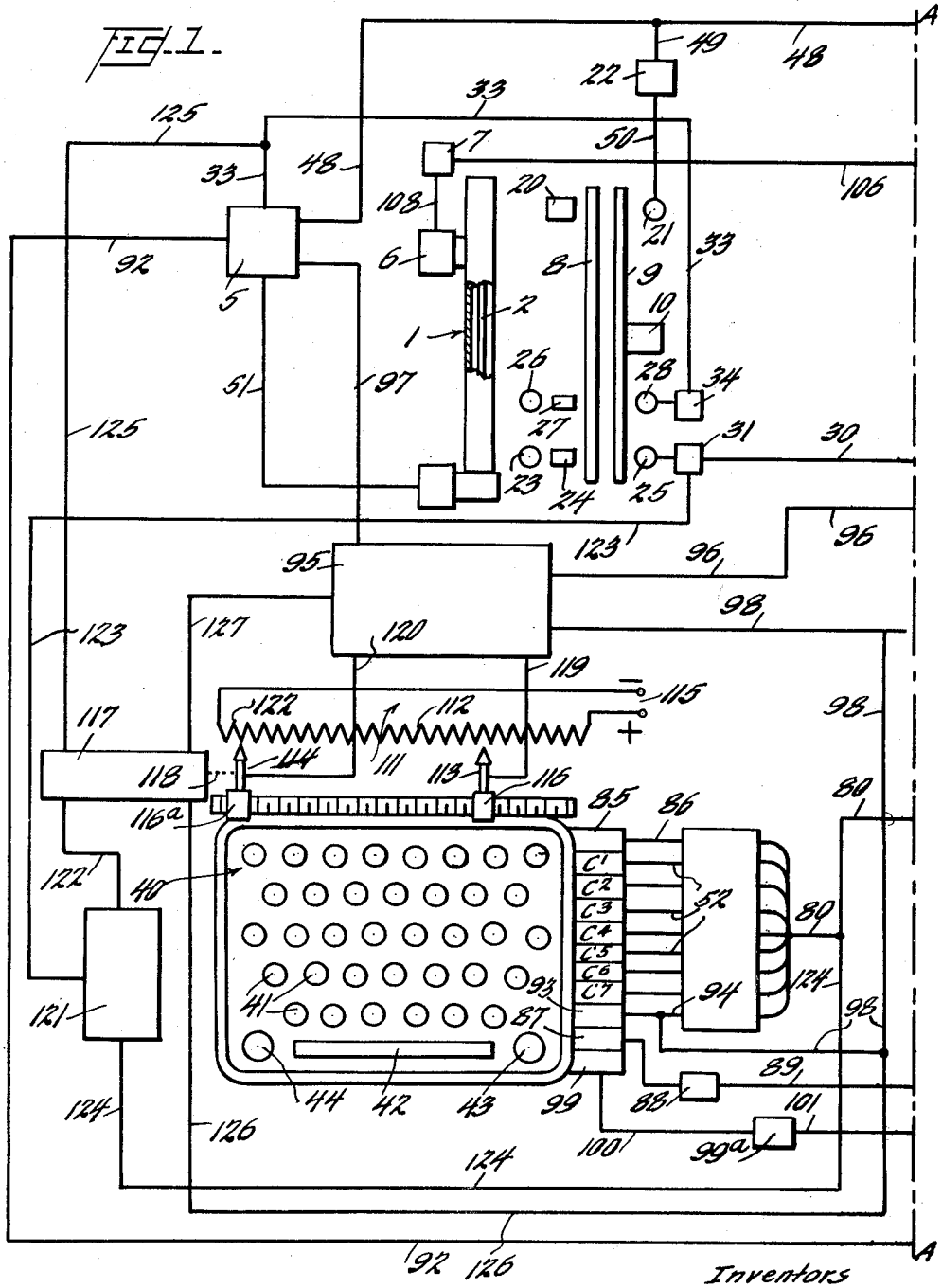
June 29, 1965 A. H. CARMACK ETAL 3,191,510

PHOTOTYPOGRAPHIC APPARATUS

Filed Aug. 31, 1962 6 Sheets-Sheet 1

FIG. 1.



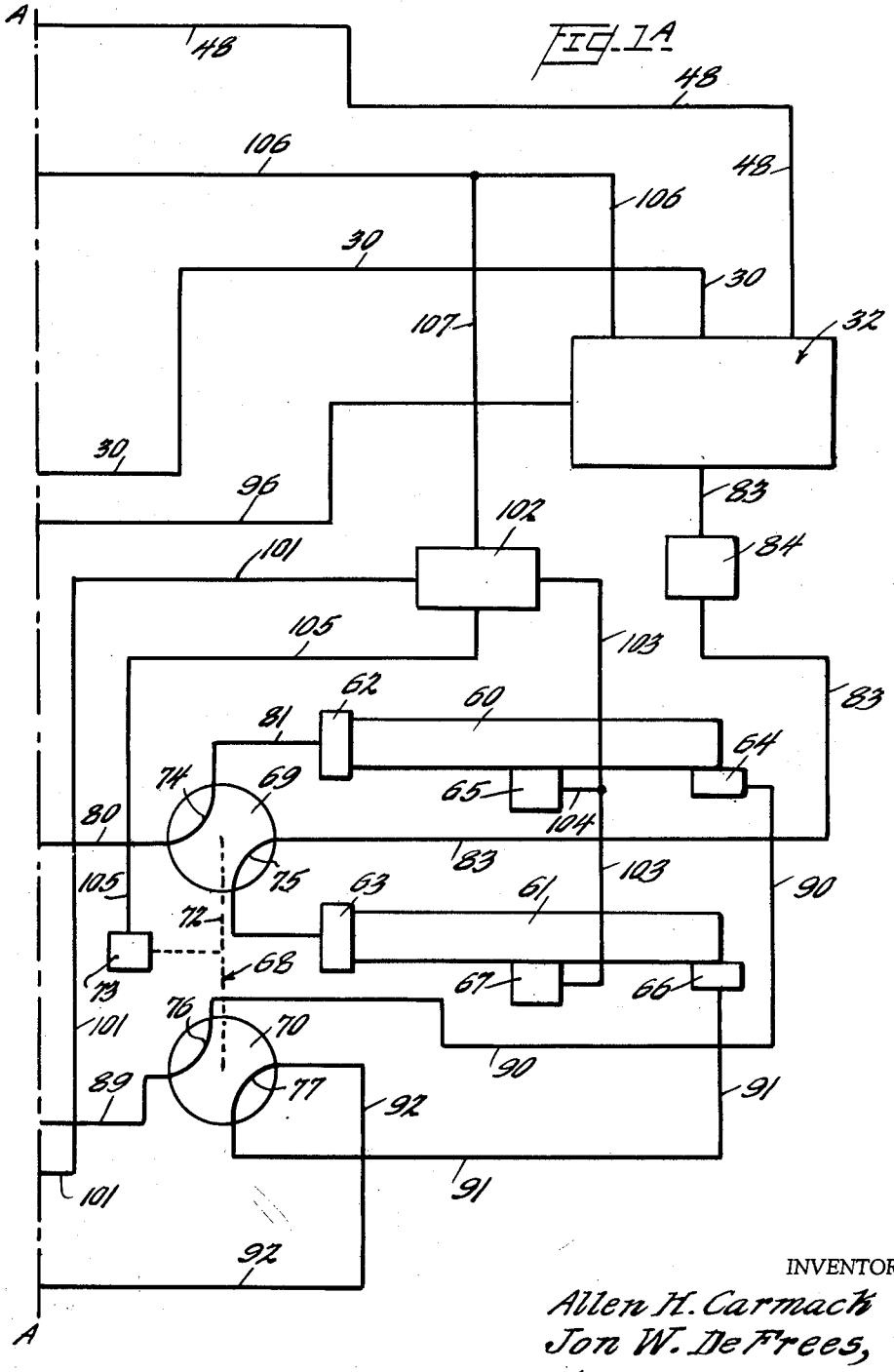
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FIG. 1A



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PHOTOTYPOGRAPHIC APPARATUS

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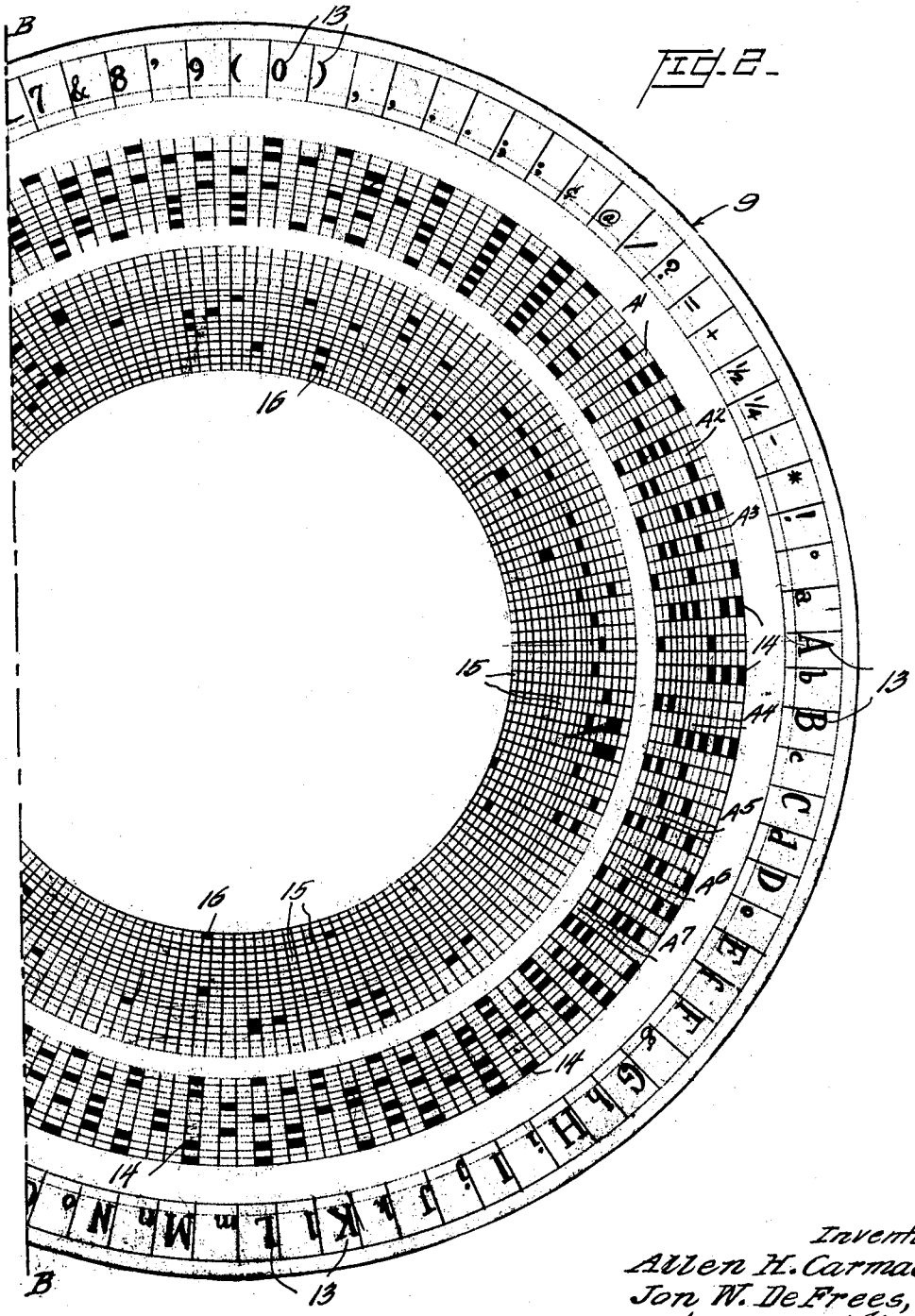


FIG. 2.

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PHOTOTYPOGRAPHIC APPARATUS

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FIG. 4.

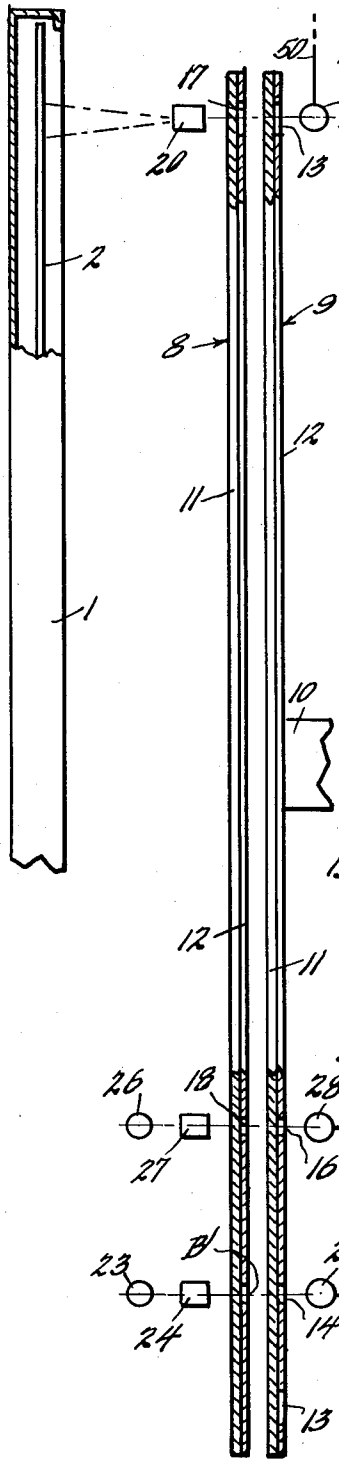
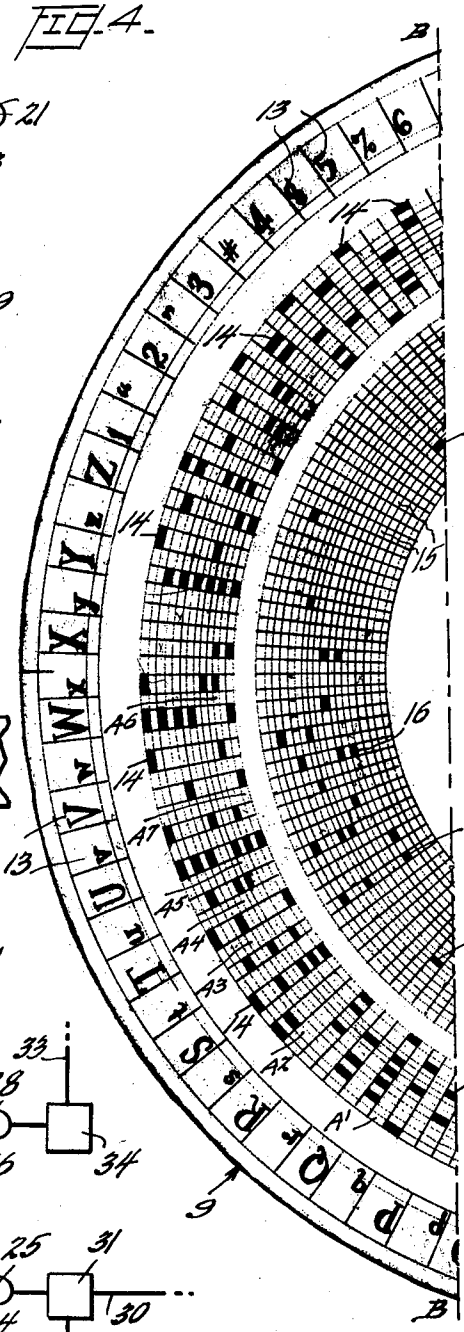


FIG. 2A.



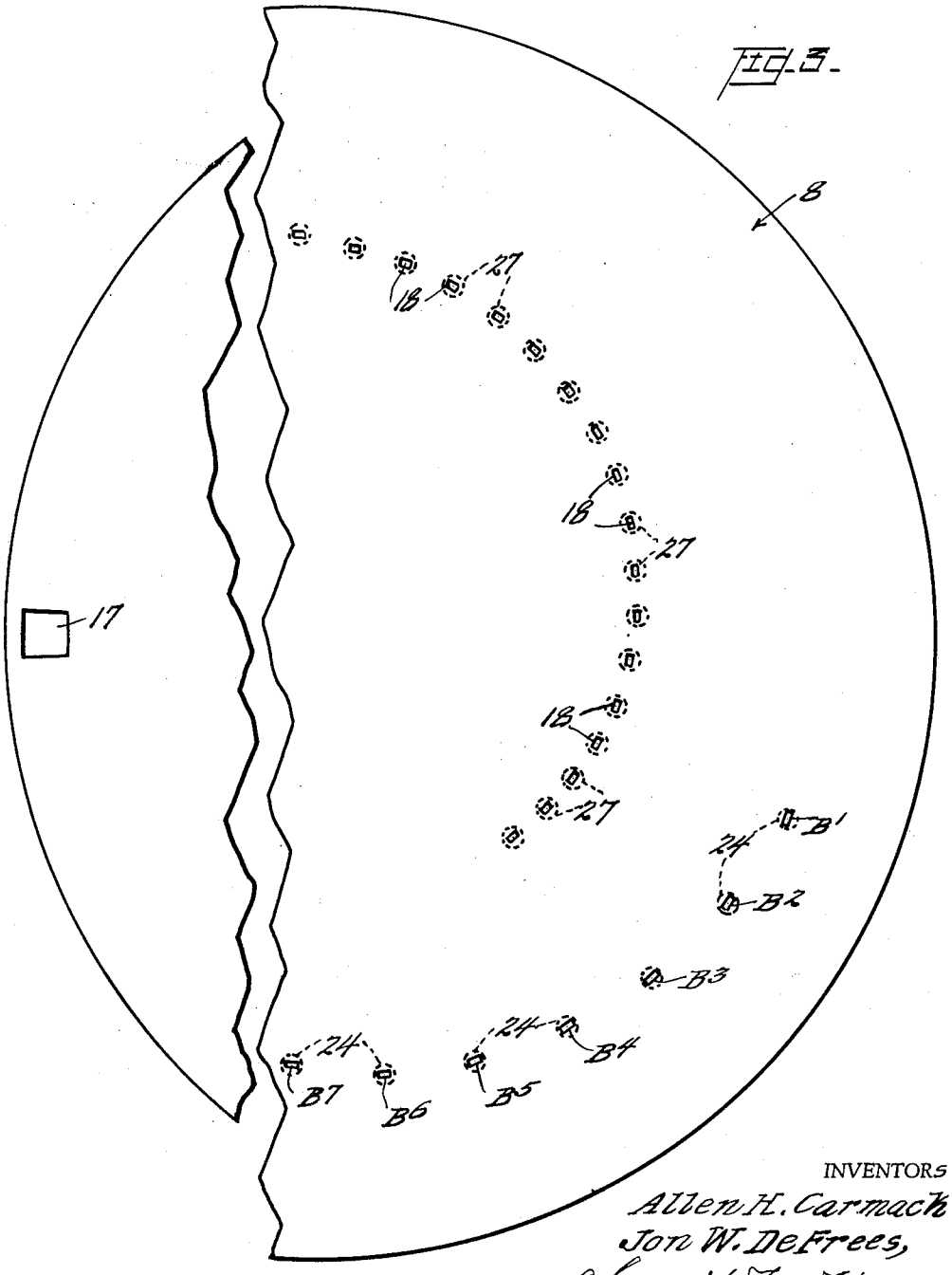
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PHOTOTYPOGRAPHIC APPARATUS

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FIG. 3.



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PHOTOTYPOGRAPHIC APPARATUS

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FIG. 5.

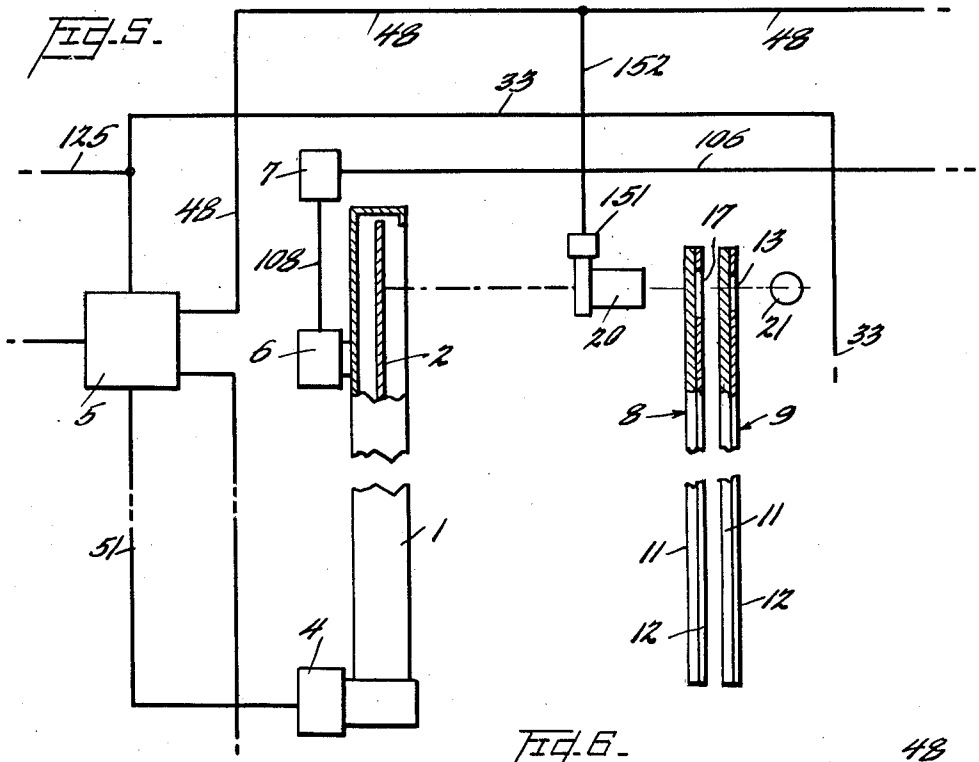
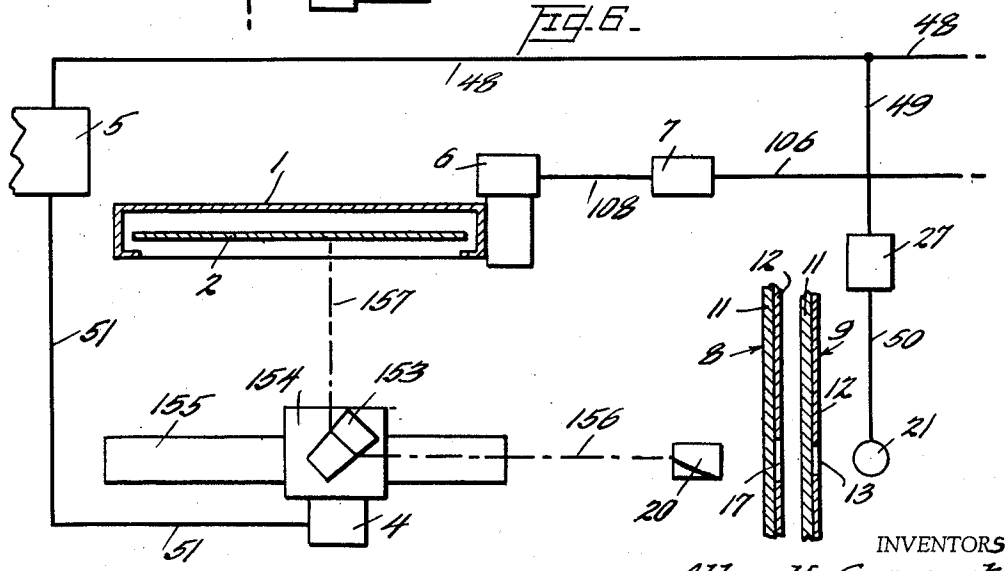


FIG. 6.



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United States Patent Office 3,191,510 Patented June 29, 1965

3,191,510

PHOTOTYPOGRAPHIC APPARATUS

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Filed Aug. 31, 1962, Ser. No. 220,836
11 Claims. (Cl. 95—4.5)

This invention relates generally to the offset or photolithographic printing art in which a printing plate having a photographic image of the copy to be printed thereon, is utilized in the printing. More specifically the invention relates to a phototypographic apparatus for producing the printing plate. Still more specifically the invention relates to an apparatus for producing the photographic negative from which the printing plate is made.

With this type of printing the method of producing the printing plate, in general use at the present time, is to first have the copy set up in type in order to obtain the desired type style, size, line spacing and length. After the copy has been set up in type, one or more proofs or prints are struck therefrom which are generally cut up into sections and rearranged in a desired order on a backing member. This rearrangement is then photographed onto a sensitized film in order to obtain a photographic negative. The negative, after being developed, is applied to a sensitized metal plate and exposed to light. The sensitized metal plate, after being developed, constitutes the printing plate by which the printing is done.

The type is set up by a hot metal type setting machine such as are now generally referred to as "Linotype" machines. Machines of this character are so large, complicated and expensive that only the very large printing establishments, such as the newspapers and major printing and/or publishing firms, can afford them. Consequently the balance of the printing industry, such as the job-shops and corporation printing departments, which produce half the dollar-volume printing of the country, are compelled to have their initial type setting done by large concerns which specialize in type setting for the printing industry, who after setting the copy in type, furnish the jobber with the desired number of proofs or prints therefrom. This initial type setting by the specialized typesetter constitutes the major portion of the jobbing printer's operating costs and overhead.

It is therefore the principal object of this invention to provide an apparatus for producing photolithographic printing plates in such a manner that the aforesaid high cost initial typesetting by specialized firms is eliminated.

Another object of the invention is to provide an apparatus of the aforesaid character which is of such simple construction that it does not require the service of a highly skilled and specially trained mechanic for operation, but which can be operated by any competent typist.

Still another object of the invention is to provide an apparatus of the aforesaid character which is relatively small and compact and which can be manufactured and sold at such a price that the average jobbing printer can afford to install one in his own plant and thereby materially reduce his overhead costs by eliminating the use of the specialized typesetting concern.

In accordance with the invention we produce the composite by which the negative from which the printing plate is made, by successively projecting the individual characters, letters and/or symbols, of the copy onto a film, of either paper or plastic, in a predetermined arrangement.

To this end we provide a film holder which is adapted to have a photographic film removably mounted therein. A stationary element and a rotating element, which are disposed in axial alignment with each other, are mounted

adjacent the film holder in operative relation thereto. The rotating element is provided with an annular row of printing characters, letters and symbols, adjacent the periphery thereof; and the stationary element is provided with a projection window with which the printing characters on the rotating element are adapted to successively register as the rotating element is continuously rapidly rotated during operation. A character image projecting means comprising a photographic lens and a light source, which are mounted in fixed position in axial alignment with the projection window in the stationary element is provided for projecting the image of a selected character on the rotating element, which is in register with the window in the stationary element, onto a film in the holder. A translating means which is operative, after the projection of a character image onto the film, to change the relative position of the film holder and the character image projecting means with respect to each other, is also provided.

The rotating element is also provided with a plurality of radially spaced concentric annular rows of character control windows, and a plurality of radially spaced, concentric annular rows of character spacing control windows.

The rotating element may consist of a single disk, or one, two or three separate disks which are adapted to be mounted in a predetermined fixed relation with respect to each other. If it consists of a single disk as shown herein, the annular row of printing characters, the plurality of rows of character control windows, and the plurality of rows of character spacing control windows are all concentrically disposed thereon. If the rotating element consists of three separate disks the printing characters are disposed on the first disk, the character control windows in the second disk, and the character spacing control windows in the third disk. And if the rotating element consists of two disks the printing characters and the character spacing control windows are disposed in the first disk, and the charcter control windows in the second disk.

The stationary element, in addition to the single window with which the printing characters are adapted to register is also provided with a plurality of auxiliary character control windows which are both angularly and radially spaced with respect to each other, and each of which is adapted to align with one of the concentric character control rows of the rotating element. The stationary element is also provided with a plurality of auxiliary character spacing control windows which are also both angularly and radially spaced with respect to each other, and each of which is adapted to align with one of the character spacing control rows of the rapidly rotating element.

A light source, a focusing lens, and a photoelectric cell are mounted in fixed position in axial alignment with each of the auxiliary character control and auxiliary character spacing control windows, with the light sources and focussing lenses being disposed on one side of both the stationary element and the rotating element, and the photoelectric cells being disposed on the other side thereof.

As previously stated the rotary element is constantly rapidly rotated during operation. During rotation thereof successive character control windows in each annular row of character control windows disposed in the rotary element will successively register with the associated auxiliary character control windows disposed in the stationary element. Each time a character control window registers with an auxiliary character control window, light from the associated light source will be projected through the aligned windows against the associated photoelectric cell, thereby causing the photoelectric cell to trigger a

pulse which is first amplified and then imparted to a comparator decoder control mechanism.

Also during rotation of the rotary element successive character spacing control windows in each annular row of character spacing control windows disposed in the rotary element will successively register with the auxiliary character spacing control windows disposed in the stationary element. And each time a character spacing control window registers with an auxiliary character spacing control window, light from the associated light source is projected through the registering windows against the associated photoelectric cell, thereby causing the photoelectric cell to trigger a pulse which is amplified first and then imparted to the translating mechanism.

The character control windows in the various annular rows of character control windows disposed in the rotary element are so arranged with respect to each other, and the auxiliary character control windows disposed in the stationary element are so arranged with respect to each other and to the character control windows in the rotary element that a plurality of pairs of character control windows and auxiliary character control windows will be in register at the same time. But the character spacing control windows in the various annular rows of character spacing control windows in the rotary element are so arranged with respect of each other and to the auxiliary character spacing control windows in the stationary element that only a single character spacing control window and a single auxiliary character spacing control window are in register at any one time.

From this it will be apparent that a plurality of character control pulses will be simultaneously generated, and that a plurality of character spacing control pulses will also be simultaneously generated. The plurality of character control pulses constitute a printing character code, and the plurality of character spacing control pulses constitute a character spacing code. The arrangement of the various windows in the rotary element and the stationary element is such that each printing character has a different code and also a different spacing code.

The auxiliary character control windows and the auxiliary character spacing control windows in the stationary element are so positioned and arranged with respect to the character projection window therein, and the character control windows and the character spacing control windows in the rotating element are so arranged with respect to their respective character thereon and with respect to the auxiliary character control and character spacing windows in the stationary element that the character and character spacing codes for a selected character will always be generated simultaneously with the registration of the selected character on the rotating element with the character projection window in the stationary element.

The photographic lens and the translating mechanism are rendered operative by an electronic mechanism which is rendered operative by an associated keyboard which is provided with a manually depressable key for each character on the rotating element. Otherwise the keyboard is similar to the standard conventional typewriter keyboards, being provided with the usual spacer bar, back spacer, line shifter, and re-set keys.

Each time the key for any selected character is depressed it effects the generation of the same character code pulses as those generated by the cooperative action of the stationary and rotary elements. These pulses are first recorded or stored in a magnetic memory device from which they are subsequently imparted to the comparator decoder control mechanism where they are combined with the similar code pulses imparted thereto from the rotating and stationary elements code generating mechanism. This combining of the two similar sets of code pulses, when the selected character on the rotating element is in register with the character projection window, causes the comparator decoder control mechanism to impart an actuating pulse which renders the lens operative to project the selected character onto the film in the film holder. At the same time the comparator decoder imparts an actuating pulse to the translating means which effects a change in the relative positions of the character image projecting means and the film holder in accordance with the unit spacing code for the selected character imparted to the translating means from the element generating mechanism. The foregoing operation is repeated for each successively depressed key on the keyboard.

The magnetic memory device comprises two similar magnetic drums each of which has a combined recording, read-out and erasing head operatively associated therewith.

Each time a key for a selected character is depressed it actuates a predetermined combination of a plurality of micro switches in accordance with the pulse code for the selected character. The actuation of the predetermined combination of switches causes a pulse generator and amplifier to generate the requisite code signal pulses and impart them to one or the other of the magnetic memory drums through an alternating switching unit which is operative to alternately connect one of the drums to the pulse generator while connecting the other drum to the comparator decoder control mechanism.

The magnetic drums are adapted to be intermittently advanced step by step after each code signal imparted thereto until the code signals for an entire line of copy have been imparted thereto, after which the drum is adapted to be returned to initial position and connected to the comparator decoder control mechanism. While the code signals for one line of copy are being recorded on one of the drums the code signals for another line of copy, which were previously recorded on the other of the drums, are being imparted to the comparator decoder through a read-back pulse amplifier. After all of the code signals on a drum have been read out and imparted to the comparator decoder control mechanism the drum is returned to its initial position and connected to the pulse generator. As the drum is being returned to initial position the code signal pulses thereon are erased.

A re-set and line spacing key is also provided on the keyboard which is operative when depressed to effect the imparting of a re-set pulse to the comparator decoder through the magnetic memory device after the code signals for one line of copy have been recorded on one of the magnetic drums, and the code signals previously recorded on the other of the drums have been read out and imparted to the comparator decoder control mechanism. In response to a re-set signal the comparator decoder imparts an actuating pulse to the translating mechanism which effects the elevating of the film holder a predetermined amount. In further response to a re-set signal the comparator decoder also imparts an actuating pulse to the magnetic memory device which is operative to effect the actuation of the alternating switch unit to reverse the connection of the two magnetic drums with respect to the pulse generator and comparator decoder, return the drums from which the code signals have just been read-out and imparted to the comparator decoder, to initial position, erase the code signals thereon, and initiate the recording of new code signals thereon and the reading out of the code signals just recorded on the other drum.

Each line of copy typed and projected onto the film must occupy or extend from end to end of a predetermined length of space on the film, with the beginning of successive lines disposed in vertical alignment. This is determined by the operator prior to typing a line of copy. The width of characters and the spacing between characters is fixed in accordance with the type of characters being used. This spacing of the characters upon the film is determined by the character spacing code, for the particular type of characters used, which is generated by the cooperative action of the character spacing control windows provided for the particular type of characters used, with the auxiliary character spacing control windows which are

the same for all types of characters. It being understood that the arrangement of character spacing control windows in the rotary element are changed in accordance with the different types of characters used.

Assuming that a typed line of copy projected onto a film in accordance with the generated code signals for the particular type of characters used does not extend the full length of the predetermined length of line on the film, means must be provided for increasing the length of the line on the film. Since the width of the characters and the spacing between characters is fixed, other means must be provided for extending the length of the line projected onto the film. This is done by proportionately increasing the spacing between the various words of a line projected onto the film. For this purpose a line and column justification mechanism comprising an electronic computer means which is connected to the keyboard, the comparator decoder and the translating means, is provided. This justification mechanism, which is also rendered operative by the keyboard, automatically spaces the various words of a line from each other in such a manner that successive typed lines of copy will extend the full predetermined length of line on the film.

After each line of copy has been typed on the keyboard and projected onto the film, the foregoing operations will be repeated for each succeeding line of copy typed, upon the actuation of the re-set and line spacing key on the keyboard.

Having stated the principal objects of the invention other and more limited objects thereof will be apparent from the following specification and the accompanying drawings forming a part thereof in which;

FIG. 1 and FIG. 1A joined together on the lines A—A thereon constitute a diagrammatic lay-out of a phototypographic apparatus constructed according to our invention;

FIG. 2 and FIG. 2A joined together on the lines B—B thereon constitute a face view of the rotary element showing the printing characters thereon, the character control and character spacing control windows therein, and the relative positions thereof with respect to each other;

FIG. 3 is a face view of the stationary element showing the character projecting window therein, the auxiliary character control and the auxiliary character spacing control windows therein, and the relative positions thereof with respect to each other;

FIG. 4 is an enlarged central vertical section through the cooperating stationary and rotary elements, showing the cooperative relation of the printing characters on the rotary element, the character projection window in the stationary element, and the character image projection mechanism with respect to each other; the cooperative relation of the character control windows in the rotary element, the auxiliary character control windows in the stationary element and the character code signal pulse generating means with respect to each other; and the cooperative relation of the character spacing control windows in the rotary element, the auxiliary character spacing control windows in the stationary element, and the character spacing code signal pulse generating means with respect to each other;

FIG. 5 is a diagrammatic detail vertical sectional view showing a slightly modified control means for the character image projection mechanism; and

FIG. 6 is a diagrammatic detail horizontal sectional view showing a modified means for projecting a character image onto a film, and for changing the relative position of the film holder and a film therein, and the character image projecting means with respect to each other.

The specific construction and operation of the apparatus will now be described with the use of reference numerals in connection with the drawing. As shown therein, the apparatus comprises a film holder **1** in which a photographic film **2** is adapted to be removably mounted. The film holder **1** is suitably mounted for both lateral and vertical movement during operation of the apparatus, a translating mechanism, being provided for this purpose.

The translating mechanism comprises a servo **4**, which under the control of an auxiliary electronic control unit **5**, is adapted to intermittently advance the holder **1** predetermined amounts laterally; and a servo **6**, which under the control of an electronic control unit **7**, is adapted to intermittently advance the holder **1** predetermined amounts vertically.

A stationary element shown herein as a disk **8** is mounted in fixed position rearwardly of the holder **1** in operative relation thereto; and a rotary element shown herein as a disk **9**, which is adapted to be constantly rotated in the order of 300 r.p.m. by a motor **10** during operation, is mounted in axial alignment with the disk **8** closely adjacent thereto. Each of the disks **8** and **9** consists of a transparent plastic base **11** having a thin opaque coating **12** applied to one side thereof.

The rotary disk **9**, adjacent the periphery thereof, is provided with an annular row of printing characters **13**, letters and symbols, which are formed by cutting away the opaque coating **12** in the shape of the characters thereby exposing the transparent base. The rotary disk **9** is also provided with a plurality of spaced concentric circular rows of annularly spaced character control windows **14**. As shown herein seven such rows, which are designated A^1, A^2, A^3, A^4, A^5, A^6 and A^7 respectively, are provided. The rotary disk **9** is also provided with a plurality of concentric circular rows **15** of annularly spaced character spacing control windows **16**, eighteen such rows **15** being shown herein.

The stationary disk **8** is provided with a single character projection window **17** with which successive printing characters **13** are adapted to register as the rotary disk **9** is rotated. The stationary disk **8** is also provided with a plurality of angularly and radially spaced auxiliary character control windows, designated B^1, B^2, B^3, B^4, B^5, B^6 and B^7, which are so positioned in the disk **8** that one of the windows B^1 to B^7 will align with each of the rows A^1 to A^7 respectively of character control windows **14** in the disk **9** whereby the character control windows **14** in each of the rows A^1 to A^7 will successively register with the auxiliary character control window in alignment therewith as said rotary disk **9** is rotated. The stationary disk **8** is also provided with eighteen annularly and radially spaced auxiliary character spacing control windows **18** which are so positioned in the disk **8** that one of the auxiliary character spacing control windows **18** will align with each of the rows **15** of the character spacing control windows **16** in the rotary disk **9**, whereby the successive character spacing control windows **16** in any row **15** of character spacing control windows will successively register with the auxiliary character control window **18** in alignment therewith in the same manner that the character control windows **14** in the rotary disk **9** successively register with the auxiliary character control windows B^1 to B^7 in the stationary disk **8** as the disk **9** is rotated.

The character control windows **14** and the character spacing control windows **16** in the rotating disk **9**, the auxiliary character control windows B^1 to B^7, the auxiliary character spacing control windows **18** and the character projection window **17** in the stationary disk **8** are all preferably formed by cutting away the opaque coatings **12** of the disks **8** and **9** in the same manner that the printing characters **13** are formed. But if desired, all of these windows could consist of apertures which extend entirely through the disks **8** and **9**, which would of necessity be done if the disks **8** and **9** were made of a single thickness of metal or other opaque material. In the drawings the various windows and printing characters are shown in solid black, instead of in outline, for ease and clarity of illustration.

A photographic lens **20** and a light source **21** are disposed in axial alignment with the character projection

window 17, in the stationary disk 8, with the lens 20 disposed between the disk 8 and the film holder 1, and the light source 21 disposed in spaced relation thereto with the stationary disk 8 and the rotary disk 9 interposed therebetween. The light source 21 which is normally de-energized under the control of an electronic control unit 22, renders the photographic lens 20 inoperative to project a printing character on the rotating disk 9 which is in register with the projection window 17 onto the film 2 in the film holder 1. Whenever the light source 21 is momentarily energized by the control unit 22, as will be hereinafter described, the photographic lens 20 is rendered operative to project the image of a printing character 13 on the rotary disk 9, which is in register with the character projection window 17 in the stationary disk 8, onto the film 2 in the film holder 1.

A plurality of constantly energized light sources 23, a plurality of focusing lenses 24 and a plurality of photoelectric cells 25 are provided, one each of which are mounted in fixed position in axial alignment with each of the auxiliary character control windows, B^1 to B^7, with the disks 8 and 9 being interposed between the lenses 24 and the photoelectric cells 25. A plurality of similar light sources 26, focusing lenses 27 and photoelectric cells 28 are similarly disposed in axial alignment with each of the auxiliary character spacing control windows 18. Whenever a character control window 14, in the rotating disk 9, registers with an auxiliary character control window B^1 to B^7, in the stationary disk 8, light will be projected through the aligned windows by the associated focusing lens 24 against the associated photoelectric cell 25. Likewise whenever a character spacing control window 16, in the rotating disk 9, registers with an auxiliary character spacing control window 18, in the stationary disk 8, light will be projected through the aligned character spacing and auxiliary character spacing control windows by the associated lens 27 against the associated photoelectric cell 28. Each time a light source is projected against a photoelectric cell the photoelectric cell against which a light source is projected will generate an electric pulse.

During the rotation of the rotating disk 9 each time a printing character 13 in the rotating disk 9, is in register with the projection window 17 in the stationary disk 8 a plurality of auxiliary character control windows 14, in the rotating disk 9, each one of which is in a different row A^1 to A^7, will register with the associated auxiliary character control window B^1 to B^7 in the stationary disk 8. The character control windows 14 in the various rows A^1 to A^7 are so arranged with respect to each other and to the auxiliary character control windows B^1 to B^7 that there will be a different combination of registering character control and auxiliary character control windows for each printing character 13 on the rotating disk 9. As previously stated whenever a character control window is in register with an auxiliary character control window, light from the associated light source will be projected through the aligned registering pair of windows against the associated photoelectric cell, thereby causing the cell to generate an electric pulse. It will therefore be seen that each time a printing character 13 on the rotating disk 9 is in register with the character projection window 17 in the stationary disk 8 a predetermined combination of pulses will be generated which constitutes a character code signal.

The character spacing control windows 16 in the rotating disk 9 are so arranged with respect to each other and to the auxiliary character spacing control windows 18 in the stationary disk 8 that a character spacing control and an auxiliary character spacing control window will be in registering alignment each time a printing character 13 is in register with the projection window 17. Therefore a predetermined number of electric pulses, which constitute a character spacing code signal, will likewise be generated each time a printing character 13 is in register with the character projection window 17.

The character code signal pulses are imparted through a cable 30 and amplifier 31 to a comparator decoder control mechanism 32; and the character spacing code signal pulses are imparted through a cable 33 and an amplifier 34 to the control unit 5 of the translating means. The projection of a printing character 13 onto the film 2 and the spacing of the projected characters on the film with respect to each succeeding character projected onto the film are controlled by the comparator decoder control mechanism 32 in accordance with the character code signals imparted thereto, and the character spacing code signals imparted to the control unit 5, and the operation of the comparator decoder control mechanism 32 to effect the projection and spacing of printing characters on the film is controlled in accordance with character code signals, which are generated in response to the manual operation of a keyboard 40, and also imparted to the comparator decoder control mechanism 32.

The keyboard 40 is provided with a plurality of character keys 41, one for each character 13 on the rotary disk 9, a spacer bar 42, a re-set and line spacer key 43, and to the auxiliary character spacing control windows is the same as a conventional typewriter keyboard and is adapted to be manually operated in the same manner.

Each time a printing character key 41, for a selected character 13, is manually actuated it effects the generation of a plurality of pulses which constitute a character code signal identical with the character code signal generated by the cooperative action of the disks 8 and 9 for the said selected character. The character code signal pulses thus generated are first recorded in a magnetic memory device generally indicated by the numeral 45, and then subsequently imparted to the comparator decoder control mechanism 32. Then when a similar character code signal is imparted to the comparator decoder control mechanism 32 from the photoelectric cells 25 through the cable 30 and amplifier 31 and a corresponding character spacing code signal for the said selected character is imparted to the control unit 5 through the cable 33 and amplifier 34, the comparator decoder 32 control mechanism is rendered operative to impart a triggering pulse, through the conductor 48 to the control unit 5 for the servo 4, and through the conductors 48 and 49 to the control unit 22 for the light source 21, all of which is done simultaneously with the registration of the said selected character 13 on the rotating disk 9 with the character projection window 17 in the stationary disk 8. The control unit 22 through the conductor 50 effects the momentary energization of the light source 21 thereby permitting the photographic lens 20 to project the image of the said selected character onto the film 2; and the control unit 5, through the conductor 51, effects the operation of the servo 4 to shift the holder 1 and film 2 mounted therein into position for the image of the next printing character selected to be projected onto the film 2 in proper spaced relation to the next preceeding character image projected onto the film, there being sufficient lag in the operation of the servo 4 to prevent movement of the holder 1 and film 2 until after the light source 21 has been de-energized by the control unit 22.

A plurality of pulse generators designated C^1, C^2, C^3, C^4, C^5, C^6 and C^7, which correspond respectively to the auxiliary character control windows B^1, B^2, B^3, B^4, B^5, B^6 and B^7, in the stationary disk 8, are provided in connection with the keyboard 40. Each of the character keys 41 in the keyboard 40, is operatively connected to a predetermined number of the pulse generators C^1 to C^7, each of the keys 41 being connected to a different combination of pulse generators C^1 to C^7. Each time a character key 41 is actuated it causes the pulse generators connected thereto to generate pulses which are imparted through conductors 52 to an amplifier 53, from which they are imparted

to the magnetic memory device 45, as will now be described.

The magnetic memory device 45 comprises a pair of similar rotatable mounted magnetic drums 60 and 61 which are adapted to be intermittently advanced step by step during operation. A combined recording, read-out and erasing head 62 is operatively associated with the drum 60, and a similar head 63 is operatively associated with the drum 61. The heads 62 and 63, and consequently the drums 60 and 61, are adapted to be alternately connected first to the amplifier 53 and then to the comparator decoder control mechanism 32. After one of the drums has had the character code sginals for a full line of copy recorded thereon it is disconnected from the amplifier 53 and connected to the comparator decoder control mechanism 32 and returned to initial position; and simultaneously therewith the other of the drums is disconnected from the comparator decoder 32 and connected to the amplifier 53, and returned to initial position. This arrangement and mode of operation permits the recording of the character code signals for one line of copy to be recorded on one of the drums simultaneously with the reading out and imparting to the comparator decoder control mechanism 32 the character code signals for another line of copy which had previously been recorded on the other of the drums. The drum 60 is adapted to be intermittently advanced step by step, during both recording and read-out by an intermittently actuated advancing mechanism 64, and to be returned to initial position, after both recording and read-out, by a re-set servo 65; and the drum 61 is adapted to be similarly advanced and returned to initial position by a similar intermittently actuated advancing mechanism 66 and servo 67.

The sequential operation of the drums 60 and 61 is controlled by a switching mechanism generally indicated by the numeral 68. As diagrammatically shown herein the switching mechanism 68 comprises two similar individual units 69 and 70 which are mechanically connected together, as indicated at 72, for rotation through 90°, by a servo 73, after each recording of a series of character code signals on a drum. The switch unit 69 is provided with two similar conducting bridges 74 and 75 spaced 180° apart, and the unit 70 is provided with two similar conducting bridges 76 and 77 spaced 180° apart.

The switching unit 69 is connected to the amplifier 53 by a cable 80 and to the head 62 by a cable 81. It is also connected to the head 63 by a cable 82, and to the comparator decoder control mechanism 32 by a cable 83 in which an amplifier 84 is interposed. As shown herein the switching mechanism 68 is in position for character code signal pulses imparted from the amplifier 53 to be recorded on the drum 60, and for character code signal pulses previously recorded on the drum 61 to be read-out and imparted to the comparator decoder control mechanism 32. In this position of the switching mechanism 68 the cables 80 and 81 are electrically connected together by the bridge 74 of the unit 69, and the cables 82 and 83 are electrically connected together by the bridge 75 thereof. Pulses from the amplifier 53 are therefore being imparted from the amplifier 53 to the head 62, for recording on the drum 60, through the cable 80, bridge 74 and cable 81. Simultaneously therewith previously recorded pulses are being read-out from the drum 61 by the head 63 and imparted to the comparator decoder control mechanism 32 through the cable 82, bridge 75 cable 83 and amplifier 84. Whenever the switching mechanism 68 is rotated 90° in either direction one of the bridges 74 and 75 of the unit 69 will electrically connect the cable 80 to the cable 82 and the other of the bridges 74 and 75 thereof will electrically connect the cable 81 to the cable 83. In this position of the switching mechanism 68 pulses from the amplifier 53 will be imparted to the head 63, for recording on the drum 61, through the cable 80, one of the bridges 74–75, and the cable 82; and simultaneously therewith pulses previously recorded on the drum 60 will be read-out by the head 62 and imparted to the comparator decoder control mechanism 32 through the cable 81, the other of the bridges 74–75, cable 83 and amplifier 84.

After each line of copy is typed on the keyboard 40 the line termination key 44 is actuated. The line termination key 44 is connected to a pulse generator 85 which in turn is connected, through a conductor 86, to the amplifier 53. Pulses generated by the generator 85, in response to the actuation of the key 44, are imparted to the amplifier 53, and from there, through the cable 80, to and recorded on the drums 60–61 in the same manner that character code signal pulses from the amplifier 53 are imparted to the drums 60–61; and from the drums 60–61 these line termination pulses are imparted to the comparator decoder control mechanism 32 immediately after the imparting of the character code signal pulses thereto.

Each of the printing character keys 41 is connected to a pulse generator 87 which in turn is connected to an amplifier 88. The switching unit 70, of the switching mechanism 68, is connected to the amplifier 88 by a conductor 89 and to the intermittently actuated advancing mechanism 64 for the drum 60 by a conductor 90, and to the intermittently actuated advancing mechanism 66 for the drum 61 by a conductor 91. The switching unit 70 is also connected, by a conductor 92 to the control unit 5. Each time a printing character key 41 is actuated it effects the generation of a drum advancing pulse which is imparted from the amplifier 88 to the switching unit 70 through the conductor 89. From the switching unit 70, when the switching mechanism 68 is in the position shown for recording character code signal pulses on the drum 60, these drum advancing pulses are imparted to the advancing unit 64 for the drum 60 through the conductor 90 and the bridge 76 of the switching unit 70 which electrically connects the conductor 89 to the conductor 90. At the same time the advancing mechanism 66 for the drum 61 is connected to the control unit 5 by the conductor 91, bridge 77, and conductor 92. The drum 60 will therefore be intermittently advanced, during recording, by the advancing mechanism 64 in response to pulses imparted thereto, from the character spacing generator 87 and amplifier 88 through the conductor 89, bridge 76, and conductor 90; and simultaneously therewith the drum 61 will be intermittently advanced, during read-out by the advancing mechanism 66 in response to drum advancing pulses fed back thereto from the control unit 5 though the conductor 92, bridge 77 and conductor 91. When the switching mechanism 68 is rotated 90° in either direction from the position shown, thereby connecting the drum 61 to the amplifier 53 for recording and the drum 60 to the comparator decoder 32 for read-out, drum advancing pulses from the generator 87 and amplifier 88 will be imparted to the advancing mechanism 66, for the drum 61, through the conductor 89, one of the bridges 76–77, and conductor 91; and simultaneously therewith drum advancing pulses will be fed back from the control unit 5 to the advancing mechanism 64, for the drum 60, through the conductor 92, the other of the bridges 76–77, and conductor 90.

The spacer bar 42 is operatively connected to a pulse generator 93 which in turn is connected to the amplifier 53 by a conductor 94. The spacer bar 42, when actuated, is operative to effect the generation of word spacing pulses which provide the requisite spacing between the words of a line of copy being typed. After each word of a copy being typed on the keyboard 40, the spacer bar is actuated to provide the requisite spacing between words of a copy being typed. Whenever the spacer bar 42 is actuated the pulse generator 93 emits pulses which are imparted to the amplifier 53, through conductor 94, and from the amplifier 53 to the drum 60 or 61 connected to the amplifier 53 for the recording of pulses thereon. The word spacing pulses generated by the pulse generator 93 and recorded on one of the drums 60–61 are subsequently imparted to the comparator decoder control mechanism 32 through

the conductor 80, switching unit 69 and conductor 83. The character spacing pulses and the word spacing pulses imparted to the comparator decoder control mechanism 32 are subsequently imparted to the control unit 5 through a line justification computing unit, generally indicated by the numeral 95, which is connected to the comparator decoder control mechanism 32 by a conductor 96 and to the control unit 5 through a conductor 97, for the purpose to be hereinafter described. The word spacing pulses generated by the generator 93 are also imparted to the justification mechanism unit 95 through a conductor 98 which is connected to the line justification unit 95 and the conductor 94 by which the pulse generator 93 is connected to the amplifier 53.

The re-set and line spacing key 43, of the keyboard 40, is operatively connected to a pulse generator 99, which in turn is connected to an amplifier 99*a* by a conductor 100. The re-set amplifier 99*a* is connected by a conductor 101 to a control unit 102 for the magnetic memory device 45. The control unit 102 is connected to the re-set servo 67 for the drum 61 by a conductor 103, and to the re-set servo 65 for the drum 60 by the conductor 103 and a branch conductor 104. The control unit 102 is also connected to the servo 73, by which the switching mechanism 68 is adapted to be rotated 90° after a line termination pulse has been recorded on one of the drums 60–61, by a conductor 105.

Whenever a line termination pulse, at the end of a series of pulses, recorded on a drum, is read-out and imparted to the comparator decoder control mechanism 32 it causes the comparator decoder control unit 32 to impart an actuating pulse to the control unit 7 of the translating mechanism 3 through a conductor 106, and to the control unit 102 for the memory device 45 through the conductor 106 and a branch conductor 107. Upon the receipt of an actuating pulse from the comparator decoder control mechanism 32 the control unit 7, which is connected to the servo 6 by a conductor 108, effects the operation of the servo 6 to elevate the film holder 1 a distance equal to the desired spacing between lines of copy being projected onto the film 2.

After the pulses for a line of copy, including the line termination pulse, have been recorded on one of the drums 60–61 the re-set key 43 is actuated which causes the generation of a re-set pulse which is imparted through the conductor 101 to the control unit 102 where it is combined with the pulse imparted to the control unit 102 by the comparator decoder control mechanism 32 in response to a line termination pulse read-out from the other of the drums 60–61 and imparted to the comparator decoder control mechanism 32. The combining of these two pulses in the control unit 102 causes the control unit 102, through the conductors 103 and 104, to effect the actuation of the servos 65 and 67 to return the drums 60 and 61 back to their initial position; and through the conductor 105 effect the actuation of the servo 73 to rotate the switching mechanism 68 through 90° thereby reversing the connection of the drums 60 and 61 to and between the amplifier 53 and the comparator decoder control mechanism 32. The entire apparatus is then in condition for the next line of copy to be typed and projected onto the film 2.

Each line of copy typed on the keyboard 40 for projection onto the film 2 must extend from end to end of a predetermined length of space on the film 2, which is determined by the operator prior to the typing, and set on a line length control gauge 110 which is associated with the keyboard 40 and has an indicator 116 slidably mounted thereon, which is adapted to be set on the gauge 110 in accordance with the desired end of a line. The width of the printing characters and the spacing between individual printing characters is fixed, in accordance with the particular type of printing character being used and cannot be increased or decreased.

Let it be assumed that the space between the individual printing characters, of a particular type of printing character being used is such that a line of copy will not occupy the full predetermined length of space, or line, on the film 2 when projected thereonto in accordance with the predetermined spacing between individual printing characters and the nominal spacing between successive words of a typed line of copy. Since the spacing between the individual printing characters being used cannot be changed, other means must be provided for increasing the length of a typed line of copy until it occupies the full predetermined length of space on the film 2. This is accomplished by increasing the spacing between the individual words of a line of copy as projected onto the film 2.

The line justification unit 95 is operative to automatically proportionately increase the spacing between successive words of a line of copy as it is projected onto the film 2 is therefore provided.

The specific construction and operation of the line justification unit 95, per se, forms no part of the present invention. Consequently only the general operation thereof and the manner in which it is connected into the instant apparatus will be described herein.

The line justification unit 95 comprises electronic computer means which is connected to the comparator decoder control mechanism 32 by the conductor 96, to the word spacing generator 93 by the conductors 94 and 98, and to the control unit 5 by the conductor 97.

A potentiometer, generally indicated by the numeral 111, which is operatively associated with the line space control gauge 110 comprises a resistance winding 112 and a pair of sliders 113 and 114. The winding 112 has a fixed voltage, in the order of 300 volts D.C. constantly applied thereto as indicated at 115. The slider 113 is secured to the indicator 116, on the gauge 110, which is adapted to be set thereon in accordance with the desired length and end of a line of the film 2. The slider 114 which is initially set at the zero position on the potentiometer winding 112 is mechanically connected to a unit space advancing mechanism 117, as indicated at 118, for movement along the resistor 112 during operation. The slider 113, is connected to the justification mechanism 95 by a conductor 119, and the slider 114 is connected to the justification mechanism 95 by a conductor 120.

The operation of the unit space advancing mechanism 117, by which the slider 114 is intermittently advanced along the resistor 112 from its initial position towards the fixed slider 113, is controlled by an auxiliary comparator decoder mechanism 121 through on interposed conductor 122. The comparator decoder 121 is connected to the character code signal pulse amplifier 31, by which the character code signal pulses generated by the cooperative action of the disks 8 and 9 are amplified by a conductor 123; and to the amplifier 53, by which the character code signal pulses generated by the actuation of a character key 41 are amplified, by a cable 124 which is connected to the cable 39 through which character code signal pulses are imparted to the memory device 45, from the amplifier 53. The unit space advancing mechanism 117 is connected to the amplifier 34, by which the character spacing code signal pulses generated by the cooperative action of the disks 8 and 9 are amplified, by a cable 125 and the cable 33. The unit space advancing mechanism 117 is also connected to the conductor 98, through which word spacing pulses generated by the actuation of the spacer bar 42 are imparted to the line justification unit 95 from the word space pulse generator 93, by a conductor 126; and to the line justification mechanism 95 by a conductor 127.

The character spacing code signal pulses generated by the cooperative action of the disks 8 and 9 are imparted to the control unit 5 are therefore simultaneously imparted to the unit space advancing mechanism 117; and the word spacing pulses generated by the actuation of the spacer bar 42 and imparted to the line justification unit 95 are also simultaneously imparted to the unit space advancing mechanism 117.

The character code signal pulses generated by the co-

operative action of the disks 8 and 9 and imparted to the comparator decoder control mechanism 32 are also simultaneously imparted to the auxiliary comparator decoder 121; and the character code signal pulses generated by the actuation of a character key 41 and imparted to the memory device 45 for recording therein are also simultaneously imparted to the auxiliary comparator decoder 121.

The spacing between different printing characters varies in accordance with the nature of the characters and the type of printing characters being used. It may be one or more space units. The nominal spacing between words is usually fixed at six space units.

Each time a selected character key 41 is actuated the character code signal therefor generated thereby, is imparted to the auxiliary comparator decoder 121 where it is combined with a similar character code signal which is generated by the cooperative action of the disks 8 and 9 and imparted to the auxiliary comparator decoder 121. This combining of the two similar character code signal pulses by the auxiliary comparator decoder 121 causes the comparator decoder 121 to trigger the unit space advancing mechanism 117 to advance the slider 114 towards the fixed slider 113 a distance along the resistor 112 which is equal to the voltage equivalent of the spacing between the selected character and the next selected character which may be one or more unit spaces, as determind by the character spacing code signal for the selected character, imparted to the unit space advancing mechanism 117 from the amplifier 34, for the selected character key 41 actuated.

Each time the spacing bar 42 is actuated it triggers the unit space advancing mechanism 121 to advance the slider 114 towards the fixed slider 113 a distance equal to the voltage equivalent of the nominal spacing between words as determined by the line justification unit 95 and imparted to the unit space advancing mechanism 117 through the conductor 127.

Let it be assumed that one volt is the equivalent of one space unit, that the slider 114 is at zero position 122 of the resistor 112 and that the slider 113 is set at the 150 volt position on the resistor 112, and that at the end of the typing of a line of copy on the keyboard 40 the slider 114 had been advanced to the 140 volt position on the resistor 112. There is therefore a difference of 10 volts between the slider 113 and 114, which voltage difference is imparted to the line justification unit 95 through the conductor 119 and 120. Based on the assumption that one volt is the equivalent of one space unit the ten voltage difference between the sliders 113 and 114 indicates that the line of copy just typed on the keyboard 40 would fall 10 space units short of the desired length of line on the film 2 if it was projected onto film 2 in accordance with the word spacing units imparted to the line justification unit 95 from the generator 93 through the conductor 98. The justification unit 95 is therefore operative to proportionately increase the spacing between the words of the line of copy just typed, in accordance with the 10 volt difference between the sliders 113 and 114 and impart the resultant word spacing to the control unit 5 through the conductor 97. Based on the further assumption that the line of copy typed contained six words and five word spacers, the justification unit 95 would cause each of the five word spacers to be increased by two space units.

In connection with the foregoing it should be borne in mind that a line of copy typed on the keyboard 40 is first recorded on one of the memory drums and then subsequently imparted to the comparator decoder control mechanism 32 for projection onto the film 2; and that the described movement of the slider 114 along the resistor 112 and the resulting operation of the unit space advancing mechanism 117 occurs during the recording of a typed line of copy on one of the drums 60 or 61 of the memory device 45. Then as a recorded line of copy is read out from a drum and imparted to the comparator decoder control mechanism 32 the justification mechanism imparts the computed additional word spacing units to the control unit 5 to be added to the nominal word spacing units imparted thereto by the comparator decoder control mechanism 32.

FIG. 5 discloses a slightly modified control means for the photographic lens 20. In this form of the invention we provide the photographic lens 20 with a normally closed shutter 150, and we constantly energize the light source 21 during operation. The shutter 150 is adapted to be momentarily opened by a solenoid 151 which is connected to the conductor 48 by a branch conductor 152. Each time a pulse is imparted from the comparator decoder control mechanism 32 through the conductor 48, as previously described in connection with FIGS. 1 to 4, it will momentarily energize the solenoid 151 which will open the normally closed shutter 150 and permit the photographic lens 20 to project the image of a printing character 13 on the rotary disk 9 which is in register with the projection window in the stationary disk 8, onto the film 2 in the film holder 1. Otherwise this form of the invention is identical with that shown and described in connection with FIGS. 1 to 4 and operates in the same manner.

FIG. 6 discloses a slightly modified form of mechanism for automatically changing the relative lateral position of the film holder 1, and the printing character projecting mechanism with respect to each other, after each projection of a printing character image onto the film 2. In this form of the invention we mount the film holder 1 for vertical movement only and dispose it perpendicular to the disks 8 and 9 instead of parallel thereto. And we provide an optical element 153 which is operative to deflect a character image projected thereonto, by the photographic lens 20, at a right angle thereto and onto the film 2 as indicated by the lines 154 and 155 on FIG. 6. The optical element 153 is mounted on a holder 154 which is adapted to be intermittently moved back and forth along a supporting track 155, in axial alignment with the lens 20 and light source 21 by a servo 4. The optical element 153 may be a prism or a mirror. If it is a prism the light rays 156 projected thereagainst by the photographic lens 20 will be refracted onto the film 2 as indicated by the line 157; and if the optical element 153 is a mirror the light rays projected thereagainst will be reflected onto the film 2. After each character image projected onto the film 2 the holder 154 and optical element 153 thereon are moved a predetermined distance toward the lens 20 by the servo 4, and after a full line of copy has been projected onto the film 2 the film holder 1 and film 2 are raised one line space by the servo 6, and the holder 154 and optical element 153 returned to initial position. Otherwise this form of the invention is identical with that shown and described in connection with FIGS. 1 to 4 and operates in the same manner.

From the foregoing it will be apparent to those skilled in this art that we have provided a very simple, efficient and relatively inexpensive apparatus for accomplishing the objects of the invention.

It is to be understood that we are not limited to the specific construction shown and described herein as various modifications may be made therein within the spirit of the invention and the scope of the appended claims. For instance, the stationary and rotary elements may comprise a stationary and a rotary cylinder instead of the stationary and rotary disks shown and described; or if desired, they may comprise the combination of a disk and a cylinder, one of which is stationary and the other of which is rotary.

What is claimed is:

1. A phototypographic apparatus of the character described comprising:

a film holder which is adapted to have a photographic film removably mounted therein, mounting means

by which said holder is mounted for lateral and vertical movements, translating means by which said holder is adapted to be intermittently moved laterally and/or vertically in response to code signals imparted to said translating means;

a stationary element having a character image projection window therein, a rotary element which is disposed adjacent to said stationary element in axial alignment therewith and is adapted to be constantly rotated during operation, an annular row of printing characters disposed on said rotary element in position to successively register with said projection window as said rotary element is rotated;

a character image projecting means comprising a photographic lens and a light source which are mounted in fixed position in axial alignment with said projection window with said lens disposed forwardly of said stationary and rotary elements between said elements and said film holder and said light source being disposed rearwardly of said elements, said lens being operative to project the image of a printing character in register with said projection window onto a film in said film holder;

control means by which said photographic lens is normally maintained inoperative to project a printing character image onto said film, said lens control means being operative in response to an actuating pulse imparted thereto to render said lens operative to project a printing character image onto said film;

a plurality of annularly and radially spaced character control windows, and a plurality of annularly and radially spaced character spacing control windows in said rotary element, a plurality of annularly and radially spaced auxiliary character control windows and a plurality of annularly and radially spaced auxiliary character spacing control windows in said stationary element, certain of said character control windows being adapted to register with certain of said auxiliary character control windows, and certain of said character spacing control windows being adapted to register with certain of said auxiliary character spacing control windows when a printing character is in register with said projection window as said rotary element is rotated, there being a different combination of registering character control and auxiliary character control windows for each printing character on said rotary element, a first pulse generating means and a comparator decoder, the registration of said certain of said character control windows with said certain of said auxiliary character control windows causing said pulse generating means to emit a plurality of pulses constituting a character code signal, and the registration of said certain of said character spacing control windows with said certain of said auxiliary character spacing control windows causing said pulse generating means to emit a plurality of pulses constituting a character spacing code signal simultaneously with the character code signal, means by which said character code signal is imparted to said comparator decoder, and means by which said character spacing code signal is imparted to said translating means;

a manually operable key-board having a plurality of keys corresponding to the printing characters on said rotary elements, each of said keys being operative when actuated to effect the generation of a character code signal similar to the character code signal generated by the cooperative action of said stationary and said rotary elements which corresponds to the printing character represented by the actuated key, electronic means by which said key induced character code signal is generated and imparted to said comparator decoder, said comparator decoder being rendered operative by the two similar character code signals imparted thereto to impart actuating pulses to said control means and to said translating means, said control means being operative in response to the said pulse imparted thereto to render said photographic lens operative to project the image of a character in register with said projection window onto said film, and said holder translating means being operative by the said pulse imparted thereto to translate said film holder in accordance with the character spacing code signal imparted thereto.

2. A phototypographic apparatus as defined by claim **1** in which an electronic line justification unit which is conected to said keyboard is interposed between said comparator decoder and said translating means.

3. A phototypographic apparatus as defined by claim **1** in which said first pulse generating means comprises a plurality of light sources, a plurality of light focusing lenses and a plurality of photoelectric cells, one of said light sources, said lenses and said photoelectric cells being disposed in axial alignment with each of said auxiliary character control and said character spacing control windows in said stationary element with said stationary element and said rotary element disposed between said focusing lens and said photoelectric cells;

each of said lenses being operative to project a ray of light against the associated photoelectric cell when the associated auxiliary control window in said stationary element is in register with a control window in said rotary element, and each of said photoelectric cells being operative to generate a pulse each time a ray of light is projected thereagainst.

4. A phototypographic apparatus as defined by claim **3** in which said character control windows in said rotary element are disposed in a plurality of spaced concentric annular rows, with said auxiliary character control windows in said stationary element so disposed that one of said auxiliary character control windows is adapted to align with each of said annular rows of character control windows;

and in which said character spacing control windows in said rotary element are also disposed in a plurality of spaced annular rows with the auxiliary character spacing control windows in said stationary element so disposed that one of said auxiliary character control windows is adapted to align with each of said annular rows of auxiliary character spacing control windows.

5. A phototypographic apparatus as defined by claim **1** in which said character control windows in said rotary element are disposed in a plurality of spaced concentric annular rows, with said auxiliary character control windows in said stationary element so disposed that one of said auxiliary character control windows is adapted to align with each of said annular rows of character control windows;

and in which said character spacing control windows in said rotary element are also disposed in a plurality of spaced annular rows with the auxiliary character spacing control windows in said stationary element so disposed that one of said auxiliary character control windows is adapted to align with each of said annular rows of character spacing control windows.

6. A phototypographic apparatus as defined by claim **1** in which said electronic means comprises a second pulse generator, a magnetic memory device, means by which a series of successive pulses generated by said second pulse generator is imparted to and recorded in said memory device, and means by which pulses recorded in said magnetic memory device are subsequently imparted to said comparator decoder.

7. A phototypographic apparatus as defined by claim **6** in which a re-set mechanism is provided which is responsive to a re-set and line spacing key in said keyboard and is operative to re-set said magnetic memory device for the reception of a new series of successively generated

pulses after the previously recorded series of pulses has been imparted to said comparator decoder, and to effect the operation of said film holder translating means to return said film holder to initial lateral position and to elevate said film holder a predetermined amount.

3. A phototypographic apparatus adapted for automatically composing a photograph of selectable printing characters on a medium comprising in combination a rotary disk including an annular row of said printing characters as apertures therein; said disk further including a plurality of annular rows including apertures in the form of a unique code for each of said characters; with each code disposed in predetermined orientation with the character which it represents; said disk including a further plurality of annular rows apertured in accordance with a spacing code for each said character with the respective spacing codes being oriented in similar predetermined relation to said characters, respectively; the apertures of said annular character code rows and said annular spacing code rows representing bits of the respective codes; a stationary element in opposed relation to said disk and including a projection window at a position in alignment with the character row of the rotary disk; said stationary element being apertured at locations corresponding to each bit position available to the character code for the character in alignment with said projection window; said stationary element also being apertured at each bit position available for the spacing code associated with said character at the projection window; light projecting means disposed on one side of the opposed rotary disk and element for projecting light through the apertures thereof when in alignment; light responsive means deployed on the other side of said opposed rotary disk and stationary element at positions corresponding to each of said available bit positions; said light responsive means converting light impinging thereupon through the character code apertures into electrical impulse character codes and said light responsive means receiving light through the spacing bits simultaneously converting the light to electrical spacing code pulses; means for selectably producing pulses coded in accordance with each character; means for comparing the character code pulses from the charater code light responsive means with the selectably produced character code pulses to sense a matched condition; means for photographing the character in said projection window when the matched condition is sensed; and, means responsive to the spacing code pulses for translating the medium in accordance with the spacing of the character photographed.

9. A phototypographic apparatus adapted for automatically composing, on a medium, a photograph of printing characters manually selected from a keyboard including a plurality of keys corresponding to the printing characters comprising in combination a rotary disk including an annular row of said printing characters in the form of light transmitting apertures theren; said disk further including a plurality of annular rows bearing a unique multi-bit code for each of said characters with the respective unique codes disposed in similar predetermined orientation with the characters; said disk including a plurality of annular rows bearing a single bit spacing code for each said character with the respective spacing codes being oriented in like predetermined relation to the associated characters; the bits of each of said codes being both circumferentially and radially spaced apart in said rows for each character; means for deriving a character code signal from said disk for each character; means for deriving a spacing code signal from said disk in association with each character signal; actuable light projecting means disposed on one side of the opposed rotary disk for projecting light through the character apertures thereof to photograph the characters onto said medium; means for storing pulses as a signal coded in accordance with each character initiated from the keyboard; means for comparing the character signals from the disk with each selected stored character signal to sense a matched condition; means for actuating the light projection means when the matched condition is sensed; and, means responsive to the spacing code signal for translating the medium in accordance with the spacing of the character photographed.

10. The apparatus of claim 9, wherein the deriving means and the bit positions of the codes are deployed to insure simultaneous generation of the code and spacing signals.

11. A phototypographic apparatus adapted for automatically composing a photograph of selectable printing characters on a medium, comprising in combination a single disc carrying said printing characters and carrying a unique multi-bit code representative of each of said characters and carrying a unique multi-position single bit spacing code for each of the said printing characters; means for developing a signal in accordance with any selected one of said character codes including means responsive to each bit of the carried character code for developing a signal in accordance with each character; means responsive to said signals for selecting any of said characters for photographing; means responsive to such selection for photographing the character onto said medium; means responsive to the single bit of the spacing code to develop a further signal instantly and directly related to the incremental linear spacing magnitude simultaneously with the development of the associated character signal; and, means for translating said medium an amount equal to said linear spacing magnitude in accordance with said further signal.

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