. Stepping of the read-out devices takes place, one step for each interword space in the composed line. Therefore, if there are ten interword spaces, the carriage carrying the read-out devices will have been stepped ten times, and each time a step occurred, the read-out devices will have moved from one column of the segment with which they are associated to the next adjacent column. If the devices are positioned at the start of a line in column 0 then after being stepped ten times as for ten spaces, they will be positioned in column ten. Since there are twenty-four columns, twenty-four spaces can be accommodated in a single line of composition.

Having specified that the drum is stepped past the read-out devices in response to character width information and the read-out devices themselves moved with respect to the drum, a specific example will be considered to illustrate the drum coding. Assume that row 65 of the drum (there will be two such rows, one for quotient answers and one for quotient remainder answers) has been brought opposite the read-out devices. This will mean that the total unit widths of all the characters and normal word spaces are 65 units less than the number of units in a full line or in other words, the line remainder is 65 units. The length of a full line is immaterial for our present consideration. Assume further that the read-out devices are opposite column 10 of their respective segments. This means that there are ten interword spaces in the line of composition. For justification therefore, the sixty-five units line remainder must be apportioned between the ten interword spaces. By carrying out simple division, dividing 65 by 10, there is obtained a quotient of 6 and a quotient remainder of 5. Therefore, the drum must be coded to give these answers, and the quotient read-out devices associated with the segments assigned binary value 4 and binary value 2 will be actuated, the remaining three quotient read-out devices being, in this example, non-actuated. Actually, the coding on the drum will be such that the normal word space of four units will be added to the quotient. In the specific example above, while the quotient is six, row 65 and column 10 of the drum will be coded to give the answer ten. The quotient remainder read-out devices associated with the segments assigned binary value 4 and binary value 1 will be actuated to give the true quotient remainders, the remaining three quotient remainder read-out devices being non-actuated. All possible answers stemming from any combination of from 0 to 72 units line remainder and from 1 to 24 interword spaces, with a few exceptions for the less likely combinations (e.g. a 72 unit line remainder with 1 interword space), have been computed and coded on the drum. In theory, line remainders greater than 72 units and interword spaces greater in number than 24 could be accommodated, but these figures were chosen as normal and practical limits.

In FIGS. 21 and 22, the line remainder portion of drum **271** is shown in enlarged detail. The coding of FIG. 21 will appear on the drum adjacent the quotient remainder information while the coding of FIG. 22 will appear adjacent the quotient information. It will be noted that this portion of the drum is divided into five columns which, looking from left to right, have the binary values 1, 2, 4, 8 and 16 respectively. The circular markings **288** represent references past which this portion of the drum moves, and they are shown relative to the code markings

in a normal or full line position. That is, if after the drum is set for a particular line length and total width information equal to the pre-set line length is introduced to the computer apparatus, the drum will come to rest relative to the reference point in the position shown in the figures. Read-out devices will be placed at the reference points to read the code markings. In the normal position, the read-out devices will read zero which means that the line is full and the units-of-an-em remainder is zero. If the keyboarding the line, the width information transmitted to the computer apparatus did not equal the pre-set line length, then the drum will be displaced from the reference points by the deficiency in the line. For example, if the line deficiency is two units, then the drum, which advances in the direction of the arrow shown in the figures, will be positioned with respect to the read-out devices located at the reference points such that the row, two positions below the row shown coinciding with the reference points, will be in cooperative relationship to the read-out devices. Thus the value two will be read from the drum. As a further example, if the line deficiency is twelve units, the drum will be coded to give the value twelve, i.e. binary 4 and binary 8.

The coding on the line remainder portion of the drum is such that, if the drum is stepped in a reverse direction (opposite to that in which it rotates when receiving width information from the keyboard), the line remainder values go from one to eighteen, one to eighteen, one to eighteen, etc. This is due to the use of an eighteen unit system in the present apparatus. It is thus clear that this section of the drum will at all times give the units-of-an-em remainder in a line, regardless of the pre-set line length or the total line remainder. The ems remainder in a line will be obtained from mechanism hereinafter described.

In the present apparatus, a drum coded by way of opaque and transparent elements is preferred since it permits of easy manufacture and is of light weight, thus reducing the mass and minimizing inertia effects. See FIGS. 7, 23 and 24. A clear transparent cylinder **290** is secured to hub **291** and annular ring **292**. The hub is keyed to shaft **267**, while ring **292** is journaled for rotation in end supporting bracket **293**. A cold cathode light tube **294**, arranged in the interior of drum **271**, is fixedly supported in non-rotating member **295**. The surface of the transparent cylinder is encased by a sheet **296** (see FIG. 7A) on which the coded justification information has been placed. The sheet may be in the form of a photographic negative with opaque portions **297** and transparent portions **298**. The transparent portions will be those which cause the actuation of the read-out devices, which are photocells. Photocells **300A**, **300B**, **300C**, **300D** and **300E** read the units-of-an-em line remainder from drum portion **271**. Photocells **301A**, **301B**, **301C**, **301D** and **301E** read the quotient answers from drum portion **287** and represent binary values 1, 2, 4, 8 and 16 respectively. Photocells **302A**, **302B**, **302C**, **302D** and **302E** read the quotient remainder answers from the drum portion **287** and represent binary values 1, 2, 4, 8 and 16 respectively. In FIGS. 20, 21 and 22, the portions of the drum which are actually transparent are shown blackened, while the opaque sections are shown in white.

In FIG. 39 there is shown an enlarged detail of a photocell pick-up circuit and attention is now directed to the workings thereof. One terminal of photocell **530** is connected by lead **531** to a B+ power supply, while the other terminal is connected through contacts **532**, resistor **533**, movable brush **534**, and a portion of bias potentiometer **535** to ground. In its quiescent state, no current flows through the photocell. Contacts **532** are provided for controlling when the circuit will be effective. For example, if the photocell is one of those which read justification information, then contacts **532** will be engaged when the operator depresses the justification push button on the auxiliary keyboard.

The cathode **536** of tube **537** is connected to ground through cathode resistor **540** and to B+ through resistor **541**. The grid **542** is connected to bias potentiometer **535** through grid resistor **543** and resistor **533**. The plate **544** is connected to B+ through resistor **545**; and, from point **546**, intermediate plate **544** and resistor **545**, a lead **57** extends to other circuitry, e.g. the circuit shown in FIG. 6. In the cut-off state of tube, the arrangement is such that the cathode is maintained at +25 volts while the grid is maintained at −20 volts.

In the operation of the circuit, as when photocell **530** is rendered conductive by the imposition of light thereon and contacts **532** engage, current will flow through the photocell circuit, above described, to ground with the result that grid **542** voltage is raised from −20 to 0 volts. The tube **537**, however, still is non-conductive due to the cathode being at +25 volts. Thereafter, when contacts **550** engage to short circuit cathode resistor and drop the cathode voltage to ground potential, tube conducts and the potential at point **546** falls from its B+ value to a value near ground potential, depending on the tube voltage drop. Still later in time, contacts **551** separate to again raise the cathode voltage to +25 volts and thus interrupt conduction in the tube. The potential of point **546** now rises to the B+ value, with the result that a positive voltage pulse is transmitted over lead **547** to the next succeeding circuit or, in the example given, to the FIG. 6 circuit. In that circuit, the positive pulse fires the thyratron and energizes a perforator interponent solenoid.

In FIGS. 23, 24 and 25, the five photocells **300A**, **300B**, etc. which read line remainder information, are shown stationarily mounted on arcuate plate **299** which is fixedly secured to supporting bracket **293**. Therefore, as drum **271** is rotated, as by receipt of width information from the keyboard, it is stepped past the stationary line remainder reading photocells. The ten photocells which read the justification information are shown mounted on channel shaped carriage **303** which is urged to a start-of-line position, abutting stop **304** by carriage return spring **305**. The carriage is supported for sliding movement on guide rods **306**, while underneath the carriage is a rack **307** for effecting such movement. A pair of pillow blocks **310**, depending from baseboard **311**, rotatably support shaft **312** on which is mounted pinion **313**. The pinion engages rack **307**, whereby rotative movement of the pinion results in translation of the rack and, consequently, the carriage. Keyed to shaft **312** is a toothed segment **314**, while swinging arm **315** is free to turn thereon. The lower extremity of the arm carries a pawl **316** biased to engagement with toothed segment **314**. A link **317**, pivotally connected to arm **315**, is at its other end pivotally connected to solenoid arm **320**. In its inactive position, arm **320** abuts stop screw **321** which limits the throw of the solenoid arm. Energization of interword space solenoid **322**, as by depressing a space key on the keyboard, pivots arm **320** counterclockwise, thereby pushing on link **317** and pivoting arm **315** counterclockwise. The pawl **316** carried by the arm, being in engagement with segment **314**, pivots the segment counterclockwise to rotate shaft **312** and pinion **313** and thereby translate carriage **303** one step to the left (FIG. 23). Upon deenergization of solenoid **322**, a spring (not shown) returns solenoid arm **320** to its at-rest position abutting stop screw **321** and, with it, arm **315** carries pawl **316** back into engagement with the next succeeding tooth on segment **314**. An elongated spring-like finger **323** engages the toothed segment and prevents the segment from being pivoted clockwise as pawl **316** is returned to its pre-stepping position. Upon the next energization of solenoid **322**, the process is repeated and the carriage and photocells mounted thereon are again stepped one position. The

extent of movement of the photocells will be from one column on the drum to the next adjacent column, as explained above.

At completion of a line of composition and after the justification information has been read from the coded drum, a circuit is completed for energization of reset solenoid **324** to pivot arm **325** in a clockwise direction (FIG. 27). A pin **326**, carried by the arm and extending through elongated slot **327** of lever **330**, pivots the lever about pin **331**. The other extremity of lever **330** engages the underside of pawl **316** and therefore pivots the pawl clockwise. Pawl **316** in turn engages the reverse motion detent **323** and forces it out of locking engagement with segment **314**. Immediately thereupon, compression spring **305** returns carriage **303** and the photocells to a start-of-line position.

A pair of switch actuating cams are also keyed to shaft **312** (FIG. 26). The first cam **332** has a contour which permits switch roller **333** to ride into the dwell thereof after an initial movement indicates that several spaces have been included in the line. In this manner, a circuit is controlled which permits a reset operation to be accomplished only at a time when it is likely that justification information can be read from the drum. By riding into the cam dwell, roller **333** removes the tension from switch contact arms **334** and **335**, thereby actuating switch **336**. The second cam **340** is contoured such that the switch **341** controlled thereby is not actuated until approximately twenty-two spaces have been stepped off by the carriage stepping mechanism. This switch **341** is similar in construction to that described in the preceding paragraph and it performs the function of controlling circuits to signal the operator that only a few more spaces can be coded in the line being composed, otherwise the self-imposed limits of the justification drum will be exceeded.

It was heretofore stated that the computer or read-out drum was initially positioned in accordance with the full or justified length of the line. Reference will now be made particularly to FIGS. 7, 28, 29 and 34 for a description of the line length setting indicator.

A rearwardly extending shaft **342**, to one end of which is pinned a pinion gear **343** and to the front end of which is splined a knob **344** and unit set indicator dial **345**, is journaled in supporting brackets **346** and **347**. A pair of spaced apart members **350** are pivotally supported on the forwardmost bracket **346** and are urged by spring **351** to exert a clamping action on knob detents **352**. A spur gear **353** is also pinned to shaft **342** between the two brackets **346** and **347**. Engaging this gear and driven thereby, as knob **344** is rotated, is a pinion gear **354** secured on shaft **355** as by pin **356**, shaft **355** being rotatably supported above shaft **342** in brackets **346** and **347**. A groove cam **357** is keyed to shaft **355** for rotation therewith. An electrical switch **348** (FIG. 7), is actuated when dial **345** is in a set position, but moves to its non-actuated position when knob **344** and dial **345** are withdrawn preparatory to a line length setting operation.

A plurality of pins **360**, projecting from the end of spring casing **361** and arranged in a circular array, are positioned to be engaged by cam **357** (FIGS. 29 and 30). Therefore, if one pin is in the groove of cam **357** and the cam is rotated, at the completion of one revolution of the cam, the pin will have been transported a distance equal to the throw of the cam and the next following pin will enter into the cam groove.

The spring casing **361** is supported for rotation in bracket **362** by ball bearings **363**. A clock spring **364** is enclosed in casing **361** with the outer end thereof fastened to the interior wall of the casing and the inner end thereof secured to shaft **365**, the shaft being journaled in the end wall of casing **361** at the center of the circularly arranged pins **360** and in the stand **366**. A pawl **367** projects from casing **361** and abuts a pawl **370** on washer **371**, the washer being freely supported on shaft **365** and able to rotate relative thereto. The side of the washer pawl **370**, opposite to that which abuts pawl **367**, is itself abutted by pawl **372** of washer **373**. This abutment process continues for all of washers **374**, **375**, **376**, **377**, **378** and **380**, each of which is provided with an abutment pawl, until the pawl on the last washer **380** is engaged by pawl **381** of ratchet wheel **382**. The ratchet wheel is pinned to shaft **365**, as is one end of spring **364**. Consequently, if spring **364** is given an initial tension as it is, all of the aforementioned pawls, from the one provided on spring casing **361** through those on the washer assembly to the one on ratchet wheel **382**, will pile up and abut one another as shown in FIGS. 28 and 29.

A Veeder-Root digit wheel counter **383**, designed for adding and subtracting, is also furnished in the line set component of the computer or read-out mechanism now under consideration. The units count wheel **384** thereof is pinned to shaft **365** and therefore is actuated as the shaft is rotated. Integral with wheel **384** is coded contact cylinder **385** which will be hereinafter considered. The tens count wheel **388** is free to turn on shaft **365** and it is actuated by a Geneva movement **386** (FIG. 36) driven from the units count wheel **384**. A pin **387**, mounted in the side face of wheel **384**, engages a star wheel **390** rotatably mounted on shaft **391**. A pinion **392** on shaft **391** drives gear **393** to which the tens count wheel is connected (FIG. 35). The arrangement is such that for each revolution of the units count wheel **384**, tens count wheel **388** makes one tenth of a revolution. A coded contact cylinder **394** is also provided integral and movable with the tens count wheel.

The coded contact cylinder for both the unit count wheel and the tens count wheel is shown in developed form in FIG. 37. The surface of the cylinder may be considered as divided by a grid into ten segmental divisions **395** corresponding to the ten positions taken by a wheel in making one revolution and five bands or strips **396** encircling the cylinder. Each of the segmental divisions may be considered to have a decimal value so that the circumference represents the decimal values one to ten. This corresponds with the ten positions of the units count wheel and the ten positions of the tens count wheel. The bands or strips may be considered to have the binary values 1, 2, 4, and 8 with the first strip being common. In FIG. 37, the shaded portion represents electrical conducting means, while the white or non-shaded portion represents insulated material. All of the conducting portions of the cylinder surface are connected together electrically. A plurality of finger type switches **397** (FIGS. 28 and 33) make contact with each strip of the cylindrical surfaces **385** and **394**. These switches, both for the units count coded cylinder and for the tens count coded cylinder, are mounted on switch bracket **400** and serve as a reference past which the coded cylinders pass. In this capacity, they provide in binary fashion coded information corresponding to the count indicated by the wheel. For example if the units count wheel is so positioned that the designation seven is visible through the opening **401** (FIG. 31) in the cover plate, the coded cylinder will be positioned with respect to switches **397** such that the switches contact the electrical conducting elements representing the binary values 1, 2 and 4 and the common element. The coded cylinder associated with the tens unit wheel **394** operates in precisely the same fashion. Therefore, the ems remainder in a line will be available in binary form and coded as tens of ems and units of ems. For example, if the line remainder is 34 ems, the information will be coded as binary three (3) by the tens coded cylinder and binary four (4) by the units coded cylinder. Thus, with the mechanism described with reference to FIGS. 21 and 22 whereby units-of-an-em line remainder is coded, mechanism has been provided which will code the line remainder information as ems and units-of-an-em.

The pinion **402** mounted on the extremity of shaft **365**

and to which reference was above made, meshes with bevel gear **403** which is pinned to the vertically extending shaft **404** (FIGS. 28 to 30). The shaft is journaled in pillow block **405** at its lower end and in guide **406** near its upper end. A sprocket wheel **407** is provided at the upper end of the shaft and an endless chain **410** is trained thereover to drive sprocket wheel **411** keyed to vertical stub shaft **412** (FIGS. 31 and 32). An additional sprocket wheel **413** is keyed to shaft **412** and a chain **414** is placed thereover as well as over sprocket wheel **415** rotatably mounted in bracket **416**. One end of chain **414** is fastened to a stud **417** protruding from the reverse side of carriage **420**, while the other end of the chain is also connected to stud **417** but through spring **421**. The carriage is provided with three rollers **422**, two of which ride on the upper edge of guide rails **423** and the last of which rides on the lower guide rail edge. A pointer **424** secured to the carriage by screws **425** coincides with linear em scale **426**.

A pair of roller actuated electrical switches are positioned at the end of the em scale in position to be actuated by carriage **420**. The first switch **427** is located so that its roller **430** is engaged by carriage **420** when the pointer indicates that four ems remain in the line. A circuit is controlled thereby to signal the machine operator that he is within justification range and that the line being composed may be thereafter ended and a justification answer obtained from the computer unit. The second switch **431** is so located that its roller **432** is engaged by carriage **420** when the pre-set line length has been exceeded and the pointer has gone beyond the zero mark on scale **426**. The operator will then take a corrective action.

The foregoing description covers the mechanism whereby the dials and indicator are set preparatory to a composing operation. Next to be described is the mechanism which actuates the dials to give a continuous indication of line remainder as a line is being composed.

The width values for the individual characters which make up the line are transmitted to gears **263** and **272** and through them to spider **270** (FIG. 7). The spider, being pinned to shaft **267**, rotates the read-out drum in accordance with such width information. Shaft **267** in addition to turning drum **271**, also, through bevel gears **433** and spur gears **434**, rototes shaft **435**, units-of-em read dial **438** and cam **436** mounted on the shaft (see FIG. 28). The gear ratios are such that cam **436** makes one revolution for each eighteen units, or one em, transmitted to drum **271**. During one revolution of the cam, contacts **437** engage and disengage while contacts **440** disengage ond engage.

Engagement of contacts **437** energizes the em indicator actuating solenoid **441** (FIGS. 28 and 33) to pivot arm **442** counterclockwise in FIG. 33. A link **443** connected thereto pivots bell crank lever **444** counterclockwise and a pawl **445** mounted thereon is thereby carried to engagement with the next succeeding tooth of ratchet wheel **382**. A detent **446** prevents reverse rotation of wheel **382** when pawl **445** is being set as above. Upon deenergization of solenoid **441**, as when contacts **437** disengage, a tensioned spring **447** restores the elements to their original position shown and thereby advances the ratchet one step. The ratchet, of course, is keyed to shaft **365** and actuates the Veeder-Root counter **383**. As width information is fed to the indicator mechanism and rotates shaft **365**, spring **364** is being tensioned. Also washers **371**, etc. are being unwound.

At the completion of a line of composition, circuitry is completed for the energization of the em indicator reset solenoid **450**. Arm **451** is thereupon pivoted counterclockwise and it engages pawl **445** to pivot it out of engagement with the ratchet tooth which it was then engaging. In being so pivoted, pawl **445** strikes the bent portion **452** of detent **446** to thereby pivot the detent out of locking engagement with the ratchet tooth. The ratchet is now free to turn, as is shaft **365**. Therefore, spring **364** which was tensioned during the composing cycle (since casing **361** was locked in position as will hereinafter be described) will now restore the indicators to their start-of-line position as determined by lug **367** on spring casing **361**. That is, the shaft **365** will rotate until washer assembly **371**, etc. winds up.

To set the computer or read-out unit for a particular line length representative of a full or justified line, the operator pulls knob **344** and dial **346** forward on shaft **342** (FIG. 34). In so doing, the detent hole **449** on dial plate **345** is disengaged from locking pin **453**, thus permitting the knob to be turned and with it the entire line length setting mechanism. One-half revolution of knob **344** represents 18 units as shown on dial **345** or 1 em, and inasmuch as the gear ratio between gears **353** and **354** is 2 to 1, cam **357** rotates one revolution to advance the pin disk by one pin. A total of ten pins are provided and therefore the spring case **361** is rotated one-tenth of a revolution. Since case **361** is tied to shaft **365** by pre-tensioned spring **364**, shaft **365** also is rotated one-tenth of a revolution. Unit count wheel **384** is rotated one-tenth of a revolution to increase or decrease the count thereof by one, depending on the direction in which knob **344** is rotated. For each complete revolution of shaft **365** and wheel **384**, as by rotating knob five complete revolutions or 10 ems, tens count wheel **388** is stepped one-tenth of a revolution through the Geneva movement. The tens count wheel **388** and units count wheel **384** therefore may be used to indicate ems set into the line. Accordingly, appropriate markings **454** are placed on the circumference of the wheels, such markings visually indicating the em setting for the line to be composed. Rotation of shaft **365** also results in pointer **424** indicating the em setting for the line to be composed.

It was heretofore stated that the line length setting mechanism also controlled the start-of-line position of read-out drum **271** and now such structure as does control this initial position will be described. The pinion **343** located on shaft **342** meshes with bevel gear **455** (FIG. 7), the latter being rotatably supported on shaft **267**, i.e. gear **455** is free to turn independent of shaft **267**. A so-called "ducking pin" **456** is carried by the gear and is spring biased to a non-engaging position wherein it is retracted toward the reverse side of the gear, the pin itself extending therethrough.

When a line is to be composed and drum **271** positioned in accordance with the setting for the line length, solenoid **457** (FIG. 16) is energized, causing the shaft **460** thereof to be extended and push against screw **461**, which latter is adjustably mounted in the depending lug **462** of pivoting frame **463**. The frame comprises a pair of upwardly extending arms **464**, through which pivot pins **465** pass to the upright supporting member **466**, and a cross piece **467** from which lug **462** depends. The upper extremities of the arms **464** bear against pressure plate **470** which is normally urged by a compression spring **471** in a direction opposite to that in which the plate is moved by frame **463**. The rightward movement of plate **470** (FIG. 16), as when solenoid **457** is energized and arms **464** bear against the plate, compresses spring **471** and causes the plate to engage ducking pin **456** and project it to the extended position wherein it is in the path of the stop pin **472** carried by the disk **473**. Disk **473** is mounted on shaft **267** and is free to turn with respect thereto. It is connected to drum **271** by a plurality of tension springs (not shown) which permit a limited amount of relative rotative movement therebetween but which restore the members to their original positions. A pin **474** (FIG. 7), carried by the drum, extends through an elongated slot in disk **473** and limits the amount of relative movement therebetween. The adjacent surfaces of the drum and the disk each are provided with a plurality of abutments **475** in the form of rivet heads arranged in a circular pattern with those abutments on the disk **473** interlocking, or alternately disposed, with those on the plate. With this arrangement,

as stopping pin **472** engages ducking pin **456**, disk **473** is abruptly halted, but drum **271** continues to move. In so moving the springs connecting the drum and disk **473** are tensioned. Furthermore the relative movement causes the disk to move away from the drum since the abutments **475** serve as cam members. Such movement of disk **473** separates contacts **476** and this effect is utilized in the control circuitry to indicate that the apparatus is in a start-of-line position.

The motive means for driving the drum for the start-of-line or reset operation is the electrical motor **477** mounted beneath the baseboard **311** of the apparatus (FIGS. 17 and 18). A pulley **480**, mounted on the motor shaft **481**, drives an endless belt **482** over two idle pulleys **483** to turn the driven pulley **484** which in turn rotates shaft **267**. Pulley **484** is operatively connected to shaft **267** by an overrunning clutch **485**. In this manner, the drive to shaft **267** can come either from pulley **484**, as in a reset operation, or from spider gear **270**, as in the normal line composing operation.

The computer apparatus heretofore described in detail, while driven by continuously rotating motor **224**, is also controlled as to sequence of operations by control cam shaft **486** (FIG. 7) upon which are mounted various timing cams. A drive for shaft **486** through slip clutch **488** is obtained from motor **224** by a toothed belt **487** trained over sprocket wheels **490** and **491**, the latter sprocket wheel being keyed to the shaft which is journaled in bearing stand **492**.

Referring specifically to FIG. 38, a cycle of operations cam **493** is shown mounted on cam shaft **486**. The cam is shown with two detents **494** which are engaged by a dog **495** on locking lever **496**, the lever being pivotably supported for a rocking movement and carrying a follower roller **497** at its upper extremity. The lower end of lever **496** is fitted into a notch **500** formed in lever **501**. A spring **505** urges lever **496** in a counterclockwise direction, whereby dog **495** disengages detent **494**, but the lever is restrained by its engagement with notch **500** of lever **501**. The end of lever **501** is provided with an abutment member **502** which is positioned to be struck by the swing arm **503** of solenoid **504**. When the solenoid is energized, arm **503** strikes member **502** and pivots lever **501** clockwise, tensioning return spring **505** but removing the notch from locking engagement with lever **496**. Spring **502** thereupon pivots lever **496** to disengage dog **495** and detent **494**.

Immediately upon release of the shaft **486** for rotation, roller **497** falls on cam surface **506**. After one quarter turn of shaft **486**, lever **496** has been pivoted to its original locking position with dog **495** ready to engage detent **494**. Solenoid **504** is deenergized and arm **503** restored to neutral position, whereupon spring **505** returns lever to its locking position with notch **500** engaging the lower end of lever **496**. When shaft **486** has completed one-half revolution, detent **494** engages dog **495** to arrest further shaft rotation whereupon clutch **488** begins to slip. It is thus seen that a 180 degree rotation of shaft **486** is permitted for each energization of solenoid **504** and a complete cycle wil be effected during this period.

The squencing cam shaft **486** carries the rotor bar rest cam **257** (see also FIG. 14) which resets a previously operated squirrel cage rotor bar and thereby permits new width information to be transmitted to the read-out or computer drum as previously described. Also carried by the shaft **486** is index cam **507**, the function of which was heretofore described with reference to FIG. 12. Additional cams **521** may be provided to control the actuation of electrical switches **522** and circuits controlled thereby, the function of which is not germane to the present invention.

Having described the mechanical and electrical details whereby a signal corresponding to a depressed character key of the keyboard is transmited to the control tape perforator interposer solenoids (to code the character both as to identity and width) and to the read-out device, so that information for controlling composition of a line in the photographic unit may be obtained after the line is keyboarded and coded on tape, the information itself being coded on the control tape immediately following the character signals for the line to which it is applicable, a summary of the procedures to be followed in keyboarding a line will be described as well as a summary of operations of the unit. The description wil make reference, where appropriate, to certain individual control circuits which will be shown in the drawings, but no attempt will be made to describe a control wiring diagram which would be used in an actual machine since such an attempt would only complicate the description without aiding in an understanding of the present invention.

The control circuitry, for the most part, is employed in certain instances when machine functions are specified or called for at the beginning of a line or before composition of a line, as by actuation of the keyboard character keys, and when the line of composition is completed and the end-of-line sequence is initiated. In this latter sequence, justification or line remainder information for quadding right or centering operations is read from the read-out device and coded on the control tape. In addition, the read-out device is sent to its start-of-line position preparatory to the keyboarding of a new line.

The first operation performed by the machine operator is to set the mechanism for the desired line length of the material to be composed. An electric switch connecting the circuits to the power source is closed and the circuitry thus prepared for operation. The line set dial **345** is withdrawn from its detented position to the position shown in dotted lines in FIG. 34, preparatory to the actual setting of the desired line length. The forward movement of the dial results in the actuation of switch **348** to complete a circuit for line set relay coil LS as shown in FIG. 40. Contacts (not shown) of this relay separate to prevent the energization of certain circuits prior to setting of the line length and the return of the dial to its normal position. Contacts LS4, which enegage upon energization of coil LS, complete a circuit for the em-indicator reset solenoid EMR (**450** in FIG. 33). As previously explained with reference to FIG. 33, energization of the solenoid results in the pivoting of detent **446** out of its active position to thereby permit shaft **365** to be rotated.

The operator thereupon commences to rotate knob **344** either clockwise or counterclockwise, depending on the previous line length setting and the line length being curently set. Each one-half rotation of knob **344**, and with it dial **345** and shaft **342**, causes shaft **365** to rotate one-tenth of a revolution and em counter **383** to change its reading by one em. At the same time, shaft **365** is turning bevel gear **403** to set pointer **424** along scale **426** to give a corresponding visual indication of line length in ems.

When the knob **344** has been rotated an amount such that the em indicator and pointer **424** show the desired number of ems for the line to be composed, and dial **345** is positioned such that the desired subdivision of an em, i.e. units-of-an-em, is viewed through window **552** of the mechanism cover **553**, further rotation is arrested since both the visual means for indicating line length and the gear **455** carrying the ducking pin **456** are then set in accordance with the desired line length. The pin **456**, of course, determines the start-of-line position of drum **271**.

While knob **344** is being manipulated to set the mechanism for the desired line length, line set relay coil LS remains energized as shown in FIG. 40. Contacts LS4, in addition to completing a circuit for the em indicator solenoid EMR (**450**), also complete a circuit for duck-

ing pin solenoid DP (457), space reading carriage reset solenoid CR (324) and auxiliary line set relay coil LSX.

Energization of the ducking pin solenoid results in the pin 456 being projected to its intercepting position, wherein it will abut the stopping pin 472 carried by plate 473. Energization of the carriage reset solenoid CR pivots lever 330 counterclockwise (see FIG. 27), thereby removing dog 316 and detent 323 from engagement with ratchet 314 and permitting compression spring 305 (FIG. 23) to act against carriage 303 and restore it to its initial position against stop 304. Energiaztion of auxiliary line set relay coil LSX engages contacts LSX1 and LSX2, with the result that the drum reset motor DRM (477 in FIG. 17) is connected to an A.C. voltage supply and thereby operated. Consequently, through belt 482 and overrunning clutch 485, shaft 267 is rotated to bring drum 271 to its initial or start-of-line position as determined by the abutment of stop pin 472 and ducking pin 456. As pin 472 and plate 473 come to a halt, the inertia of the rotating masses tends to maintain drum 271 in motion, with the result that there is a separation of drum 271 and plate 473 as the rivet heads 475 engage. The separation occurs as by plate 473 moving leftwardly (FIG. 16) to cooperate with the drum home position switch 476. Separation of the switch contacts signals the end of a reset cycle. In normal composition, the re-setting operations also occur at the completion of a line but the circuits for the end-of-line re-setting operations are not shown since they involve sequencing considerations which would unduly complicate the description while not contributing to an understanding of the present invention.

The other extremity of shaft 267, which is rotated to bring drum 271 to its start-of-line position, acts through bevel gears 433 and spur gears 434 to turn shaft 435 on which is mounted units-of-an-em read dial 438. The numeral on dial 435 which is visible through window 554 of cover plate 553 will, therefore, indicate at this time the number of units-of-an-em over and above the number of ems for which the line is set. The reading on dial 438 will, of course, correspond with the reading on setting dial 345. Contacts 437 and 440 (FIG. 28) actuated by cam 436 mounted on shaft 435 are ineffective during this initial line setting operation and consequently circuits controlled by switch contacts will not be considered now, but later on, when operations during which they are effective are considered.

After the mechanism has been set as described, knob 344 is restored to its normal position and one of the detents 449 coacts with pin 453 to lock the mechanisms in the adjusted position. Restoration of knob 344 and dial 345 to normal positions actuates switch 348, the contacts of which interrupt a circuit for coil LS but a self-holding circuit through contacts LSR1 and LS1 maintains the coil in an energized conditions. Engagement of the back contacts of switch 348 completes a circuit through contacts LS2 for the line set reset relay coil LSR, thus resulting in the separation of contacts LSR1. Separation of these contacts interrupt the circuit for coil LS, thus permitting contacts controlled thereby to be restored to normal condition. Contacts LS2 separate to deenergize coil LSR and contacts LS4 separate to interrupt the circuit for em indicator reset solenoid EMR, ducking pin solenoid DP, carriage reset solenoid CR and auxiliary line set relay coil LSX. Contacts LSX1 and LSX2 controlled by the latter relay coil separate to deenergize drum reset motor DRM.

Thus, the mechanism has been set for a particular line length (which is indicated on em indicator 383, em scale 426, and units-of-an-em-dials 345 and 438), and is now in readiness to be actuated, as by keyboarding of a line.

Prior to beginning the letter by letter composition of a line, the machine operator will in general perform several auxiliary or preparatory operations which will control composition insofar as point size of composition, leading between successive lines and type face style of the characters are concerned. Thus, signals will be coded on the tape which when read or decoded in the photographic machine will control the point size of the imaged characters, the leading between lines of imaged characters and the type face style of the characters to be imaged on the sensitized sheet.

Referring to FIG. 41 a "function" coder 548 is shown. The coder circuit is so denominated inasmuch as machine functional signals, as contrasted to character identification or width signals, are coded on the tape through the intermediary of this circuit. Each of the ten output conductors, 555A, 555B, 555C, etc., is connected to a perforator interponent solenoid circuit, as shown in FIG. 6. Certain of the function coder circuits will be in parallel with character identification coder circuits and therefore are connected to the same FIG. 6 circuit as are such character identification coder circuits.

A point size selector switch PSS is provided on an auxiliary keyboard 549 (FIG. 1) and the operator, by swinging brush 556 to a desired position, e.g., to contact 557, will ready a circuit for coding point size information on the tape. Each position to which brush may be swung will correspond to a predetermined point size which will indicate on the keyboard. Thus, by swinging brush 556 until it coacts with contact 557, the operator will have selected a point size, e.g. 6 points, at which photography will take place in the photographic unit. If after selecting the desired point size, the attendant depresses point size push button PSP, a signal representative of the selected point size will be coded, the signal comprising perforations associated with the interponent solenoid circuits, i.e. FIG. 6 circuits, connected to function coder output wires 555A, 555C, 555D, 555E, 555H and 555I. By way of further example, if the attendant swings brush 556 to a position wherein it coacts with contact 560, this contact being provided for a twelve point signal, after depressing button PSP, circuits will be traced to coder output wires 555B, 555C, 555G, 555H and 555I so that five interponent solenoid circuits will be energized and a corresponding number of perforations punched in the control tape.

Similar to the point size selector switch, is the leading selector switch LSE. Under circumstances of ordinary text composition, the spacing between successive lines is equal to the point size of the text composition. Thus, if the text is twelve point, the spacing between lines will be twelve point. In the art this is termed "solid composition." There are times when it is desirable to increase the spacing between lines over that provided by solid composition. To do so is to "lead" the lines. The leading selector switch is mounted on the auxiliary keyboard and the operator, by swinging brush 561 to a desired position, e.g. to contact 562, will ready a circuit for coding leading information on the tape. Each position to which brush may be swung will correspond to a predetermined amount of leading which will be indicated on the face of the keyboard. Thus, by swinging brush 561 until it coacts with contact 562, the operator will have selected the amount of leading, e.g. 6 points, which will appear between successive lines of text as photographed in the photographic machine. If after selecting the desired leading, the operator depresses the leading push button LP, a signal representative of the selected leading will be coded. The signal will comprise perforations associated with the interponent solenoid circuits, i.e. FIG. 6 circuits, connected to function coder output wires 555A, 555C, 555D, 555G, 555H and 555J. As a further example, if the operator selects leading whereby brush 561 cooperates with contacts 563, the signal for such leading will be generated through coder output wires 555A, 555C, 555E, 555G and 555I, for another point size, say 12 pt.

In the present machine, point size information and leading information will be coded on the tape preceding

the signals for the line of characters to which the point size and leading information applies. This information will appear infrequently on the tape since it is not often that point size and leading vary. However, it does appear at the beginning of every tape. It is to be understood that, except at the start of every tape, point size information may be coded on the tape independent of leading information or leading information may be coded independent of point size information.

Referring to FIG. 42, there is shown a representative circuit for selecting one of a plurality of character fonts from which composition is effected in the photographic unit. By depressing any one of the font selection push buttons IFP . . . NFP, an appropriate signal, unique to the particular push button depressed, is coded on the control tape. When read or decoded in the photographic unit, the signal brings the selected font into photographing position so that composition of characters represented by the signals following the font signal will be effected from the selected font. In addition to controlling selection of the font which is photographed in the photographic unit, as by coding an appropriate signal on the control tape, the font selection circuit controls which one of the plurality of width decimal coder circuits **94A**, **94B**, etc., hereinabove described with reference to FIG. 1, is activated to total character widths.

As was above discussed, the keyboard unit of the present photocomposing machine acts to totalize the widths of the individual characters which go to make up a line of composition in order that justification, quad right or centering information may be obtained from the mechanism of the unit, coded on the control tape, and used to control composition in the photographic unit. Since it is desired that the present machine accommodate a wide variety of character fonts and since the unit widths of otherwise identical characters may vary from one font to another , the present machine incorporates mechanism whereby selection of a desired font from a large available number of fonts will also select a corresponding width coding mechanism for coding character widths. The selection is made automatically without the necessity of the machine operator manually changing code bars or the like.

The font selection push buttons IFP . . . NFP are provided on the auxiliary keyboad **549** and each comprises a double set of contacts. Considering the push button circuit for selection of the first font, the first set of push button contacts **FP1** complete a circuit for font reset relay coil FR through contacts **FS2** and for font selection relay coil FS. The latter coil controls a switch which is time-delayed in operation, hence the switch controlled by coil FR will operate first to separate contacts **FR1**. The purpose of this is to deenergize any font selection circuit which may have been previously operated. For example, if, by a prior operation, pushbutton NFP had been depressed to select the font associated therewith, a self-holding circuit for coil NF would be completed through contacts **FR1** and **NF1**. Separation of contacts **FR1**, as now contemplated, will deenergize the circuit and thus prepare for selection of another font. Shortly after operation of the switch controlled by coil FR, the slow-in-operating switch controlled by coil FS operates to engage contacts **FS1** and **FS3** and to separate contacts **FS2**. Separation of contacts **FS2** deenergizes coil FR to restore contacts **FR1** to their normally engaged condition. Contacts **FS1** complete a circuit through push button contacts **FP2**, since the push button is still depressed, for the first font relay coil IF and the parallel connected pilot lamp IPL. This lamp is located adjacent the font push button IFP on the auxiliary keyboard and serves to visually signal the machine operator as to the font in use. Energization of coil IF results in the engagement of contacts **IF1**, **IF2** . . . **IF90** (assuming an eighty-eight character keyboard). Contacts **IF1** complete a self-holding circuit for coil IF and pilot lamp IPL through contacts **FR1**. Thus, coil IF and lamp IPL remain energized while the machine is being operated and the first font is in use. If a second font were to be selected, contacts **FR1** would separate to interrupt the circuit for coil IF and lamp IPL, as heretofore explained.

Contacts **IF2** and contacts **FS3** complete a circuit for establishing the signal representative of the selected font in the function coder. It will be noted that the output wires of the coder **548** shown in FIG. 43 are designated the same as the output wires of FIG. 41, and they terminate in the same interponent solenoid circuits i.e. FIG. 6 circuits. The signal for the first font which was the one selected will comprise perforations made by operation of the interponent solenoids actuated through output wires **555A**, **555B**, **555E**, **555F**, **555I** and **555J**. Contacts **IF3** . . . to **IF90** complete circuits from the character keys to the width decimal coder circuits **94A** associated with the selected font. In this manner, width information corresponding to the character font selected for photography will be coded on the control tape with the character identification portion of the overall character signal and will also be fed to the width totalizing circuits for the ultimate determination of justification, quad right or centering information.

If instead of depressing font push button IFP the operator had depressed push button NFP, circuitry would be established, in a manner similar to that explained above, for the coding of a font signal as by the energization of function coder outputs wires **555A**, **555D**, **555E**, **555H** and **555J**. Also, in FIG. 1, the character width information would be transmitted through decimal coder **94B** which corresponds to the selected font.

The arrangement disclosed has been found extremely suitable for accommodating a wide variety of character fonts having different type face styles in a photocomposing machine while at the same time eliminating the necessity for the machine operator to manually change width code mechanisms or foregoing the typographical aesthetics of varying the set widths of individual characters from one type face style to another.

The font selection signal, like the point size and leading signals, will appear on the control tape at the beginning thereof in order that photography of characters represented by signals following the introductory signals will be from a selected font. A font signal may also be interposed at any point within a line, as when it is desired to impart emphasis to text meaning by italicizing a word or words. Of course, the point size of a character from a new font, when located within a line, will be the same as that of the characters preceding or following it.

After the preliminary signals relating to point size, leading, and font selection have beeen coded on the control tape, the operator proceeds to keyboard the text material. If it is desired to indent, as in the first line of a paragraph, the operator will depress one of the width push buttons, e.g. **121B**, either once or several times, depending on the amount of indentation desired, to code on the tape signals representative of width only. Thereafter, normal text composition is initiated. Each operation of a character key completes a circuit through the key operated switch, e.g. **50**, and (assuming that the shift key was operated so that switch **53** is in the non-actuated position shown in FIG. 1), to conductor **60**. The conductor is divided into two branches. One branch through conductor **62** leads to the character identification diode coder **63**, wherein the single conductor is connected to a unique combination of output wires **64**, **65**, etc. through unidirectional current conducting devices. Each of the conductors leading from a character key is connected to a unique combination of coder output wires **64**, **65**, etc., so that each character will be identified by a signal peculiar to itself. The output wires lead through circuitry (FIG. 6, for example) to perforator interponent solenoids and therefore the control tape will

be perforated to accord with the coder output wires energized as a result of depressing the character key.

If the shift key had not been operated, and the same character key depressed, the circuit would be traced through the other set of contacts, i.e. **51**, of the double pole switch, actuated by the character key, to conductor **62A** and thence to a unique combination of coder output wires. In the same manner, depressing any other character key will lead to the energization of a unique set of coder output wires, with the consequent perforation of a unique signal in the control tape for identification of the character represented by the character key.

Since character identification represents only one portion of the intelligence to be coded for a character, consideration now will be given to the coding of the character width information which is accomplished through conductor branch **92**. The conductor leads to a plurality of decimal coders **94A**, **94B**, etc., each of which is associated with a character font, as heretofore described. Depending on which font has been selected through operation of a font selection push button, a set of font relay contacts **1F3** . . . **1F90** will connect one decimal coder to the conductors leading from the character key operated switches. In the example now being considered, font relay contacts **1F3** . . . **1F90** are engaged so that the circuit extends from the conductors to decimal coder **94A**. If a different font selection push button had been depressed and other font relay contacts, e.g. contacts **NF3** . . . **NF90** engaged, the circuit would be to decimal coder **94B**.

In the decimal coder, the conductor **92** is connected to an output wire which has an assigned value corresponding to the set width of the character represented by the character key. Other characters may have the same set width and the conductor leading from the switch actuated by the character key also will be connected to the same output wire. The output wire, e.g. **96**, is then traced to the unit spacing circuit where, depending on whether or not a unit spacing push button (preferably located on the auxiliary keyboard) is depressed, the value of the set width of the character is coded at its normal unit value or with a plus or minus unit value.

Referring to FIGS. 45 and 5, the operator will depress push button **1PP** to energize coil **1P** and separate contacts **1P1**, **1P3**, **1P5**, **1P6** and **1P8**, and engage contacts **1P2**, **1P4**, **1P7** and **1P9**, if it is desired to add one unit space to the coded width of a character, or will depress pushbutton **2PP** to energize coil **2P** and separate and engage the contacts shown in FIG. 5, if it is desired to add two unit spaces to the coded width of a character. It will be noted that with the circuit provided, if it is desired to add three unit spaces to the coded width of a character, it is only necessary to depress push buttons **1PP** and **2PP**. In a similar manner, push button **1MP** may be depressed to energize coil **1M** and subtract one unit space from the width of a character to be coded, or push button **2MP** may be depressed to energize coil **2M** and subtract two unit spaces from the width of a character to be coded. Also, by depressing push button **1MP** and **2MP** three unit spaces will be subtracted from the character width coded. Of course, the circuit arrangement disclosed can be extended to add or subtract additional unit spaces. From the output wire of the unit spacing circuit, the circuit for the particular character being considered passes to the binary width coder (FIG. 4), where the set width value of the character as modified, if at all, by the unit spacing circuit, is converted from decimal to binary form.

After translation to binary form, the width information is transmitted to the perforator, wherein each output wire from the binary width coder terminates in a FIG. 6 circuit to control the operation of an interponent solenoid and so control the coding of the width information for the character on the control tape adjacent that portion of the signal identifying the character. The binary width information is, in addition, transmitted to the justification and line remainder computer where the set widths of individual characters are totalized as heretofore described.

Operation of the binary solenoids or switch **274**, either singly or in combination one with another, upon respect of width information from the binary width coder, results in the actuation of one or more of the parallel connected switches. e.g. **150** (FIGS. 11 and 44) or e.g. switch **286** to complete a circuit for the cam shaft trip solenoid TRS in FIG. 44 (**504** in FIG. 38) through the normally closed contacts **564** of a cam operated switch **522** (FIG. 7). Energization of the trip solenoid frees cam shaft **486** for one cycle of operation. During rotation of the cam shaft (which performs various timing functions not a part of the present invention as well as other functions hereinbefore disclosed), the drum **271** is actuated in accordance with the width information transmitted to the computer. Near the end of the cycle of operation, after the width information for the character being coded has been utilized in the computer (it being understood that a cycle of operation in the computer takes place for each bit of width information transmitted thereto), contacts **564** of switch **522** are separated to deenergize the trip solenoid and thereby set dog **495** in position to engage detent **494** and arrest rotation of the cam shaft. Contacts **565** engage to complete a circuit for thyration cut-off relay coil TC (FIG. 44) and separate contacts **TC1**. These contacts interrupt the plate circuits of the binary solenoid thyrations (FIG. 48) with the result that the tubes stop conducting and the interponent solenoids **90**, **90A**, **90B**, etc. are deenergized. Having thus completed a single cycle of operations, the computer mechanism is prepared to receive the witdh information for subsequent keyboarded characters.

The operator will keyboard the entire line of text and each time a character key is depressed, a dual signal representing the character will be coded on the control tape, the signal comprising a character identification portion and a character width information portion. At the same time, the computer will be operated by the same character width information to totalize the set widths of the individual characters and subtract such total from the pre-set justified line length.

In addition to the characters which go to make up a line of text, there is also included within the line interword spaces which appear between the word groupings of characters. In keyboarding a line, each interword space is given a predetermined or normal value of set width, which value is transmitted to the computer, so that the width of the interword spaces are totalized with the widths of the characters. Therefore, the computer gives a true line remainder which takes into account the normal spacing between words. The line remainder thus obtained may be used with facility to provide any of the normal line composition controls. That is, for purposes of justification, the line remainder is divided among the number of interword spaces and the result of such division is added to each normal word space. For quadding right, the line remainder is simply counted off before actual composition of the line by photography takes place. For centering, the line remainder is divided in half, one half the remainder appearing at the beginning of a line while the other portion of the remainder appears at the end of the line.

Referring to FIG. 1 it is clear that actuation of the space key **566** completes three circuits, otherwise independent. In the first place, conductor **567** leads from the space key to the function coder **548**, wherein a space signal is formed by the interconnection of conductor **567** with a unique combination of output wires, e.g. **555C** and **555D**. The function coder output wires transmit the space signal through interponent solenoid circuits to the perforator, where the signal is coded on the control tape.

Secondly, the space key completes a circuit through conductor **570** to a FIG. 6 circuit, in the plate circuit of which is the carriage advance solenoid **322**. Therefore, each energization of the space key results in the photocell carriage **303** being advanced one position in the manner more specifically described with reference to FIG. 23. In order to add the normal width value of a word space, a circuit is also completed to conductor **571** which leads to the binary width coder output wire and so provides a space width signal to the computer. If it is assumed that a normal word space has a width of four units, then conductor **571** can be directly connected to the FIG. 6 circuit which energizes the binary 4 solenoid (**135**) in the computer. Energization of the solenoid actuates the binary indexing mechanism and switch **150**A for the tripping solenoid TRS (**504**) to inaugurate a computer cycle of operations to total the word space width with the character set widths.

It is thus seen that as the operator keyboards a line, a running count is maintained of the units-of-an-em values of the characters and word spaces in the line of text. The operation of the computer, in response to the introduction of the width information, results in the intermittent rotation of shaft **267**, and through gears **433** and **434**, of shaft **435** and cam **436**. Each complete revolution of shaft **435**, which takes place for each eighteen units of an em, or one em in an eighteen unit system, cam **436** co-acts with roller **572** to engage and separate contacts **437**. These contacts are serially connected with solenoid **441** (FIG. 33) to energize and deenergize the solenoid so that, for each eighteen units of width information fed to the computer unit, shaft **365** is stepped one tenth of a revolution and the ems counter unit count wheel **384** subtracts one em from the previously indicated count. Rotation of shaft **365** also results in the movement of pointer carriage **420** toward the zero marker of linear em scale **426**. As the carriage reaches the justification zone, switch **427** is actuated to complete a circuit and signal the operator by lamp **573** and buzzer **574** that the unit can give justification information and that, therefore, keyboarding of the line being composed can be halted.

It will be assumed that composition of the line is halted and that, in being composed in the photographic unit, the line is to be justified. Hence the operator will depress the justification push button JPB located on the auxiliary keyboard to engage contacts and complete a circuit for the justification relay coil J (FIG. 46). Contacts J13 (FIG. 41) engage to complete a circuit to the function coder **548** and thereby code a justification signal on the control tape. Contacts J2 to J11 (FIG. 47) engage to complete the circuit to the photocell pick-ups **301**A to **301**E and **302**A to **302**E to thus read the justification information for the particular line being composed and code it on the tape immediately following the justification signal in the manner previously described. Contacts J1 separate to prevent the photocell tubes **300**A to **300**E, which read line remainder information, from conducting and coding such information on the control tape. For the same purpose contacts J13 separate to prevent a circuit being completed through the contact cylinders **385** and **394**, which also code line remainder information.

If instead of depressing the justification push button, the operator depresses the quad right push button QRP (FIG. 46), also located on the auxiliary keyboard, and thereby engages contacts to complete a circuit for quad right relay coil QR, contacts QR7 (FIG. 41), which engage when the coil is energized, complete a circuit to the function coder and thus code a quad right signal on the control tape. The line remainder information, which is utilized in the photographic machine to compose the line in a quad right position, is obtained from the ems counter contact cylinders **385** and **394** which are shown in diagrammatic form in FIG. 47. A circuit, through contacts J12 and the contact disk segments, records the ems remainder in the line on the control tape. An additional circuit, through contacts J1 and photocells **300**A to **300**E, which co-act with the remainder portion of drum **271**, records the units-of-an-em remainder on the tape. Contacts QR1 separate to prevent a circuit being completed for photocells **301**A to **301**E and photocells **302**A, **302**E, which photocells read justification information. In the photographic unit, the quad right signal, followed by the line remainder information, results in quad right composition of the line.

As another possibility, rather than depress the justification or quad right push buttons, the operator may depress the centering push button CEP (FIG. 46) which also is located on the auxiliary keyboard. In this instance, contacts engage to energize centering relay coil C and thereby engage contacts C6 (FIG. 41) to complete a circuit through the function coder and code a centering signal on the control tape. A circuit is completed through the ems counter contact cylinders segments to record the ems remainder on the control tape. However, since this information is to be used to cause a centering operation rather than a quad right operation in the photographic unit, the information will be read or decoded as if it were ens rather than ems. The distinction between ens and ems will be based on the signal which precedes the record information, that is, if the signal is a quad right signal the information will be read as ems and if it is a centering signal then the information will be read as ens.

Photocells **300**A to **300**E, which read line remainder and record this remainder in binary form for a quad right operation, are also activated when centering information is to be recorded. However, the value of the units line remainder is divided in half by the circuit shown in FIG. 47, wherein each photocell used for reading units remainder from drum **271** is connected through contacts C2 to C5 to the perforator interponent solenoid circuit normally associated with the next lower binary number. Thus, if photocell **300**B is normally associated with the circuit having a binary value 8, it will, when used for centering, be associated with the circuit having a binary value 4 through contacts C3.

Of course, for quading right and centering, switch **427** does not have to be actuated by the em indicator carriage **420**. In fact, these operations can be carried out even after only a single character has been keyboarded for a line.

After the recordation of the desired end-of-line signal and the information associated therewith, coded information for succeeding lines can likewise be entered on the control strip. At the completion of keyboard composition, as at the end of a page or when it is desired to handle the previously coded information separately from any following coded information, the operator will depress an end-of-composition push button **575** (FIG. 41) located on auxiliary keyboard **549**. The function of the push button is, first, to code an end-of-composition signal on the tape through function coder **548**, and thereafter to advance the tape in the perforator unit so that that portion of it which has been coded may be severed from the remaining web. The end-of-composition signal will be read in the photographic unit to advance the sensitized film in its magazine, so that the portion of the film bearing the latent character images may be severed from the remainder of the film and thereafter processed.

Since, having described the invention, other arrangements for carrying out the invention may be suggested thereby, and many apparently widely different embodiments thereof could be made without departing from its scope, it is intended that all matter contained in the above description or shown in the accompanying draw-

ings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In a machine for producing a coded tape representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination with character keys for coding character signals on the tape and additional keys for coding function signals which control composition of coded characters, of line length apparatus comprising means for indicating line length, means for setting said indicating means to accord with a selected value of line length, means for actuating said indicating means in response to operation of a character key to subtract the set width of the character represented by the key from the pre-set line length and thereby indicate line remainder, a computer mechanism for computing and coding the line remainder information, and means controlled by said computer mechanism and responsive to operation of a function key for producing a corresponding line remainder signal on the tape.

2. In a machine for producing a coded tape representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination with character keys for coding character signals on the tape and additional keys for coding function signals which control composition of coded characters, of line length apparatus comprising means for indicating line length in ems and units-of-an-em, means for setting said indicating means to accord with a selected value of line length, means for actuating said indicating means in response to operation of a character key to subtract the set width of the character represented by the key from the pre-set line length and thereby indicate line remainder, a computer mechanism for computing and coding the line remainder information, and means controlled by said computer mechanism and responsive to operation of a function key for producing a corresponding line remainder signal on the tape as ems and units of an em.

3. In a machine for producing a coded tape representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination with character keys for coding character signals on the tape and additional keys for coding function signals which control composition of coded characters, of line length apparatus comprising means for indicating line length, said means including a digit wheel counter which indicates total ems as tens of ems and units of ems, means for setting said indicating means to accord with a selected value of line length, means for actuating the counter in response to operation of a character key to subtract the set width of the character represented by the key from the pre-set line length and thereby indicate line remainder, a computer mechanism for computing and coding the line remainder information, and means controlled by said computer mechanism and responsive to operation of a function key for producing a corresponding line remainder signal on the tape as tens of ems and units of ems.

4. The combination according to claim 1, wherein the function key also codes on the tape a signal representative of a quad right operation.

5. The combination according to claim 1, wherein the function key codes the line remainder on the tape as tens of ens and units of ens and also codes on the tape a signal representative of a centering operation.

6. The combination according to claim 1, wherein that part of the line remainder signal which represents the ems remainder is the same whether the composing operation part thereof is for quadding right or centering.

7. The combination according to claim 1, including a space key, and means for actuating said indicating means in response to the operation of said key to subtract the set width of the space represented by the key from the pre-set line length.

8. The combination according to claim 2, wherein the numerical value of the ems and units-of-an-em are indicated in binary form, and wherein the line remainder is coded on the tape in binary form.

9. The combination according to claim 2 including a space key, means responsive to operation of said space key for indicating the number of spaces in a line of composition, means for indicating when a composed line is within a predetermined measure of the pre-selected full line length, means having coded thereon justification information for combinations of line remainder within the predetermined measure of full line length and numbers of interword spaces, and means responsive to operation of a second function key after a line is composed to within the predetermined measure of full line length of coding justification information on the tape according to the line remainder and the number of word spaces in the line of composition.

10. The combination according to claim 9, wherein the coded justification information and the line length units-of-an-em information appear on a rotatable drum which is actuated in response to actuation of the character and space keys.

11. The combination according to claim 10, wherein the coded justification information and the line length units-of-an-em information are numerical values which are placed on the drum in binary form.

12. The combination according to claim 11, wherein the drum is in the form of a cylinder having opaque and translucent portions, the latter portions being the justification and line length units-of-an-em information, and including a light source for directing light through the translucent areas of the drum, and a plurality of light responsive elements located in a reference position with respect to said drum.

13. In a machine for producing a coded tape representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination of means for setting the machine for the composition of a line of a predetermined length, means for totalizing the number of units comprised in said pre-set line, means responsive to key actuation during line composition for subtracting from the total the number of units represented by the set widths of the characters and spaces in the composed line and thereby computing the number of units in the line remainder, automatic means for coding the computed line remainder information, and signal producing mechanism actuated by said automatic coding means for producing on the tape a signal representative of the coded line remainder information.

14. The combination according to claim 13, wherein the line setting means include an em indicator as well as a units-of-an-em indicator.

15. The combination according to claim 13, wherein the totalizing means include an em indicator as well as a units-of-an-em indicator.

16. The combination according to claim 13, wherein the totalizing means include a digit wheel counter comprising a units-of-ems wheel and a tens-of-ems wheel.

17. The combination according to claim 16, wherein the totalizing means also include a units-of-an-em dial coupled to the counter.

18. The combination according to claim 13, wherein the subtracting means are operated by an indexing device under binary code control.

19. The combination according to claim 13, wherein the line remainder information is coded in ems and units of an em.

20. The combination according to claim 13, wherein the coding means include a rotary drum responsive to key actuation and having code elements arranged thereon in column and row formation to produce a line remainder signal representing units of an em.

21. The combination according to claim 13, wherein the totalizing means include a digit wheel counter comprising a units-of-ems wheel and a tens-of-ems wheel, and

wherein the coding means include coded cylinders connected to and operated with said wheels to produce a line remainder signal respresenting corresponding decimal values.

22. The combination according to claim 13, wherein the line setting means include a manually rotatable knob, an em scale pointer connected to and operated by said knob, and a units-of-an-em dial also connected to and operated by said knob.

23. The combination according to claim 22, wherein the totalizing means are also connected to and operated by said rotatable knob so as to add and register the total number of units for which the line is set.

24. The combination according to claim 22, wherein the em scale pointer, during line composition, is connected to and operated by the subtracting means so as to indicate at all times the number of ems in the line remainder.

25. The combination according to claim 15, wherein the em indicator, as well as the units-of-an-em indicator, during the line composition, are connected to and operated by the subtracting means so as to indicate at all times the exact number of units in the line remainder.

26. The combination according to claim 13, wherein the coding means are controlled by a quad right key which produces a signal in the tape representing a blank composing operation at the leading end of the line equal to the full number of units in the line remainder.

27. The combination according to claim 13, wherein the coding means are controlled by a centering key which produces a signal in the tape representing a blank composing operation at each end of the line equal to one-half the full number of units in the line remainder.

28. The combination according to claim 26, wherein the quad right key, when actuated at the end of the line, controls two electric circuits, one leading through a function coder which produces a quad right signal on the tape, and the other through a computer circuit which produces a line remainder signal in terms of ems on the tape.

29. The combination according to claim 27, wherein the centering key, when actuated at the end of the line, controls two electric circuits, one leading through a function coder which produces a centering signal on the tape, and the other through a computer circuit which produces a line remainder signal in terms of ens on the tape.

30. In a machine for producing a coded tape having a succession of code signals thereon representative of a justified composed line of type characters which vary in set widths on a unit basis, the combination of a keyboard comprising a series of character keys and a word space key, a rotary justification information computer drum, means acting in response to the actuation of the keys for rotating the drum different unit distances in accordance with unit variations in set widths of the type characters and word spaces being composed, said drum having a series of rows of light transmitting code elements spaced apart in a circumferential direction on a unit basis and also having a series of columns of light transmitting code elements spaced apart in an axial direction on a word space basis, the code elements in row formation being arranged in a plurality of groups having different quotient values as between the groups and corresponding in number in the respective groups to the number of units which may remain in an unjustified line, and the code elements in column formation being arranged in a plurality of groups and having different quotient remainder values as between the groups and corresponding in number to the number of word spaces which may occur in a composed line, decoding mechanism cooperating with the computer drum and presenting as many photocell code reading elements as there are different groups of light transmitting code elements on the drum, a movable carriage on which the photocell code reading elements are mounted and which is movable axially of the computer drum, means responsive to each actuation of the word space key for effecting movement of the carriage for a distance of one column, means operable after the composition of a line for activating the photocell code reading elements located at the time in cooperative relation to the active light transmitting code elements on the drum as determined by the group, row and column arrangement of said code elements, and electrically controlled signal producing mechanism acting in response to the photocell code reading elements to produce corresponding justification signals in the coded tape.

31. In a machine for producing a coded tape having a succession of code signals thereon representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination of a keyboard comprising a series of character keys and a word space key, means for setting the machine for the composition of a line of predetermined length, and a line remainder information computer mechanism responsive to the actuation of said keys for totalizing the number of units represented by the combined widths of characters and word spaces in a composed line and then subtracting said total from the total number of units comprised in he pre-set line so as thereby to compute the number of units in the line remainder, said computer mechanism including a rotary drum having code elements arranged thereon in column and row formation to produce a line remainder signal representing units of an em together with signal producing mechanism responsive to the code elements of the rotary drum to produce a units-of-an-em line remainder signal in the coded tape.

32. The combination according to claim 31, wherein the code elements are light transmitting, and wherein the signal producing mechanism is electrically controlled and is responsive to said light transmitting code elements.

33. The combination according to claim 31, wherein the code elements on the rotary drum are light transmitting, and including code reading elements cooperating with the drum and in the form of photocells activated by the active light transmitting code elements.

34. The combination according to claim 31, including a digit wheel counter comprising a units-of-ems wheel and a tens-of-ems wheel, said wheels having coded cylinders operated thereby and functioning to produce line remainder signals representing units of ems and tens of ems, respectively.

35. The combination according to claim 30, wherein the rotary drum is also formed with light transmitting code elements arranged thereon to produce a line remainder signal representing units of an em.

[36. In a machine for producing a coded tape representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination of a keyboard, a character identification code mechanism acting in response to key actuation for producing character identification signals in the tape, and a character width code mechanism acting in response to the same key actuation for producing corresponding character width signals in the tape, said character width code mechanism including a plurality of groups of code elements having different character width values as between groups, the different groups of character width code elements representing different type fonts and the code elements in each group representing the set width values of the type characters in the corresponding font, together with means for selecting one or another of the groups of character width code elements according to the font of type characters to be composed.]

[37. The combination according to claim 36, wherein the selecting means include a function key which produces in the tape a signal representing the group of character width code elements selected.]

[38. The combination according to claim 37, wherein the function key is a font selecting key which produces in the tape a font signal representing the group of character width code elements selected.]

[39. The combination according to claim 36, wherein the character width code elements in each of the different groups represent in decimal form the unit width values of the type characters in the corresponding group, and wherein the character width code mechanism also includes a further group of code elements for converting into binary form the decimal unit width values of the type characters of the selected group, said group of binary code elements being common to all of the groups of decimal code elements.]

[40. The combination according to claim 36, wherein the character width code elements in each of the different groups represent in decimal form the unit width values of the types characters in the corresponding group, and wherein the character width code mechanism also includes means for varying the decimal unit values of the code elements of the selected group, said unit varying means being common to all of the groups of decimal code elements.]

[41. The combination according to claim 39, wherein the character width code mechanism also includes means for varying the decimal unit values of the code elements of the selected group, said unit varying means being common to all of the groups of the decimal code elements and connected to the appropriate binary code elements of the converting group.]

[42. The combination according to claim 36, wherein all of the code elements therein referred to are in the form of electric conductors which control the operation of the signal producing mechanism according to code.]

[43. In a machine for producing a coded tape representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination of a keyboard, a character identification code mechanism acting in response to key actuation for producing character identification signals in the tape, and a character width code mechanism acting in response to the same key actuation for producing corresponding character width signals in the tape, said character width code mechanism comprising a group of code elements representing in decimal form the unit set width values of the type characters, and a further group of code elements for converting into binary form the decimal unit width values of the type characters.]

44. In a machine for producing a coded tape representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination of a keyboard, a character identification code mechanism acting in response to key actuation for producing character identification signals in the tape, and a character width code mechanism acting in response to the same key actuation for producing corresponding character width signals in the tape, said character width code mechanism comprising a group of code elements representing in decimal form the unit set width values of the type characters, and means for varying the decimal unit values of the code elements to increase or decrease by one or more units the normal character width value of any selected character.

45. In a machine for producing a coded tape representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination of a keyboard, a character identification code mechanism acting in response to key actuation for producing character identification signals in the tape, and a character width code mechanism acting in response to the same key actuation for producing corresponding character width signals in the tape, said character width code mechanism comprising a group of code elements representing in decimal form the unit set width values of the type characters, and means for varying the decimal unit values of the code elements to increase or decrease by one or more units the normal character width value of any selected character, said unit varying means including plus and minus keys which are actuated in advance of the character keys.

46. The combination according to claim 43, including means for varying the decimal unit values of the code elements to increase or decrease by one or more units the normal character width value of any selected character, said unit varying means being connected to the appropriate binary code elements of the converting group.

47. In a machine for producing a coded tape representative of a composed line of type characters which vary in [set] width on a *relative width value* [units-of-an-em] basis, the combination of a keyboard, a character identification code mechanism acting in response to key actuation for producing character identification signals in the tape, and a character width code mechanism acting in response to the same key actuation for producing corresponding character width signals in the tape, said character width code mechanism comprising a decimal unit coder connected to the finger keys, a unit spacing device connected to the decimal unit coder, and a binary width coder connected to the unit spacing device and controlling the operation of the signal producing mechanism.

48. The combination according to claim 47, including *a manually operated means* [an auxiliary keyboard] connected to the binary width coder for producing lone width signals in the tape.

[49. The combination according to claim 43, wherein all of the code elements therein referred to are in the form of electrical conductors which control the operation of the signal producing mechanism according to code.]

50. In a machine for producing a coded tape representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination of a keyboard, a character identification code mechanism acting in response to key actuation for producing character identification signals in the tape, a character width code mechanism acting in response to the same key actuation for producing corresponding character width signals in the tape, a justification information computer mechanism, and means also responsive to the same key actuation for operating the computer mechanism step by step in totalizing the number of units represented by the combined widths of the characters and word spaces in the unjustified line, said operating means including a first indexing device comprising a series of index members representing in decimal form and by even numbers unit character width values, and a second indexing device for increasing by one the unit decimal value of any one of the even decimal values represented by the first indexing device.

51. The combination according to claim 50, wherein the selection of the index members of the first indexing device is controlled by a binary code system.

52. The combination according to claim 51, wherein the second indexing device has the binary value of one and forms part of the binary code system for the first indexing device.

53. The combination according to claim 50, wherein the justification information computer mechanism comprises a rotary drum with signal producing code elements arranged thereon, and wherein the drum is rotated by the two indexing devices different unit width distances according to the varying character width values.

54. The combination according to claim 53, wherein the two indexing devices rotate the justification drum through a differential gear set, one part of which is connected to the first indexing device, and the other part of which is connected to the second indexing device.

55. The combination according to claim 50, wherein the two indexing devices are controlled by the character width code mechanism which produces character width signals in the tape.

56. The combination according to claim 55, wherein the

character width information is transmitted in binary form both to the character width signal producing mechanism and the justification information computer mechanism.

[57. In a machine for producing a coded tape representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination of a keyboard, a character identification code mechanism acting in response to key actuation for producing character identification signals in the tape, a character width code mechanism acting in response to the same key actuation for producing corresponding character width signals in the tape, a function coder acting in response to a function-key actuation for producing in the tape any selected one of a plurality of signals representative of different point sizes, and means for setting the coder according to the point size selected.]

[58. In a machine for producing a coded tape representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination of a keyboard, a character identification code mechanism acting in response to key actuation for producing character identification signals in the tape, a character width code mechanism acting in response to the same key actuation for producing corresponding character width signals in the tape, a function coder acting in response to a function-key actuation for producing in the tape any selected one of a plurality of signals representative of different point size leading, and means for setting the coder according to the point size leading selected.]

59. In a machine for producing a coded tape having a succession of code signals thereon representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination of a keyboard comprising a series of character keys and a word space key, means for setting the machine for the composition of a line of predetermined length, and a line remainder information computer mechanism responsive to the actuation of said keys for totalizing the number of units represented by the combined widths of characters and word spaces in a composed line and then subtracting said total from the total number of units comprised in the preset line so as to thereby to compute the number of units in the line remainder, said computer mechanism having code elements representative of the computed number of units comprising the line remainder, together with signal producing mechanism responsive to the code elements of the computer mechanism to produce a corresponding line remainder signal in the coded tape.

[60. In a machine for producing a coded tape representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination of a keyboard, a character identification code mechanism acting in response to key actuation for producing character identification signals in the tape, an automatic computer mechanism acting in response to the same key actuation for computing the total number of units represented by the set widths of the characters and spaces in the composed line, and an indicator mechanism actuated by said automatic computer mechanism to indicate the length of the composed line, said automatic computer mechanism including a plurality of groups of code elements having different character width values as between groups, the different groups of character width code elements representing different type fonts and the code elements in each group representing the set width values of the type characters in the corresponding font, and means for selecting one or another of the groups of character width code elements according to the font of type characters to be composed.]

[61. The combination according to claim 60, wherein the character width code elements in each of the different groups represent in decimal form the unit width values of the type characters in the corresponding group, and wherein the automatic computer mechanism also includes a further group of code elements for converting into binary form the decimal unit width values of the type characters of the selected group, said group of binary code elements being common to all of the groups of decimal code elements.]

[62. The combination according to claim 60, wherein the character width code elements in each of the different groups represent in decimal form the unit width values of the type characters in the corresponding group, and wherein the automatic computer mechanism also includes means for varying the decimal unit values of the code elements of the selected group, said unit varying means being common to all of the groups of decimal code elements.]

63. The combination according to claim *76* [61], wherein the automatic computer mechanism also includes means for varying the decimal unit values of the code elements of the selected group, said unit varying means being common to all of the groups of the decimal code elements and connected to the appropriate binary code elements of the converting group.

64. In a machine for producing a coded tape representative of a composed line of type characters which vary in width on a relative width value basis, the combination of a keyboard, a character identification code mechanism acting in response to key actuation for producing character identification signals in the tape, and a character width code mechanism acting in response to the same key actuation for producing corresponding character width signals in the tape, said character width code mechanism including three or more groups of code elements having a different character width values as between groups, the different groups of character width code elements representing different complete type fonts of the keyboard characters, and the code elements in each group representing the relative width values of the type characters in the corresponding font, all of said groups of code elements occupying fixed locations in the machine and the keyboard having connections leading to all of said groups, together with means for selecting for key actuation one or another of said groups of code elements according to the font of type characters to be composed, said selecting means comprising a plurality of font selectors, one for each different group of code elements, and each capable when actuated of rendering effective the keyboard connections to the corresponding group and rendering ineffective the keyboard connections to the remaining groups.

65. The combination according to claim 64, wherein each font selector when actuated produces in the tape a font signal representing the group of character width code elements selected for key actuation.

66. The combination according to claim 64, wherein the character width code elements in each of the different groups represent in decimal form the unit width values of the type characters in the corresponding group, and wherein the character width code mechanism includes a further but single group of code elements for converting into binary form the decimal unit width values of the type characters of the selected group, said single group of binary code elements being common to and connected to all of the groups of decimal code elements.

67. The combination according to claim 64, wherein the character width code elements of all of the different groups are in the form of electric conductors which control the operation of the signal producing mechanism according to code, and wherein the connections from the keyboard are also in the form of electric conductors, one for each different character represented by the keyboard, and all of said keyboard electric conductors being connected in parallel to the corresponding electric conductors constituting the code elements in the different groups, and wherein each font selector when actuated activates the electrical connections between the keyboard conductors and the code element conductors of the correspond-

ing group and deactivates the electrical connections between the keyboard conductors and the code element conductors of the remaining groups.

68. In a machine for producing a coded tape representative of a composed line of type characters which vary in width on a relative width value basis, the combination of a keyboard, a character identification code mechanism acting in response to key actuation for producing character identification signals in the tape, and a character width code mechanism acting in response to the same key actuation for producing corresponding character width signals in the tape, said character width code mechanism comprising a decimal unit coder connected to the finger keys, a unit spacing device distinct from and in addition to the decimal coder and operatively connected thereto, and a binary width coder distinct from and in addition to the unit spacing device and operatively connected thereto, said binary width coder controlling the operation of the signal producing mechanism.

69. The combination according to claim 68, wherein the keyboard includes a word space key, and wherein the character width code mechanism in response to actuation of said key produces a normal word space width signal in the tape, said combination including an auxiliary keyboard having keys distinct from and in addition to the word space key of the main keyboard and connected to the binary width coder for producing lone width signals in the tape distinct from and in addition to the normal word space width signals.

70. The combination according to claim 65, including a function coder acting in response to actuation of the font selectors for controlling the operation of the group selecting means according to code and acting in response to actuation of a function key for producing in the tape a signal representative of the point size of the type font selected, and means for setting the function coder according to the point size selected.

71. In a machine for producing a coded tape representative of a composed line of type characters which vary in width on a relative width value basis, the combination of a keyboard, a character identification code mechanism acting in response to key actuation for producing character identification signals in the tape, an automatic computer mechanism acting in response to the same key actuation for computing the total number of units represented by the set widths of the characters and spaces in the composed line, and an indicator mechanism actuated by said automatic computer mechanism to indicate the length of the composed line, said automatic computer mechanism including three or more groups of code elements having different character width values as between groups, the different groups of character width code elements representing different complete type fonts of the keyboard characters, and the code elements in each group representing the set width values of the type characters in the corresponding font, all of said groups of code elements occupying fixed locations in the machine, and the keyboard having connections leading to all of said groups, together with means for selecting for key actuation one or another of said groups of code elements according to the font of type characters to be composed, said selecting means comprising a plurality of font selectors, one for each different group of code elements and each capable when actuated for rendering effective the keyboard connections to the corresponding group and rendering ineffective the keyboard connections to the remaining groups.

72. The combination according to claim 71, wherein the character width code elements in each of the different groups represent in decimal form the unit width values of the type characters in the corresponding group, and wherein the automatic computer mechanism also includes a further but single group of code elements for converting into binary form the decimal unit width values of the type characters of the selected group, said single group of binary code elements being common to and connected to all of the groups of decimal code elements.

73. The combination according to claim 71, wherein each font selector when actuated produces in the tape a font signal representing the group of character width code elements selected for key actuation.

74. In a machine for producing a coded tape representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination of a keyboard, a character identification code mechanism acting in response to key actuation for producing character identification signals in the tape, and a character width code mechanism acting in response to the same key actuation for producing corresponding character width signals in the tape, said character width code mechanism including a plurality of groups of code elements having different character width values as between groups, the different groups of character width code elements representing different type fonts and the code elements in each group representing the set width values of the type characters in the corresponding font, together with means for selecting one or another of the groups of character width code elements according to the font of type characters to be composed, characterized in that the character width code elements in each of the different groups represent in decimal form the unit width values of the type characters in the corresponding group, and wherein the character width code mechanism also includes means for varying the decimal unit values of the code elements of the selected group, said unit varying means being common to all of the groups of decimal code elements.

75. In a machine for producing a coded tape representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination of a keyboard, a character identification code mechanism acting in response to key actuation for producing character identification signals in the tape, and a character width code mechanism acting in response to the same key actuation for producing corresponding character width signals in the tape, said character with code mechanism including a plurality of groups of code elements having different character width values as between groups, the different groups of character width code elements representing different type fonts and the code elements in each group representing the set width values of the type characters in the corresponding font, together with means for selecting one or another of the groups of character width code elements according to the font of type characters to be composed, characterized in that the character width code elements in each of the different groups represent in decimal form the unit width values of the type characters in the corresponding group, and wherein the character width code mechanism also includes a further group of code elements for converting into binary form the decimal unit width values of the type characters of the selected group, said group of binary code elements being common to all of the groups of decimal code elements, and further characterized in that the character width code mechanism also includes means for varying the decimal unit values of the code elements of the selected group, said unit varying means being common to all of the groups of the decimal code elements and connected to the appropriate binary code elements of the converting group.

76. In a machine for producing a coded tape representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination of a keyboard, a character identification code mechanism acting in response to key actuation for producing character identification signals in the tape, an automatic computer mechanism acting in response to the same key actuation for computing the total number of units represented by the set widths of the characters and spaces in the composed line, and an indicator mechanism actuated by said automatic computer mechanism to indicate the length of

the composed line, said automatic computer mechanism including a plurality of groups of code elements having different character width values as between groups, the different groups of character width code elements representing different type fonts and the code elements in each group representing the set width values of the type characters in the corresponding font, and means for selecting one or another of the groups of characters width code elements according to the font of type characters to be composed, characterized in that the character width code elements in each of the different groups represent in decimal form the unit width values of the type characters in the corresponding group, and wherein the automatic computer mechanism also includes a further group of code elements for converting into binary form the decimal unit width values of the type characters of the selected group, said group of binary code elements being common to all of the groups of decimal code elements.

77. In a machine for producing a coded tape representative of a composed line of type characters which vary in set width on a units-of-an-em basis, the combination of a keyboard, a character identification code mechanism acting in response to key actuation for producing character identification signals in the tape, an automatic computer mechanism acting in response to the same key actuation for computing the total number of units represented by the set widths of the characters and spaces in the composed line, and an indicator mechanism actuated by said automatic computer mechanism to indicate the length of the composed line, said automatic computer mechanism including a plurality of groups of code elements having different character width values as between groups, the different groups of character width code elements representing different type fonts and the code elements in each group representing the set width values of the type characters in the corresponding font, and means for selecting one or another of the groups of character

width code elements according to the font of type characters to be composed, characterized in that the character width code elements in each of the different groups represent in decimal form the unit width values of the type characters in the corresponding group, and wherein the automatic computer mechanism also includes means for varying the decimal unit values of the code elements of the selected group, said unit varying means being common to all of the groups of decimal code elements.

References Cited by the Examiner

The following references cited by the Examiner, are of record in the patented file of this patent or in the original patent.

UNITED STATES PATENTS

Re. 25,354	3/1963	Rossetto et al.	234—41
536,149	3/1895	Johnson	164—112
944,405	12/1909	Bancroft et al.	164—112
1,094,629	4/1914	Bancroft	164—112
1,136,080	4/1915	Cornwall.	
2,024,006	12/1935	Krum.	
2,179,493	11/1939	Cook	164—112
2,285,206	6/1942	Indahl	164—112
2,484,649	10/1949	Root	164—113
2,609,907	9/1952	Lynch	197—19
2,641,522	6/1953	King	164—115 X
2,762,485	9/1956	Bafour et al.	197—20
2,790,362	4/1957	Higonnet et al.	234—4
2,847,919	8/1958	Rossetto et al.	234—4
2,876,687	3/1959	Higonnet et al.	234—4
2,988,276	6/1961	Grea et al.	234—4

FOREIGN PATENTS

1,121,997	8/1956	France.

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