

Nov. 23, 1965

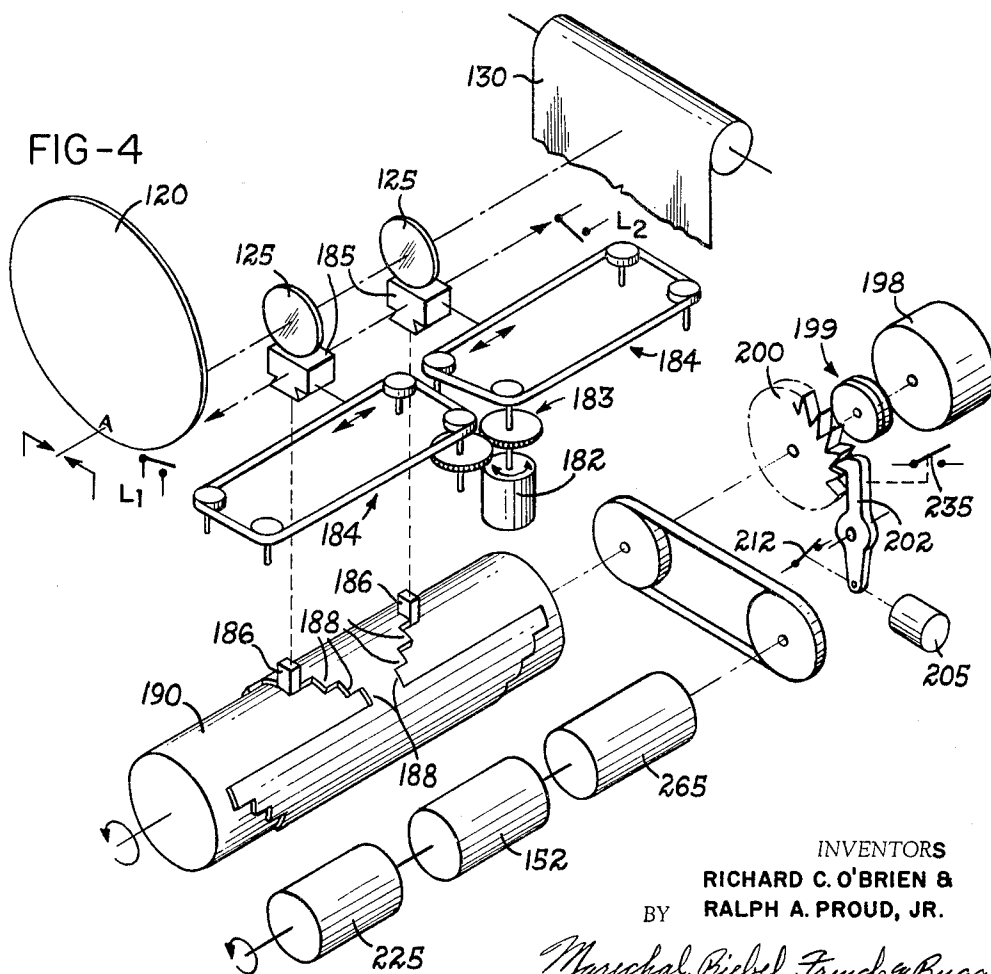
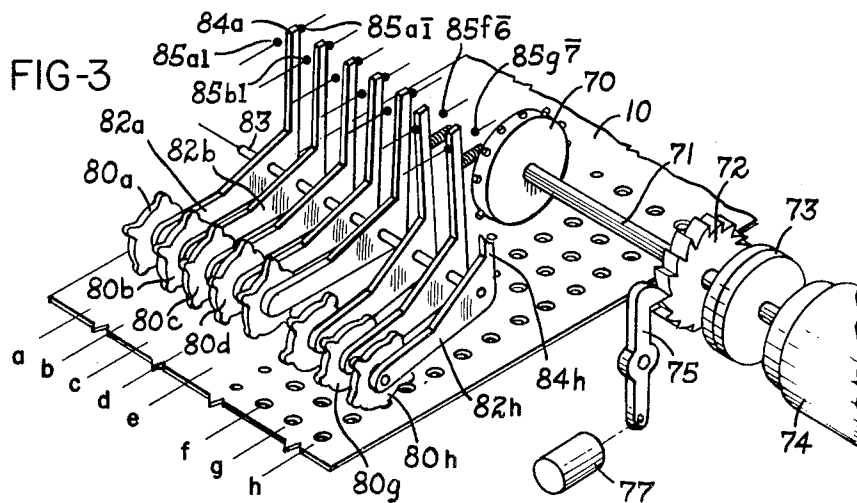
R. C. O'BRIEN ET AL

3,218,945

PHOTOTYPESETTING APPARATUS

Filed July 12, 1963

5 Sheets-Sheet 3



INVENTORS
RICHARD C. O'BRIEN &
BY RALPH A. PROUD, JR.

Marchal, Bichel, French & Bugg
ATTORNEYS

Nov. 23, 1965

R. C. O'BRIEN ET AL

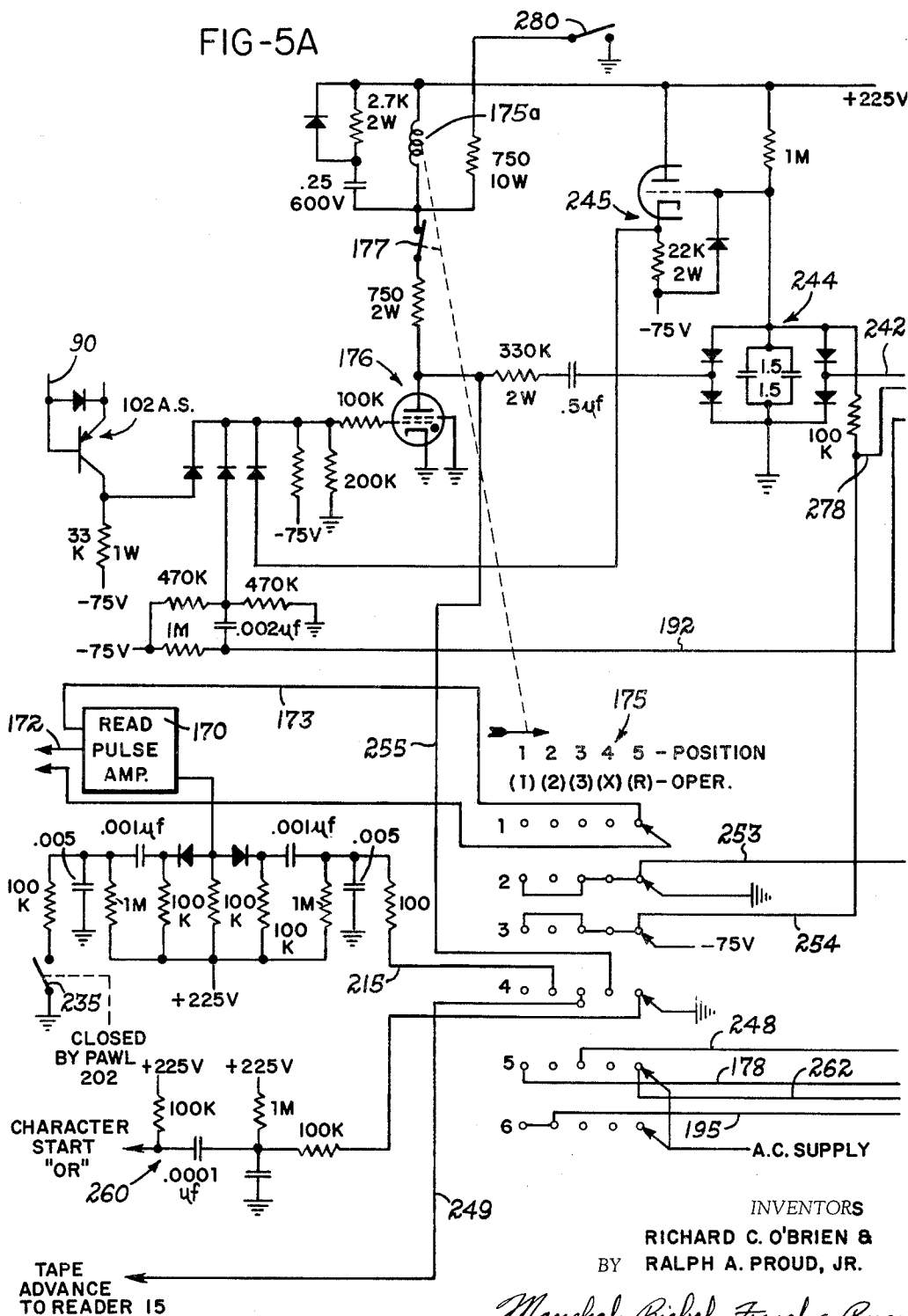
3,218,945

PHOTOTYPESETTING APPARATUS

Filed July 12, 1963

5 Sheets-Sheet 4

FIG-5A



INVENTORS

RICHARD C. O'BRIEN &

BY **RALPH A. PROUD, JR.**

Marchal, Biebel, French & Bugg
ATTORNEYS

1

3,218,945

PHOTOTYPESETTING APPARATUS

Richard C. O'Brien, Long Island, and Ralph A. Proud, Jr., Staten Island, N.Y., assignors to Harris-Intertype Corporation, Cleveland, Ohio, a corporation of Delaware

Filed July 12, 1963, Ser. No. 294,474

5 Claims. (Cl. 95-4.5)

This invention relates to phototypesetting apparatus, and particularly to forms of such apparatus which incorporate automatic code record operated controls, for instance as from a perforated tape, for the automatic production of lines of composition on photosensitive material.

The general form of phototypesetting apparatus to which the invention is applicable is described hereafter, including reference to pertinent United States patents and pending applications. This invention is concerned particularly with controls incorporated in the photographic unit which operates from a coded record tape and causes lines of composition to be formed on photosensitive material by selecting and photographing, one at a time, the individual characters making up the line of composition, by producing relative movement between the optical system of the machine and the photosensitive material to give the proper space to each character formed on the material, and by controlling the space between words such that justified lines of composition can be formed if desired. In such machines a system of variable optics is incorporated to change the size of the character image focused on the photosensitive material, with respect to the master stencil of the characters, usually referred to as the character matrix. In a preferred form of apparatus this is a continuously rotating disc having master character stencils in the form of transparencies through which a flash of light is directed into the optical system.

The primary object of this invention is to provide an automatic control for the variable optical system of a phototypesetting machine whereby the size of the character image, hereinafter referred to as the "point size," can be changed automatically by controls operating from the record tape.

Another object of the invention is to provide such automatic point size control wherein a discrete function code on the record tape is decoded to initiate operation of the control, and wherein the phototypesetting machine is temporarily halted until the point size control has determined the new point size desired and caused the change in the optical system to be made.

Another object of the invention is to provide such an automatic point size control wherein changes in point size are automatically transmitted to a character space computer, such that the proper width of each character image at the desired point size is computed after each selected character is photographed.

An additional object of the invention is to provide such an automatic point size control wherein the intensity of the flash of light used to illuminate the selected character can be adjusted according to the desired point size, in order to increase the intensity of illumination at the larger point sizes where a larger image is required to be produced.

Another object of the invention is to provide in a phototypesetting machine a completely automatic point size control which does not require attention from an operator under normal operating conditions of the machine.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

In the drawings:

FIG. 1 is a schematic and broken type diagram show-

2

ing the general arrangement of a phototypesetting machine to which the present invention applies;

FIG. 2 is a circuit diagram of a decoding circuit used in the machine;

FIG. 3 is a schematic type drawing showing the essential characteristics of a typical perforated tape reader used in the machine;

FIG. 4 is a diagrammatic type of drawing illustrating the general arrangement of the mechanical parts of a size change control according to the invention; and

FIGS. 5A and 5B are circuit diagrams of the electrical and electronic controls for an automatic size change control in accordance with the invention.

The character presentation system, selection and flash circuits, the character space computer, and the size change apparatus, are all of known construction, and details thereof are given in the following patents or co-pending applications, all assigned to the assignee of the present application, and to which reference is made for purposes of a more detailed explanation. The character selector circuit and the control of the flashing light sources may be of the type disclosed in United States Patent No. 2,944,472 or United States Patent No. 3,059,219, preferably the latter. The font selector apparatus, including control of the two rotating character matrix discs, is described in co-pending application Serial No. 39,859, filed June 30, 1960, now Patent No. 3,099,945. The space computer circuitry is disclosed in detail in co-pending application Serial No. 39,858, filed June 30, 1960, now Patent No. 3,141,395.

The apparatus for positioning the lenses of the optical system, to produce a change in size of the projected character images, is described in detail in co-pending application Serial No. 843,127, filed September 29, 1959, now Patent No. 3,118,354, and the details of the film control carriage and the associated space control and leading control circuitry are described in detail in application Serial No. 117,454, filed June 15, 1961, now Patent No. 3,183,806. As a result, these various parts, and their relationship in the machine, are shown diagrammatically in FIG. 1, and are explained herein only in sufficient detail to provide the necessary background information for the present invention.

Referring to the drawings, which illustrate a preferred embodiment of the invention, FIG. 1 shows the general arrangement of a phototypesetting apparatus embodying the features of the present invention. The apparatus is controlled by a perforated code tape 10, or an equivalent memory or record, and this tape passes through a pair of readers 12 and 15. The direction of travel of the tape is such that it first passes through the reader 12 and then through the reader 15. Both of these readers are preferably of a known type, called a "star wheel" reader or a conventional reader of equivalent function. FIG. 3 shows schematically the significant features of a typical reader having the characteristics desired for purposes of this machine.

The reader 12 is arranged to ignore all code words (e.g. a complete group of code perforations across the tape) on the tape except any of the three "end-of-line" codes, which indicate an accepted line, or a rejected line, or a non-justified line. The output contacts of reader 12 are connected through a cable 17 to an end-of-line decoder circuit 20. This circuit includes appropriate controls for the drive of the reader 12, and thus will permit the reader to continue to pass tape therethrough until one of the three aforementioned codes appears on the reader. At such time, reader 12 will stop on the appropriate code word while the function operations dictated by the code are completed. This may mean that reader 12 will "hold" a code while an entire line is being composed.

The reader 15, termed hereafter the "character reader," has its outputs connected through a cable 25 to a separate

character decoder circuit 30. The essential details of this circuit are shown in FIG. 2. The circuit includes controls for the drive of reader 15, and these likewise are arranged to stop reader 15, among other reasons, whenever one of the three "end-of-line" codes appears in the reader. Therefore, reader 15 will stop for example on the end-of-line code for a previously composed line, the reader 12 will stop on the end-of-line code for the line which is to be composed, and the portion or loop of tape between the readers, as shown in FIG. 1, will contain the information necessary to compose a full line of composition.

Details of the end-of-line decoder circuit 20 are unimportant for purposes of explaining the present invention. Suffice to say that the output circuits from this decoder will pass through a cable 32, for example as control voltages applied to one or more wires in the cable, and the wires from the cable are connected to a length memory circuit 35 (for example a conventional shift register circuit) which in turn is arranged to preset a length counter 37 upon command. Control of this function is exercised by a controlled flip-flop FF1, connected to the length counter, and arranged to connect the output of a 100 kc. pulse generator 38 to the length counter 37.

Likewise, other leads of cable 32 are connected to preset a word space memory circuit 40, into which is set the number of interword spaces in the line being composed, for purposes of justifying computation. The word space memory may likewise be a conventional shift register circuit, and is arranged to preset a word space counter 42 which cooperates with the length counter 37 in making the justifying computation. Control over the justifying computing operation is exercised by a control flip-flop FF2 which in turn switches on or off the 1 kc. pulse generator 45.

For purposes of simplification, the parts 35-45 are shown as subdivisions of an entire block 48, which will hereafter be identified as the justification computer. Its output is in the form of a number of electronic pulses passed through line 50 to the spacing control motor 57 which is driven from the space control circuit. This motor and circuit may be of the type disclosed in said application Serial No. 117,454.

Whenever the character decoder circuit 30 receives the code for a justified interword space, an appropriate signal is transmitted through the output line 58 of that circuit to the justification computer, and this initiates the operation of the computer whereby the amount of space not occupied by characters in the line of composition, having been set into the length memory 35, is divided by the number of interword spaces set into the word space memory 40. The resulting quotient is expressed in terms of the number of spacing pulses from the justifying computer output through line 50 to the space control circuit.

In a similar manner, the cable 32 contains leads arranged to preset a leading memory circuit 60 which in turn is arranged to set up a leading counter 62 controlled by flip-flop circuit FF3. The output of this circuit is through lead 63 from the pulse generator 64 comprising part of the leading computer indicated generally at 65. The output line 63 provides an input to a leading control circuit 66, comparable to the space control circuit 55, as also described in the aforementioned copending application Serial No. 117,454. This circuit controls the leading drive motor 67.

Referring to FIG. 3, the tape 10 is shown as a conventional perforated paper tape having eight channels for information, whereby a so-called "eight-bit" code word can be used for recording purposes. These channels are indicated in FIG. 3 by the letters *a-h*, and further reference thereto will be made with regard to the particular channel, for example 10*e*. The tape is advanced by a sprocket wheel 70 incorporated in the reader, it being understood that this reader construction is generally the same for both readers 12 and 15. The drive sprocket

is powered by a shaft 71 having its rotation controlled by a ratchet wheel 72 which in turn receives its power through a slip clutch 73 from a continuously operating motor 74. Pawl 75, controlled by a solenoid 77 governs the release of ratchet 72 to permit a step-by-step advance of sprocket wheel 70, whereby successive code words on the tape can be presented to the star wheel reading apparatus. It will be understood that a code word comprises a corresponding area in each of the channels 10*a-h*, preferably aligned across the tape, and each code word will comprise a bit of information from a channel according to presence or absence of a hole in the tape.

For each channel there is a reading star wheel 80*a-80h*, and these are sprocket wheels having a tooth pitch corresponding to the spacing between successive code words on the tape. If a hole appears in the same channel in successive code words, the teeth of the corresponding reading sprocket will mesh into the holes, and there will be no change in the output from that portion of the reader. Each star wheel or sprocket 80*a-80h* is pivotally mounted on a corresponding carrier lever 82*a-82h*, and these levers are mounted to pivot on a common support rod 83. Each lever has a corresponding contact arm 84*a-84h* (partly broken away) and these arms form electrical circuit contacts each of which moves between related stationary contacts, identified as contacts 85*a1* and 85*a1* through 85*h8* and 85*h8*. They are shown also in FIG. 2, on the input side of the character decoding circuit. The reader, therefore, will present outputs on these contacts according to the position of the corresponding star wheel, and for every code word there will be a possible completed circuit through each lever arm 84*a-84h*, differentiating between presence and absence of a hole. Not all of the available output circuits are required however. Note in FIG. 2 that no circuit is used for $\bar{3}$, $\bar{4}$, $\bar{5}$, $\bar{6}$ or $\bar{7}$.

Each time the reader 15 reads a code word, it will decode this code word and distinguish between a character identification (or character selection) code and a function controlling code. Basically, the difference between these two types of codes is determined by the presence or absence of a hole in the channel 10*h*, i.e., an "8" or a "8" signal.

Referring to FIG. 2, it will be noted that such a condition is represented by a completed circuit between the contact arm 84*h* and the "8" contact, identified as 85*h8*. Presence of a $\bar{8}$ signal (no hole in channel 10*h*) will determine that the code word pertains to selection of a character. Conversely, presence of an "8" signal determines that the code word is for some function control. Various ones of the functions are noted as legends over the corresponding circuit output lines shown in FIG. 2. For example, the E.O.L. circuit, which is the end of line signal, is represented by completed circuits from $\bar{1}$, 2 and 8. These are the significant digits of the end-of-line code word.

The code word and decoding circuit which are particularly significant in the present invention include the circuit identified AUTO SIZE, which is the decoding circuit for the automatic size change code. The significant digits of the corresponding codes are $\bar{2}$, 4, 5 and 8. When the reader reads this particular code word, a control output will result on the automatic size change output line 90 which is embodied in the cable 92 (FIG. 1) leading to the size control circuit 95. Further details of this circuit and its connections are explained hereafter.

Assuming for purposes of explanation that a character code is presented to the reader 15, then appropriate signals will be presented on one or more of the character code output circuits which are identified in FIG. 2 as 100*a*, 100*b*, 100*c*, 100*d*, 100*e*, 100*f* and 100*g*. Each of the decoding circuit lines is connected through a transistor amplifier, one of which is shown schematically at 102, including the line 90 for which the amplifier 102

A.S. is shown in FIG. 5A. The seven selection output lines pass through cable 105 to the character selector circuit 108. This circuit is controlled by the code reading photocells 110, as more fully explained in said Patent No. 3,059,219, and the character selector circuit in turn controls the function of a spark control unit 112 and a flash control unit 113.

These units are separate triggering circuits, the spark control unit being connected to the electrodes 115 to cause a spark to jump the gap therebetween and produce an instantaneous flash of light when the desired character passes the projection station, indicated by the dot-dash line 116 which shows the optical axis of the system.

Rotating continuously at fairly high speed, e.g., 2400 r.p.m. across the optical or projection path, is the character disc 120 which is preferably an opaque plate-like member having the individual characters formed as transparencies such that a shaped light beam is formed by the light passing through the selected character. The timing of the flash is of course precise and of such short duration that the character image bearing light beam is effectively stationary. This beam passes through the font selector prism system 122, as described in said application No. 39,859, and thence through the size controlling lenses 125. From these lenses the character image bearing beam passes through an optical flat 127, or the like, which may be pivoted between two positions by the space controller solenoid 128, as described in said application Serial No. 117,454, and thence the image is focused on the photosensitive material 130, which may be film or paper draped over and controlled by the spacing carriage 132. This carriage is moved transversely to the optical system by the spacing control motor 57 through the rack and pinion drive 133. Leading movements of the photosensitive material, i.e., vertically, are provided through the elongated gear 134 driven from the leading control motor 67.

As soon as a character image is recorded on the photosensitive material, spacing movement of this material is provided by the controlling motor 57. Information for this purpose is derived from the character unit width code or data on the disc 120. This code is read by flashing the elongated light tube 140 under control of the flash unit 113, at the same time that the character is photographed. A unit width code is thus projected to the bank of code reading photocells 142, and their outputs are fed through cable 144 to the space computer 145. This computer is provided with a control flip-flop FF4 and a pulse generator 146, and which includes a separate input through cable 150 from a drum type selector switch 152 which is coupled to the lens positioning controller 154, these parts in turn being under control of the size control circuit 95.

As is explained in greater detail in said application Serial No. 39,858 and in application Serial No. 117,454 the result is a burst of electronic spacing pulses which are transmitted along the spacing circuit line 148 to the space control circuit 55. The number of these pulses is related to the actual width to be allotted to the character image just photographed, in terms of picas and fractions of a pica, or piclets.

It should be noted also in connection with FIG. 1 that there is a second character disc 120a, and it may be moved alternatively into the optical system under control of a disc shifting apparatus 155 which is driven by disc shifting pneumatic cylinders, one of which is shown at 156. Operation of these cylinders is controlled by a disc change control circuit 160 operating from signals passing through cable 162 which leads from the decoder circuit 30.

There is also a tabulating control which receives the tabulating code signal from line 165 (see also FIG. 2) and this signal is arranged to initiate operation of the tabulating control circuit 167. Each time a tabulate code is read this circuit sends a predetermined number of spacing pulses to the space control circuit 55.

The present invention concerns particularly the automatic control of the size of character images produced from a common size of master character on the matrix disc. This involves automatic positioning of the size control lenses 125, and corresponding control of the point size input to the space computer 145. The general designation for this control circuit is at 95 in FIG. 1, and details of the circuit are shown in FIGS. 5A and 5B.

As a prelude to the detailed explanation of the automatic point size control, it is desirable to mention certain features of the operation of the photographic machine. Thus, with reference to FIG. 1, and as previously mentioned, when a control tape 10 is fed into the readers 12 and 15, the reader 12 passes over code words except the end-of-line codes, and when one of these codes appears to the reader 12, it stops and maintains this code in a reading position. The tape in the meantime builds up as a loop between the two readers, and when the reader 12 reaches the end-of-line code for an acceptable line, it senses a "go ahead signal" to the reader 15 which in turn proceeds to read all of the code words, one at a time.

Each time the reader 15 reads a code word it transmits the appropriate code to the character decoder circuit 30, and as an incident to this operation a tape step signal is sent to the solenoid 77 (FIG. 3) of the reader and the reader steps to the next code and waits. In the meantime, the decoder circuit operates to determine whether a character selection code or a function control code is presented, and routes the information accordingly either to the character selector or to the appropriate one of the function control circuits. Among these circuits is the size control circuit 95. As soon as the character selection operation, or the function operation is complete, then a signal is transmitted to the character decoder which in turn generates a "tape read" pulse or signal to the reader 15.

The read pulse amplifier 170, as shown schematically in FIGS. 2 and 5A, has an input 171 through which the feed back or "go ahead" pulse is received, and has two separate output lines 172 and 173 which both transmit the tape read pulse. Line 172 leads to the common connection of the first seven stations of the reader (see FIG. 3) and line 173 leads to the fifth position contact in the first level of a stepping switch 175. Since all operations of the machine require an output pulse through either the 8 or $\bar{8}$ line of the character decoder (note FIG. 2), it is possible to suspend normal operation of the machine for the automatic size change function by interrupting the read pulse circuit to the common input of the eighth station (84h) of the reader. The purpose and details of this operation are more fully explained hereafter.

Thus, when the automatic size change code appears in reader 15, a pulse is transmitted through amplifier 102 A.S. through an isolating diode as shown in FIG. 5A to the grid of a control thyatron 176. In the plate circuit of this thyatron there is connected the operating coil 175a of stepping switch 175, and between the plate resistor and the coil there is a normally closed switch 177 which is also controlled by coil 175a, such that the thyatron is extinguished once it has been fired to advance the stepping switch 175 through one step.

The stepping switch 175 has five positions (actually position four is an extra and performs no real function) and six different levels or connections which are indicated by the separate wipers, shown as arrows in the drawing. This control stepping switch is normally in the fifth position, when the control is at rest, as shown in the drawing. The first pulse resulting from the start signal, as just explained, moves the wipers to the first position.

As a result, a number of circuits are completed. First of all, power is supplied to line 178 from the wiper connected to the A.C. power supply at the first position in the fifth level. This circuit line leads through the winding 180 (FIG. 5B) of the reversible lens drive motor 182.

As shown in FIG. 4, this motor is connected through suitable drive gears 183 and through suitable sprockets or belts 184 to the carriages 185 of the lenses 125. These carriages include stops 186 engageable with sets of different abutments or stops indicated schematically at 188, and carried on a lens position control drum 190. As more fully explained in said application Serial No. 843,127 filed September 29, 1959, different ones of the abutments or stops 188 will provide for appropriate spacings of the lens carriages to position the lenses for different photographic enlargement or reduction, and in this manner the size of the character images is varied to provide the desired change in point size. For example, in one embodiment according to the present invention a range of point sizes is provided, according to the known scale of printer's measure, from 4 point to 36 point characters.

Completion of the circuit through winding 180 of motor 182, causes the carriages to move to the ends of the drum 190 so that the stops 186 are withdrawn and the drum is free to be rotated. When the carriages 185 reach the limit of movement, or in other words, the "clear" position, they close the series connected limit switches L-1 and L-2, shown in FIG. 5B and in FIG. 4. This completes a circuit through line 192 resulting in a pulse on the grid of the control thyatron 176 and advancing the control stepping switch 175 to its second position.

In both the first and second positions the A.C. supply (FIG. 5A) is connected through the wiper of the sixth level to the power supply line 195, which in turn leads to the winding of the selector drive motor 198. This motor is also shown schematically in FIG. 4. It drives through a slip clutch 199, a ratchet mechanism including a ratchet wheel 200 controlled by a pawl 202 which in turn is controlled by a solenoid 205. The coil of this solenoid is shown in FIG. 5B, connected between a 20 mf. capacitor and the plate circuit of a second control thyatron 210. In its plate circuit there is also a normally closed switch 212 which is controlled by the pawl 202, as shown schematically in FIG. 4, to open and extinguish the thyatron whenever solenoid 205 is energized to cause power to be withdrawn from the escapement wheel. Thus, the pawl returns immediately, and the escapement mechanism functions to permit the drum 190 to rotate one step.

When the control stepping switch 175 moves to its second position, a circuit is completed from the wiper of the fourth level through the line 215 (FIG. 5A) causing a pulse to be transmitted to the read pulse amplifier 170. In the meantime, the normal read pulse supply circuit from this amplifier is suspended due to the now open circuit between the blade 84h (common to the 8 and 8 contacts) of the reader and the read pulse supply line 173 which extends from the fifth position in the first level of stepping switch 175.

The read pulse generated in this manner by the stepping switch this is transmitted back through the tape reader and to the input lines from the reader to the size selector rotary switch which is shown schematically in FIG. 4 at 225. The schematic diagram of this switch appears at the bottom of FIG. 5B. It will be noted that the inputs from the various circuit lines of the reader pass through different positions of the size selector switch and the wipers of this switch are connected in parallel through diodes 227 to a common output line 228. This line leads through a manually operated selector switch 230, as shown, to the grid of an inverter amplifier 232. The output of this inverter drives the grid of thyatron 210, and thus if a through connection appears for the pulse from the reader at any one of the wipers of the size selector 225, this pulse will pass through 228 to the inverter amplifier and thyatron 210 will be fired momentarily causing the stepping solenoid 205 to release drum 190 for another step.

The purpose of this operation is to read the same code word, which now appears in the reader 15, a number of

times, so that the size selector controls may be interrogated in this manner to determine whether the size selector switch is in a position corresponding to that dictated by the size code word. The correct position is determined by an open circuit at all wipers at the size selector switch, such that the read pulse does not reach the feed back line 228. Until this condition is obtained, operation of the tape reader 15, with its normal mode of advancing with each read pulse, is suspended, and the automatic size control continues to repeat the interrogation-advance sequence of the size selector switch, as explained above, until the proper position is reached.

Each time the escapement mechanism for the selector switch operates, it momentarily opens the extinguishing switch 212 of thyatron 210, as previously mentioned. Then, as the pawl 202 moves back toward a position in engagement with the ratchet wheel 200, it momentarily closes a switch 235 (FIGS. 4 and 5A), and this sends an interrogating read pulse to the read pulse amplifier 170 so that interrogation of the selector switch in the next position is accomplished.

When the size selector switch reaches the desired position, and there is no longer any closed circuit to the feed back line 228, no pulse will pass to the inverter for the purpose of firing the thyatron 210.

The anode of the thyatron 210 is also coupled through a capacitor 241 and line 242 to a resistor, capacitor, diode delay circuit 244 connected to a cathode follower circuit 245. The capacitor of the delay circuit is charged each time thyatron 210 fires. When the drum 190 reaches the desired size position, the read pulse will not fire the selector thyatron. The delay capacitor will continue to discharge, and when its potential is near zero, the cathode follower 245 will fire the control thyatron 176, thus advancing the stepping switch 175 for the next part of the size control sequence, at its third position.

The selector drive motor 198 is deenergized since power to line 195 is cut off (sixth level, third position). A circuit is completed from the A.C. supply through line 248, applying power to the winding 180a of the lens drive motor 182. This causes the lens drive to set the lens system by bringing the carriers 185 inward until it stops engage the abutments now in position on the size control drum 190.

A tape advance signal is sent from the fourth level, third position of switch 175, through line 249, to the tape reader 15 to prepare it for normal operation. A time delay relay 250 is energized, but its normally open contact 250a remains open for a short period. This time delay is put in so as to provide time for the lens stops 186 to reach the abutments now in position to locate the lenses.

When the time delay relay 250 operates, a circuit is completed through line 192 and the thyatron 176 is again fired, moving switch 175 to its fourth position, deenergizing the lens motor 182.

In this fourth position of switch 175 a biasing circuit is also completed through line 253 in the second level, leading to the grid of the inverter circuit 232, and maintaining it cut off, and a similar biasing circuit is completed through the third level and line 254 to the delay circuit 244 in order to prevent this circuit from operating the cathode follower 245. In the fourth level, a pulse generating connection is formed through line 255 around the control thyatron 176 to energize the coil 175a of the stepping switch, causing it to move to its fifth or rest position.

In this position, the circuit is completed from line 173 and the wiper of the first level to the eighth channel common contact of the reader, e.g., switch 84h shown in FIG. 2. The biasing circuit is maintained through line 253 to the inverter and the delay biasing circuit is maintained through line 254. In the fourth level of the switch, a ground connection is completed to the pulse generating circuit 260 which in turn directs a pulse to the character decoder for causing normal operation of the phototype-

setting machine to resume. In addition, the A.C. supply (FIG. 5A) is connected through line 262 to the common input buss of a spark intensity control switch 265, shown schematically in FIG. 5B and in FIG. 4.

This is a multiple connection switch which rotates in unison with the size selector switch 225 and the size control drum 190. Through this switch, connections can be completed at the five different levels thereof to five A.C. relay coils, shown generally at 267. The contacts of these relays, shown at 267a, are connected to form parallel circuits with a plurality of spark firing condensers 270, and these condensers in turn are connected according to the selected pattern, to the spark control unit 112. In this manner the intensity of the spark is varied such that greater capacitance and a more intense spark discharge is employed at the larger point sizes, where greater illumination is desired for the larger character images. Similarly, the capacitance and thus the intensity of the spark is reduced at the lower point sizes.

A third selector switch 152 is also arranged to rotate with the switches 225 and 265. This is the point size computer control switch which has seven output circuit lines from its seven different levels connected through the cable 150 to the space computer 145. During space computation pulses emanating from space computer 145 pass through line 275 (FIGS. 1 and 5B) to switch 152 and as is apparent from the circuit connections shown in FIG. 5B these pulses will be transmitted through one or more of the lines of cable 150 back to the space computer 145 for the purpose of resetting the "P" counter portion of this computer. At any position, those contacts of switch 152 which are not connected to the output are held at a positive voltage bias by the connection through the biasing resistor 276.

There are included provisions for manual control of the point size selector circuits if desired. For that purpose the double pole selector switch 230 can be operated manually to shift from its normal position, shown in FIG. 5B. When this happens the feed back pulse circuit is broken at 230 and in addition a biasing circuit is completed through line 278 to the delay circuit 244. Manual withdrawal and return of the lenses can be accomplished by momentarily closing the normally open control switch 280 (FIG. 5A) which completes a power circuit to the stepper circuit 175a of the control stepping switch 175. In this manner the appropriate circuits can be completed through this stepping switch. Rotation of the point size control drum 190 is accomplished by pulsing the inverter amplifier 232 (and thus thyatron 210 and the selector stepper control coil 205) through a normally open manually operable switch 282, shown in FIG. 5B. Each time this switch is closed momentarily, with switch 230 in its manual or alternate position, the drum 190 and the associated switches 152, 225 and 265 will be moved one step.

It will be apparent from the foregoing description and examples that the present invention provides for completely automated point size control in a phototypesetting machine. The circuitry shown, which is illustrative of the principles of the invention, functions to read the coded instructions for a point size change, and to accomplish the instructed change automatically while momentarily suspending operation of the normal character selection and spacing functions of the machine. In addition, the invention affords controls for manual operation of the point size controls if desired, although it should be understood that these manual controls are optional and are not a necessary feature of the invention.

In addition, the invention provides a novel and effective system for controlling the intensity of the character flash illuminating system in accordance with the size of character image to be produced, and likewise the invention provides a simplified arrangement for presetting the character space computer according to the point size being used such that the actual size of the character images can

be computed after each image has been recorded on the photosensitive material. Other novel features of the invention will be apparent to those skilled in the art from the foregoing description.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. Size control for phototypesetting apparatus having a character matrix made up of a plurality of master characters of predetermined size relative to each other according to the styling characteristics of the particular font which they comprise, a register including means for representing thereon a point set code which indicates the desired image size with respect to the master characters on said matrix, and means for reading said register; comprising means incorporated in said reading means for recognizing information representing a desired point set factor, an optical system including at least two lenses movable with respect to each other and mounted between said matrix and an image plane which is at a fixed distance from said matrix to focus images of predetermined and different size from said matrix in said image plane, means including pairs of stops at different spacings for adjusting the positions of said lenses to produce different sizes of images according to predetermined incremental changes in image size from a common master character, control means connected to position said lenses with respect to said stops, means operated by said control means indicating the position of said stops at any particular instant, and a comparative circuit means connected to said register reading means and to said indicating means for producing a stepping movement of said control means until the setting thereof corresponds to the point set code in said register means.

2. A size control for phototypesetting apparatus having a character matrix made up of a plurality of master characters of predetermined size, an optical system cooperating with said matrix and including movable lenses which may be adjusted to focus different sizes of images of the master characters in a common image plane, a point size control means including a device operating on said lens to predetermine different positions thereof for production of different sizes of character images according to predetermined typographic dimensions, a point size control including a rotatable stop drum and a selector switch rotatable in synchronism with said stop drum to complete different circuit connections at each position thereof according to the point size related to each position, means for directing a reading pulse through predetermined ones of the circuit connections of the selector switch according to a code indicating a desired point size, and means for adjusting the position of said stop drum and said selector switch until all circuits on which a read pulse transmitted to said selector switch are open circuits in such switch and for setting said optical system according to the position at which said stop drum is then located.

3. In phototypesetting apparatus adapted for automatic control from a coded register and having means for projecting images of selected characters according to code information in the register including a character matrix with a plurality of master characters of predetermined related size, a light source adapted to illuminate selected ones of said master characters, means for supporting photosensitive material onto which the character images are projected, and an adjustable optical system cooperating with said matrix and said light source to project character images of variable size from said matrix in a common image plane; the improvement comprising means for adjusting said optical system to control the size of images produced from said master characters, a point size control operatively connected to said adjusting means for

11

predetermining the size of images produced according to different typographical point sizes, said point size control including means responsive to function code information from said register to suspend the normal operation of said apparatus and to adjust said optical system for control by said point size control means, and circuit means incorporated in said point size control means and responsive to additional size control code information from said register to compare the setting of said point size control means with the setting thereof directed by such additional code information and to subsequently adjust said point size control means until its setting corresponds to the desired setting, and further circuit means responsive to completion of the point size change for causing said apparatus to resume its normal operation.

4. In phototypesetting apparatus as defined in claim 3, the combination wherein said circuit means includes a movable contact selector switch operable in synchronism with said point size control and adapted to indicate arrival of said point size control at the setting thereof pre-

12

scribed by said additional code information by providing a predetermined circuit condition through said selector switch.

5. Apparatus as defined in claim 3 wherein said light source includes a high intensity light discharge apparatus and a control circuit therefor, variable capacitor means incorporated in said control circuit, and an intensity control switch operated by said point size control and connected to vary said capacitor according to the selected point size for increasing the intensity of the light discharge with an increase in the size of character image produced by said optical system.

References Cited by the Examiner

UNITED STATES PATENTS

2,923,212	2/1960	Corrado	95—4.5
2,999,434	9/1961	Higonnet et al.	95—4.5

NORTON ANSHER, *Primary Examiner*.