

Sept. 24, 1957

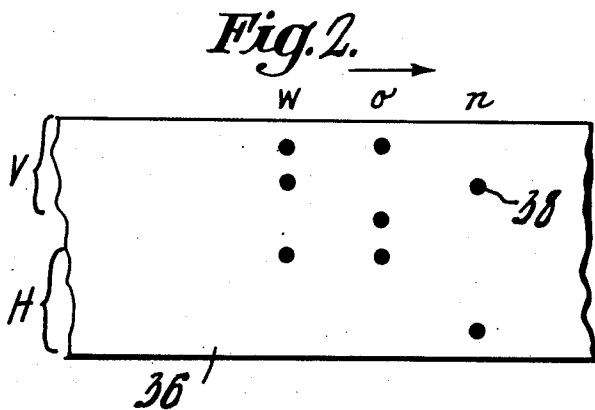
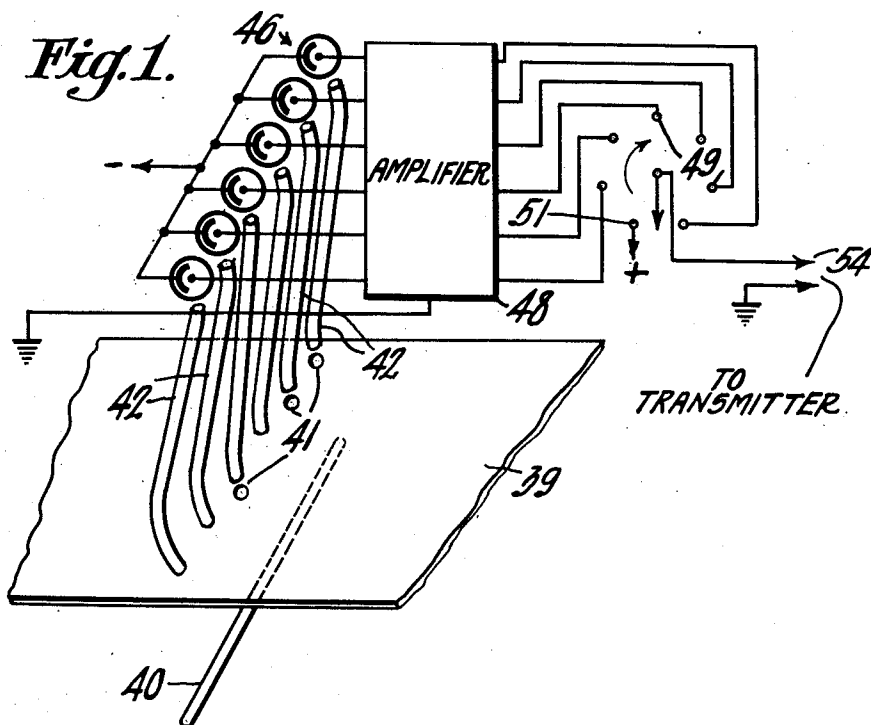
C. J. YOUNG

2,807,663

ELECTRONIC CHARACTER SELECTING AND/OR PRINTING APPARATUS

Filed Oct. 2, 1950

7 Sheets-Sheet 1



INVENTOR
Charles J. Young
BY *George J. Craig*
ATTORNEY

Sept. 24, 1957

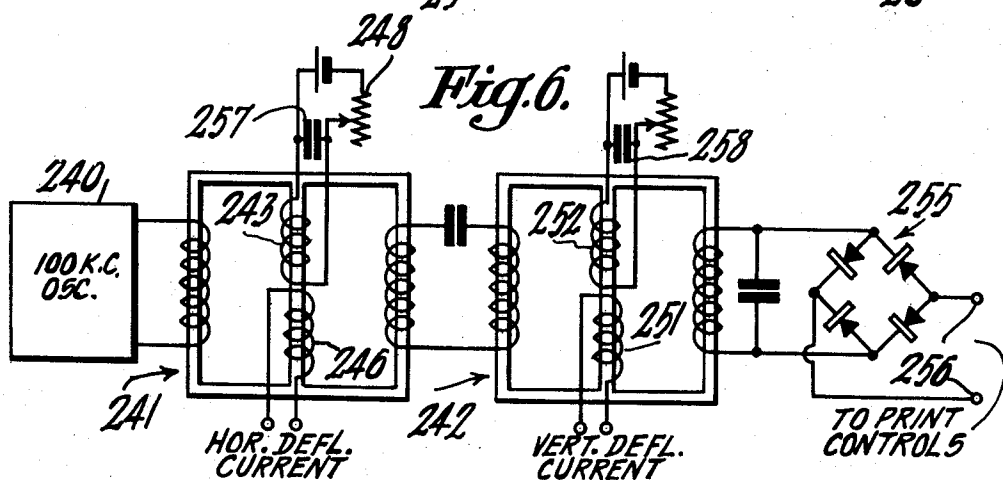
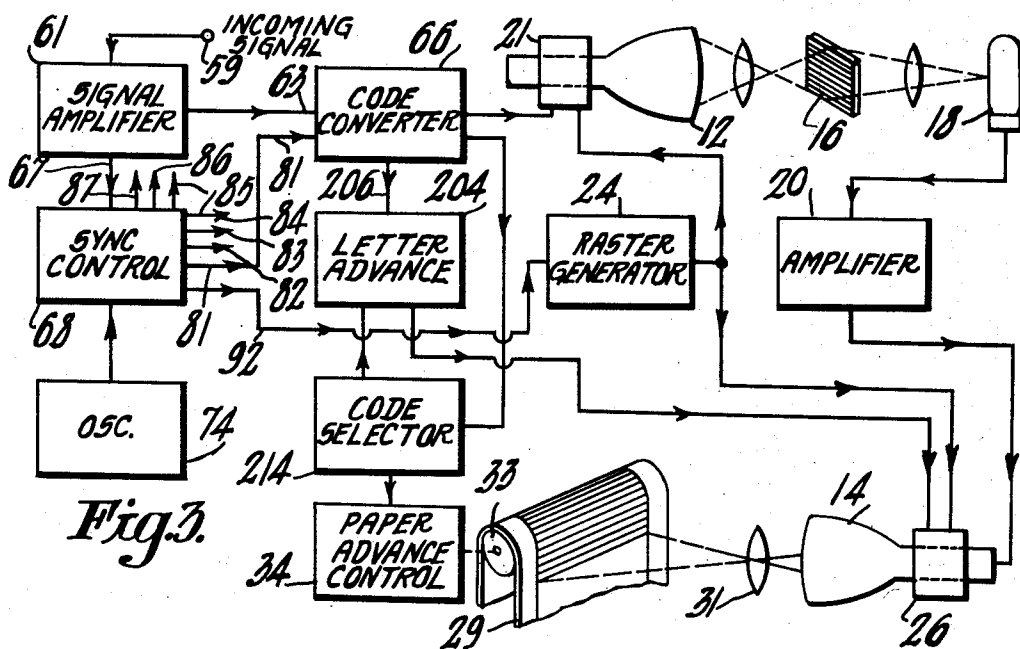
C. J. YOUNG

2,807,663

ELECTRONIC CHARACTER SELECTING AND/OR PRINTING APPARATUS

Filed Oct. 2, 1950

7 Sheets-Sheet 2



INVENTOR
Charles J. Young
 BY *George T. Craig*
 ATTORNEY

Sept. 24, 1957

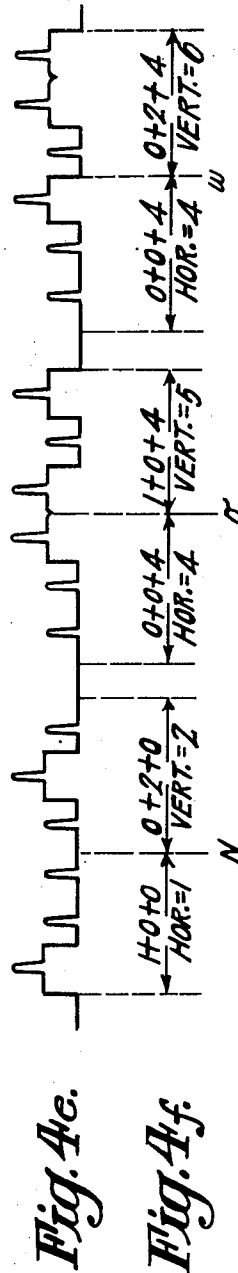
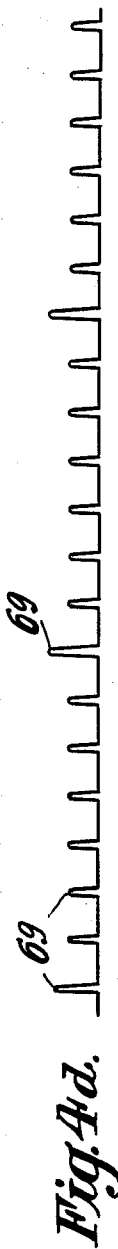
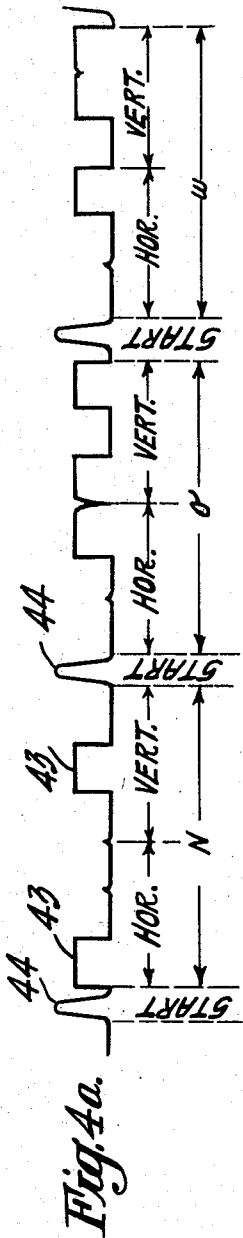
C. J. YOUNG

2,807,663

ELECTRONIC CHARACTER SELECTING AND/OR PRINTING APPARATUS

Filed Oct. 2, 1950

7 Sheets-Sheet 3



INVENTOR
Charles J. Young
BY *George T. Craig*
ATTORNEY

Sept. 24, 1957

C. J. YOUNG

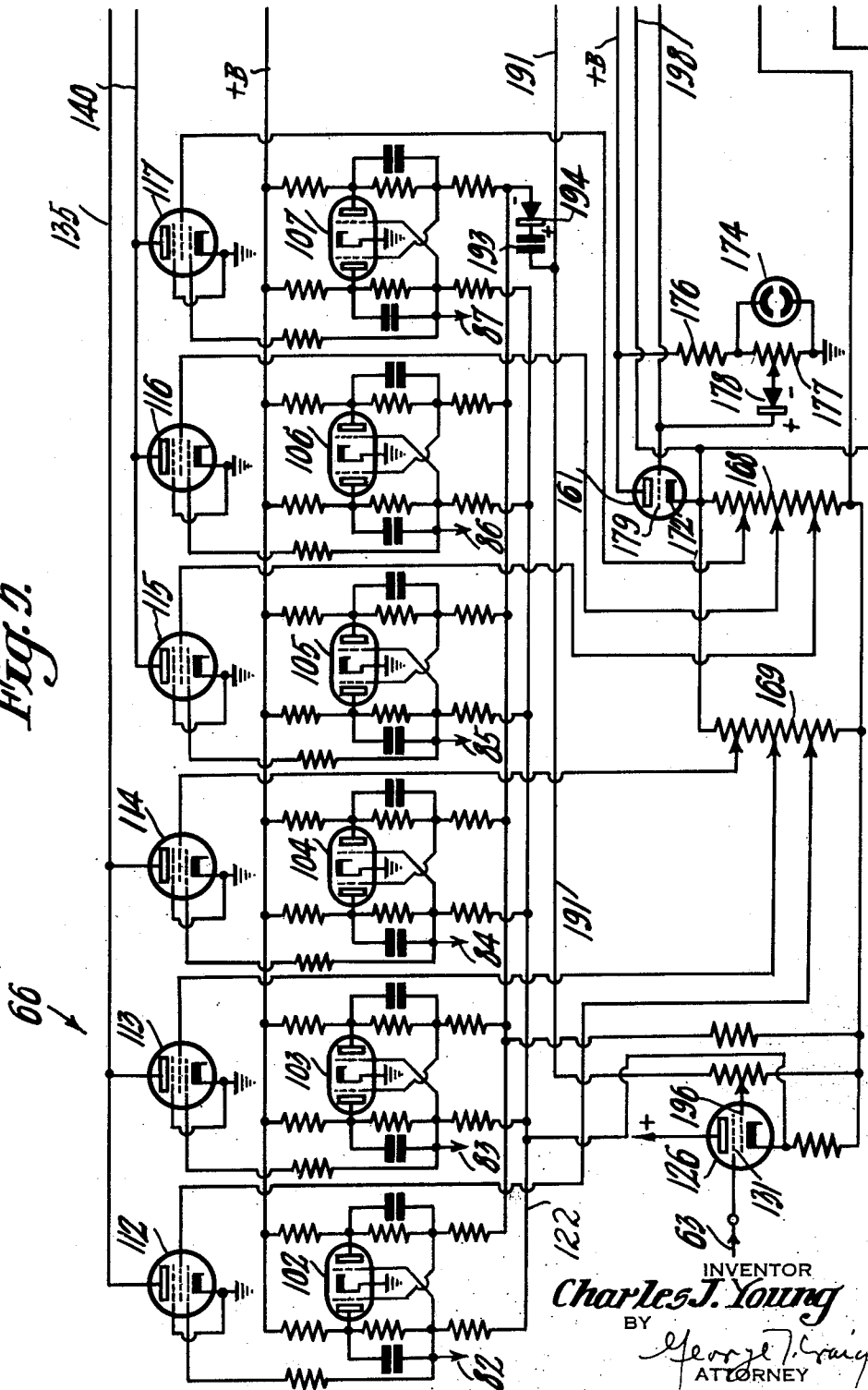
2,807,663

ELECTRONIC CHARACTER SELECTING AND/OR PRINTING APPARATUS

Filed Oct. 2, 1950

7 Sheets-Sheet 4

Fig. 5.



Sept. 24, 1957

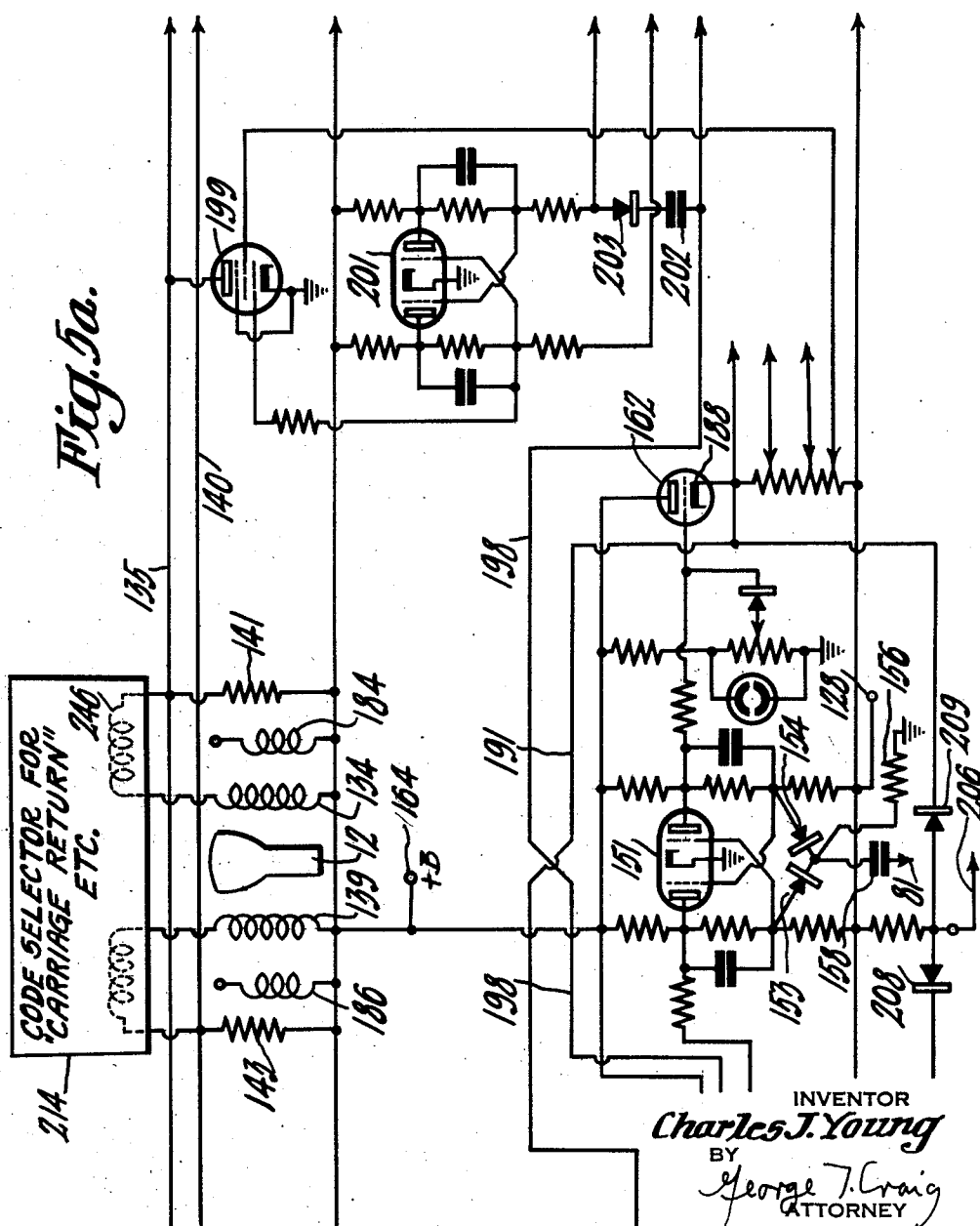
C. J. YOUNG

2,807,663

ELECTRONIC CHARACTER SELECTING AND/OR PRINTING APPARATUS

Filed Oct. 2, 1950

7 Sheets-Sheet 5



Sept. 24, 1957

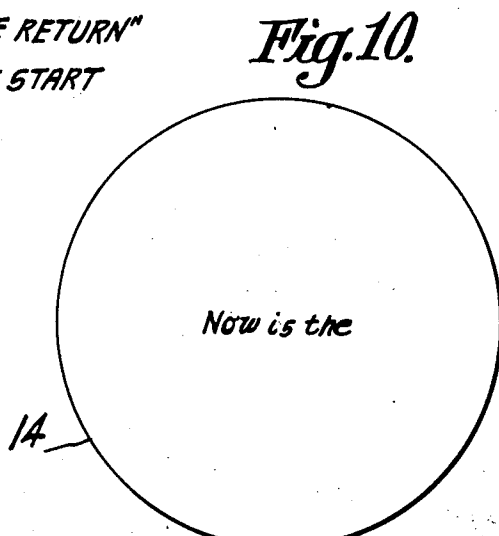
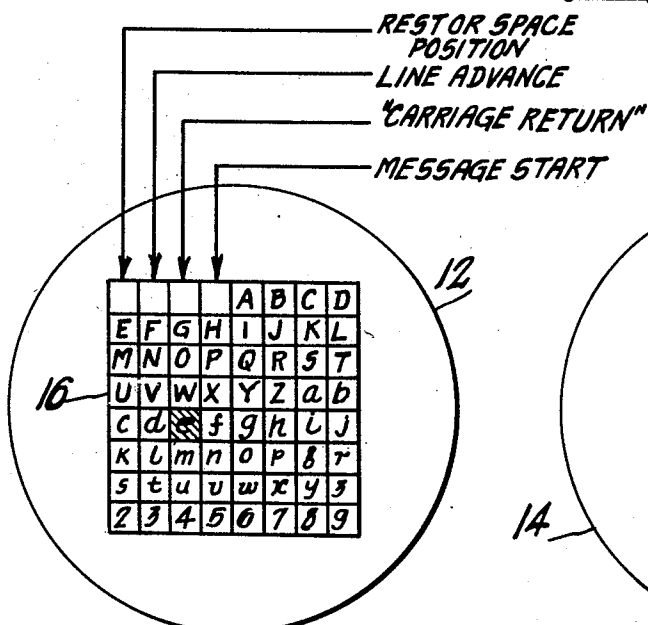
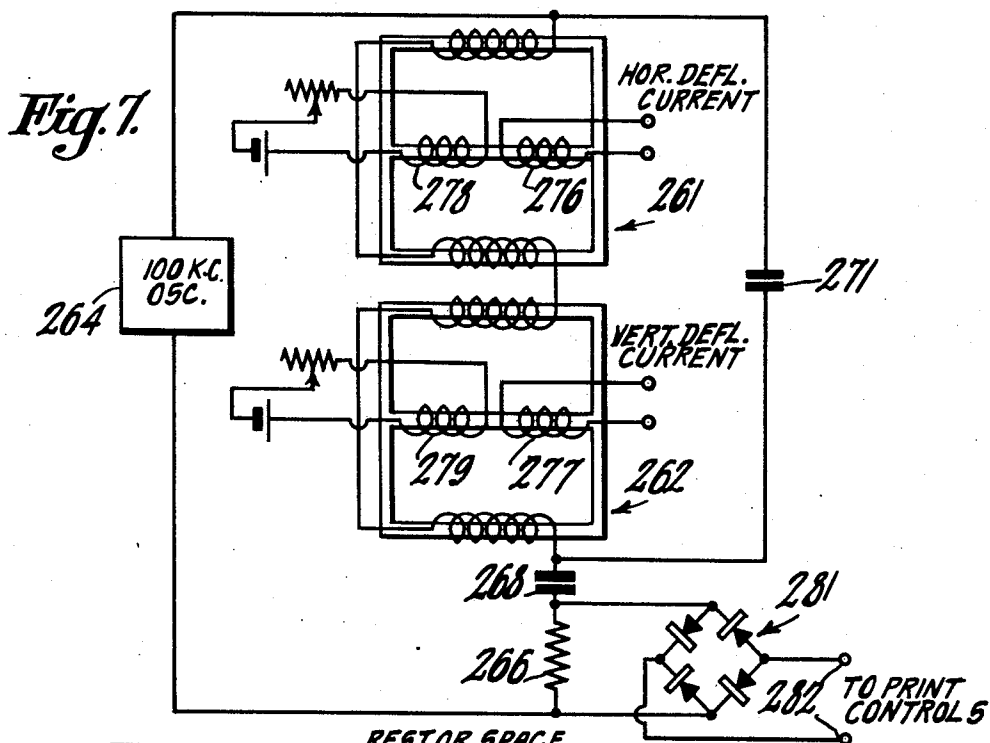
C. J. YOUNG

2,807,663

ELECTRONIC CHARACTER SELECTING AND/OR PRINTING APPARATUS

Filed Oct. 2, 1950

7 Sheets-Sheet 6



INVENTOR
Charles J. Young
 BY
George T. Craig
 ATTORNEY

Sept. 24, 1957

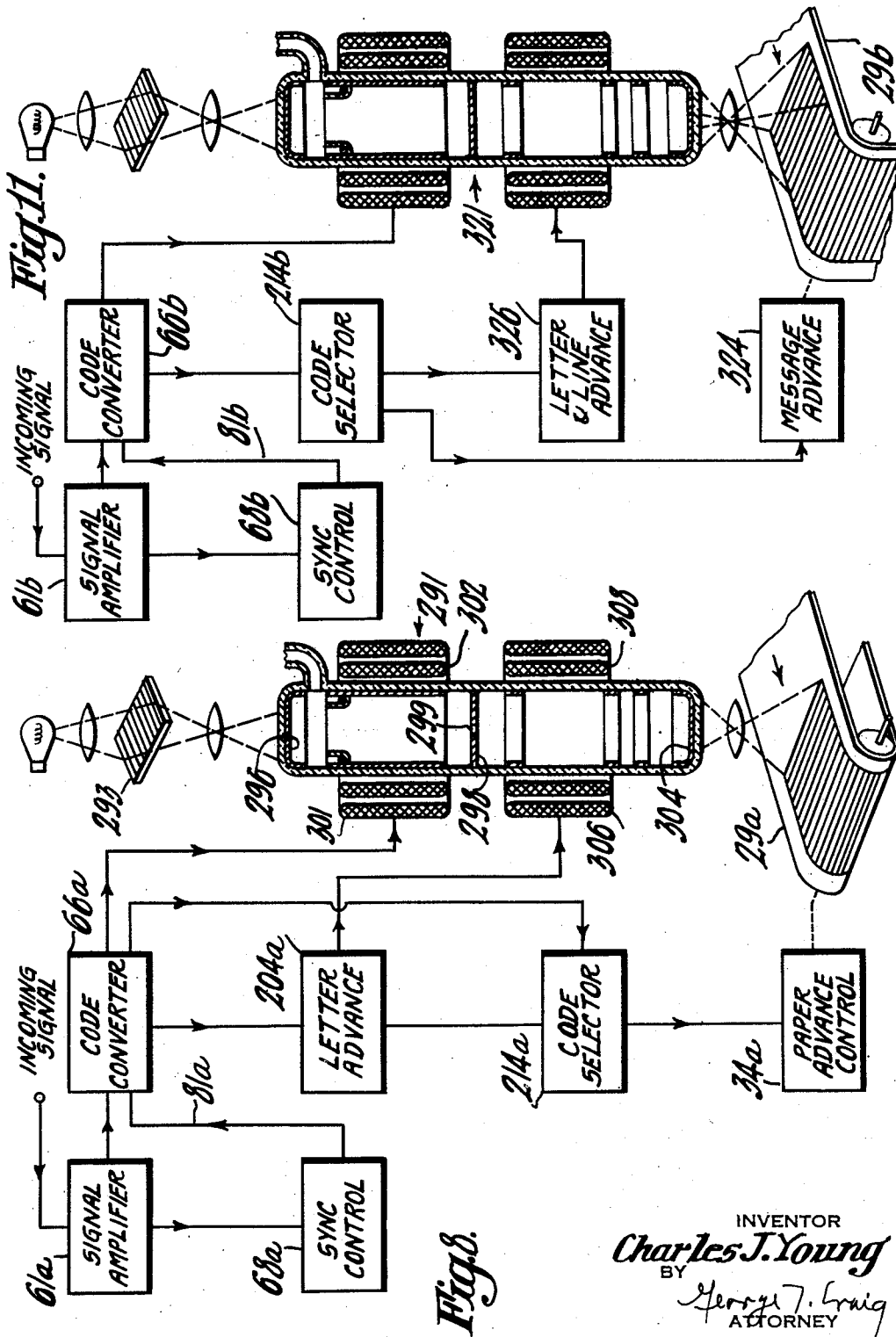
C. J. YOUNG

2,807,663

ELECTRONIC CHARACTER SELECTING AND/OR PRINTING APPARATUS

Filed Oct. 2, 1950

7 Sheets-Sheet 7



INVENTOR
Charles J. Young
 BY
George J. Craig
 ATTORNEY

1

2,807,663

ELECTRONIC CHARACTER SELECTING AND/OR PRINTING APPARATUS

Charles J. Young, Princeton, N. J., assignor to Radio Corporation of America, a corporation of Delaware

Application October 2, 1950, Serial No. 187,879

4 Claims. (Cl. 178—15)

The present invention relates to the selection of indicia including readable characters, and, more particularly, but not necessarily exclusively, to novel means for selecting indicia, such as letters of the alphabet and for arranging and presenting the selected indicia in useable form. Selection, in accordance with the invention, may occur at a place which is remote from the place of arrangement and presentation.

In accordance with the invention, an electronically produced letter of the alphabet, for example, is shifted, preferably by electronic means, to fit into an intelligible arrangement of similar letters. Initial production of the letter is obtained by a selective process. Code control is employed for guiding the selection. The resulting intelligible arrangement of letters is recorded by photographic means, for example, or by other means. Suitable recording mediums may be employed which are sensitive to visible or invisible radiant energy. Photographic methods of recording are responsive to visible as well as invisible radiation and are, therefore, suitable. Radiation controlled electrostatic patterns may be employed for recording. The invention, in effect, provides type selection and type setting by electronic instrumentalities.

An object of the invention is to provide for the selection of discrete indicia and to arrange the selected indicia in intelligible form.

Another object is to provide novel means for scanning the electron beam sensitive area of a cathode ray tube.

A further object is to provide novel means for controlling scanning deflection of the electron beam in a cathode ray tube.

A still further object is to provide novel means for the electronic selection of indicia by code controlled means.

Other objects and advantages of the invention will, of course, become apparent and immediately suggest themselves to those skilled in the art to which the invention is directed from a reading of the following specification in connection with the accompanying drawings in which:

Fig. 1 is a schematic showing of a transmitter suitable for deriving code signals representing letters of the alphabet or other indicia;

Fig. 2 shows a fragment of transparent tape marked with code characters;

Fig. 3 is a schematic showing of apparatus for selecting and arranging characters or other indicia when provided with coded signals;

Figs. 4a to 4f show a series of waveforms used in explaining the operation of the apparatus of Fig. 3;

Fig. 5 and 5a are to be combined as a schematic diagram of one of the principal units shown by Fig. 3;

Figs. 6 and 7 disclose details of arrangements in accordance with the invention for controlling functions of the apparatus;

Fig. 8 is similar to Fig. 3 and shows another embodiment of the invention;

Fig. 9 is a view of the character defining means of the invention representing characters disposed for selection;

2

Fig. 10 is a view illustrating selected characters arranged in intelligible order, only one of which would be visible in practice of the invention in a preferred form; and

Fig. 11 is a schematic showing of apparatus, similar to the apparatus of Fig. 8, for selecting and arranging characters or other indicia in page form in response to code signals.

Fig. 1 of the drawing shows, schematically, one form of transmitter which is capable of producing coded signals at high speed for operating the receiving apparatus shown schematically in Fig. 3 of the drawing. The transmitter of Fig. 1 may, if desired, include features shown in Zworykin Patent No. 1,753,961, granted April 8, 1930. A patent to Cremer No. 1,828,556, dated Oct. 20, 1931, also discloses a code transmitter suitable for purposes of carrying out this invention. Fig. 2 of the drawing shows a fragment of a strip of tape bearing code characters representing the word "now."

The receiving and recording arrangement of Fig. 3 includes two flying spot cathode ray tube scanners or kinescopes 12 and 14. The principle of the flying spot scanner is shown in Patent No. 2,104,066 granted to V. K. Zworykin on Jan. 4, 1938. A slide or mask 16 is interposed between the flying spot tube scanner 12 and a phototube 18. An amplifier 20 is provided for the phototube output. The slide 16 may, if desired, be in the form of a mask applied directly to the face of the kinescope 12. The indicia may be opaque or transparent on an opaque field. Fig. 9 of the drawing shows the slide or mask 16 somewhat in detail. It is divided into squares which correspond to components of deflection superimposed on the raster deflection means of the kinescope. For example, the square inscribed with the letter "e" is reached by deflecting the beam three units horizontally and five units vertically from the upper left-hand or "rest" position. Properly applied deflection currents or voltages normally maintain the beam in the rest position, and steady deflection components to select a square on the mask 16 vary these readily applied deflection components. Alternatively, and more simply, the well-known gun structure of the kinescope 12 may be located so as to direct the beam to the portion of the screen occupied by the square representing the rest position in the absence of coordinate deflection voltages or currents. A deflection yoke is indicated by reference character 21. This yoke may be of the kind fully described in Patent No. 2,428,947 granted to C. E. Torsch on Oct. 14, 1947. The coordinate deflection currents may be superimposed on the windings of the yoke 21 or an auxiliary yoke (not shown) may be provided which surrounds the yoke 21 or lies adjacent to it.

The electron beam of the cathode ray tube is deflected over a scanning pattern or raster, this raster having an area sufficient only to cover one of the squares of the mask 16. The scanned raster may be similar to the raster produced in a television tube, but it need not be interlaced. Scanning apparatus including vertical and horizontal oscillators and vertical and horizontal discharge tubes is by now well known. Reference character 24 indicates schematically a raster generator which may be of any well-known type. Deflection control circuits for a kinescope are shown in Patent No. 2,101,520 granted to Tolson et al. on Dec. 7, 1937. The deflection timing, however, for the raster generator 24 is obtained in a novel manner later to be described.

The kinescope 14 is provided with a deflection yoke 26 which is or may be similar to the yoke 21 described in connection with the kinescope 12. The yoke 26 receives deflection currents from the raster generator 24 so as to produce a scanning raster of nearly the size of the raster on the tube 12 on the target area or face of the kinescope.

In addition, the yoke provides a component of horizontal deflection which is adjustable stripwise to shift the scanning pattern or raster horizontally on the tube face. It will be understood that the terms vertical and horizontal are used herein merely to designate components of scanning and do not necessarily have any relationship to the position in space of the target face of the kinescopes 12 and 14. Fig. 10 of the drawings shows diagrammatically the exposed screen or target face of the kinescope 14. The adjustable or variable component of horizontal deflection in the illustrative view of Fig. 3 has been set so that the rectangular raster producing the letter "e" by modulation of the kinescope beam has been moved along the target face of the tube so that this letter "e" occupies a position on the tube to form a letter of an intelligibly arranged word. Reference numeral 29 designates a sheet or web of radiant energy or light sensitive material upon which light is projected from the target face on the kinescope 14 by a lens 31. In the message example of Fig. 10, the line of letters appearing on the screen of the kinescope 14 will be recorded on the web 29. Following selection and presentation of a line of characters, the web is moved through one line space which may be accomplished as shown illustratively by drawing the web over a driven roll 33. This may be accomplished in the well-known manner by a ratchet mechanism actuated by the paper advance control 34. The paper advance control 34 as well as the other apparatus making up Fig. 3 will be described more in detail hereinafter.

From the foregoing general description of the arrangement of Fig. 3, it will be seen that type characters are selected by the kinescope 12 and are in effect "set" by the kinescope 14.

As stated above, the apparatus of Fig. 3 is controlled by received code pulses. Referring to Fig. 2, there is shown a fragment of tape from a message bearing strip. In Fig. 2, the tape 36 may be transparent and code marks 38 thereon may be opaque. Fig. 1 of the drawings shows a tape transmitter or reader having a tape 39 with code punchings 41 therein. For the sake of convenience of description, the tape 36 and the tape 39 will be regarded as full equivalents, and it will be assumed that opaque tape with code punchings 41 is employed. In accordance with the embodiment of the invention shown in Fig. 3 a six-unit code, devised as part of the present invention, is used in which the intelligence pulses 43 (Fig. 4a) are preceded by a start pulse 44. There are six positions spaced laterally of the tape which may be occupied by punched holes 41. The code combination for "w" is in position to be read by three phototubes in the phototube bank 46. A suitable lamp 40 projects light through light guides 42 onto the phototubes. Lens means or other optical means may be employed to direct light from the lamp 40 through a given hole 41 onto the corresponding phototube. The anode or output circuits of the phototubes are connected through an amplifier 48 having separate amplifying paths, to the contacts 49 of a rotary distributor. The distributor is shown, illustratively as a mechanical commutator, however, an optical or electronic distributor will be necessary to match the high operating speed capabilities of systems embodying this invention. One contact 51 provides the start pulse. This may be of greater amplitude than the intelligence pulses 43 to afford amplitude discrimination for separation. The distributor output terminal 54 is available for connection to a transmission line or the input to a radio transmitter. For use in counting or computing devices, or the like, the transmitter and receiver or printer will be located adjacent each other.

In Fig. 3, coded signals, such, for example, as the signals appearing at terminal 54 of Fig. 1, are applied to the terminal 59 and are amplified by an amplifier 61 of known construction. One output connection 63 of the amplifier feeds a code converter 66 which is shown more in detail in Figs. 5 and 5a. The device 66 receives the

groups of pulses identifying the letters and changes them into related values of deflection current, which are fixed momentarily for the time of one raster. Furthermore, an alternate letter cycle is set up so that, while one letter is being scanned, the code for the next letter is being converted. This allows maximum time for each function. To avoid unnecessary repetition in the drawing, Figs. 5 and 5a show slightly more than one-half of the circuit since the diagram can be symmetrical about the axis of the schematically shown kinescope 12.

The other output connection 67 of the amplifier 61 feeds a device 68 which provides a series of pulses (Fig. 4d) designated 69. The device 68 is in the form of a commutator circuit and in the illustrative example has 7 stages. A circuit suitable for the purpose is shown in Patent Re. 22,672 granted to C. C. Shumard on Aug. 28, 1945. The preferred commutator circuit does not have overall feedback so that it will count 7 and stop until the next incoming start pulse 44 trips its first stage. A stable oscillator of any known type is indicated by reference character 74 which provides pulses to be counted by the counter chain circuit of the device 68. The oscillator 74 is preferably adjusted to a slightly faster rate than the incoming signal pulses 43 and 44. Taps from the several stages are designated 81 to 87 which are connected to points in the device 66 as shown by Figs. 5 and 5a of the drawing. A slight phase adjustment of the sync pulses 69 derived from the oscillator in combination with the device 68 will permit centering the sync pulses on the best part of the received pulses 43. The received pulses may then be considerably degraded at start and finish allowing these sync pulses to be transmitted over a relatively low quality transmission channel. The device 68 also supplies a triggering voltage over the connection 92 to the raster generator 24.

Multivibrators 102 to 107 in the code converter 66 (shown in detail in Fig. 5) form a storage bank in which is set the code for one letter as it is received. Operation of the multivibrators determines which tubes of the bank of tubes 112 to 117 is conductive. Electronic apparatus employing multivibrators similar to those shown illustratively in Fig. 5 of the drawing are discussed in an article entitled "Electronic Digital Counters" by Warren H. Bliss appearing in the April 1949 issue of Electrical Engineering. The tubes 112 to 117 are screen grid tubes. In accordance with the invention, the screen of each tube serves as an additional control electrode. The control grid of each of these tubes is connected to a corresponding multivibrator. The multivibrator 102 and its connection to the tube 112, as well as the screen grid connection and the screen grid bias control for this tube, will be described in detail hereinafter. The other multivibrators and screen grid tubes all function in a somewhat similar manner.

The six multivibrators 102 to 107 are each supplied with two triggering pulses. Conductor 122 is connected to the corresponding side of each multivibrator through a resistor. The conductor 122 is part of the common bias circuit for the multivibrators. The cathode of tube 126 is connected to the common bias circuit between the conductor 122 and a terminal 128 (Fig. 5a) which is connected in any suitable manner (not shown) to a source of direct current bias of negative polarity. The anode of the tube 126 is connected to the +B terminal designated 164. The screen grid 131 of the tube 126 is connected to the previously mentioned conductor 63 in which the signal pulses 43 and 44 appear. The other set of triggering pulses is applied over the previously mentioned connections 81 to 87. The code pulses and the pulses 69 when they are additive, as shown in Fig. 4e trip the multivibrator in which they are additive.

Three of the tubes 112, 113, and 114 are connected to draw plate current through the horizontal deflection coil 134 (Fig. 5a) which is part of the yoke 21. The counterparts of these three tubes (not shown) exist in the second

5

portion of the code converter which lies to the right of the kinescope 12 in the schematic showing of Fig. 5a.

The remaining three tubes 115, 116, and 117 of the bank of tubes 112 to 117 are connected to draw plate current through the vertical deflection coils 139. A resistor 141 serves as a damping resistor for the yoke. A resistor 143 also serves as a damping resistor.

A multivibrator 151 serves as a transfer so that the bank of multivibrators 102 to 107, as well as the corresponding bank (not shown) to the right of kinescope 12, as shown in Fig. 5a, stores and records elements of information, such as letters, alternately. The grids of the multivibrator 151 are connected through diodes 153 and 154 to ground through a resistor 156. The cathode of the multivibrator tube 151 is also connected to ground or to the circuit point to which the resistor 156 is returned. When the first pulse in a negative direction from the sync control device 68 is transmitted over the lead 81 through the condenser 158 to the diodes, the diode 153 or 154 will apply this negative pulse to the grid of the section of the multivibrator which is conducting.

Switch tubes 161 and 162 are provided and the condition of the multivibrator 151 determines which of these tubes is conducting. The tubes 161 and 162 have similar circuit connections and therefore only the circuit connection of the tube 161 will be described. The circuit connections for the tube 162 accomplish similar purposes for the portion of the equipment which lies to the right of the kinescope 12. The space discharge path of the tube 161 is connected between the +B terminal 164 and the negative bias terminal 128. Cathode resistors 168 and 169 are provided which are in the form of multiple slider potentiometers.

Fig. 4c represents the voltage at the cathode 172 of the tube 161. It is either equal to the negative bias applied at the terminal 128 when the tube 161 is cut off or rises to a value which is definitely fixed by the regulation of the grid circuit provided by a voltage regulator tube 174 together with resistors 176 and 177. A diode rectifier 178 provides regulated direct current bias voltage for the grid 179 of the tube 161.

The screen grids of the tubes 112, 113 and 114 are connected to taps on the multiple slider potentiometer 169. The screen grids of the tubes 115, 116 and 117 are connected to the taps on the multiple slider potentiometer 168. Voltage settings are arranged by the sliders on the potentiometers 168 and 169 so that when the deflection tubes 112 to 117 are conductive their screens are held to values which make the plate current have a ratio of 1-2-4. For example, if the tube 114 is set for .040 ampere, then the tube 113 is set for .020 ampere, and the tube 112 is set for .010 ampere. With the plate current of the tubes 112, 113, and 114 set as stated, then the plate current of the tube 115 would be set for .010 ampere; the plate current of the tube 116 would be set for .020 ampere; and the plate current of the tube 117 would be set for .040 ampere. The separate potentiometers 168 and 169 are provided to compensate for differences in individual tubes.

The plate currents of the tubes 112, 113, and 114 combine in the deflection coil 134 over the lead 135. Since these tubes are pentodes, the operation of one tube does not affect the operation of the other. Likewise, the plate currents of the tubes 115, 116, and 117 combine in the coils 139 over the lead 140 to produce the vertical deflection. Coils 184 and 186 are additional deflection coils to generate the smaller raster and are supplied from the raster generator 24 shown in Fig. 3. It will be understood that the coils 184 and 186 may also include set values of direct current to establish the start position of the beam.

The operation will be clarified by taking a sequence of events. When the first start pulse, shown in Fig. 4b for example, reaches the sync control counting chain 68, it starts this counter and simultaneously trips the multi-

6

vibrator 151 over lead 81 to the position where current flows in its left branch, making the grid 179 of the tube 161 negative. The cathode 172 of this tube is also negative at this time. At this time, the cathode 188 of the tube 162 goes positive. The cathode 188 is connected by a conductor 191 to a condenser 193 and a rectifier 194 to the grid connection for the left-hand half of the multivibrator 107. The positive pulse appearing on conductor 191 at this instant resets the multivibrators 102 to 107 so that all have plate currents flowing in the left branch. As a result of this, the tubes 112 to 117 are cut off since their control grids are all at a negative potential because of conductivity in the left branches of the multivibrators. These tubes are also held at cut-off because all of their screen grids, supplied from resistors 168 and 169 as explained above, are negative. In the same switching operation, the signal input tube 126 becomes active because the lead 191 goes positive and brings its signal grid 196 to its normal potential. The connections to the grids 131 and 196 may be interchanged when the tube 126 is of the type, by now well known, in which both grids are capable of exercising a control function.

As the first signal pulse comes into the tube 126 over the connection 63, it raises somewhat the potential of all of the points connected to the leads 82 to 87. Mid-way of the duration of the first signal pulse, the second timing pulse 69 shown in Fig. 4d arrives over lead 82 and trips the multivibrator 102. Immediately, the control grid of the tube 112 becomes slightly positive although this tube is still cut off by its screen. In the assumed example of Fig. 4a, it will be seen that the first letter "N" trips one more multivibrator 106. This leaves the control grids of the tubes 113, 114, 115, and 117 still negative.

As the second start pulse arrives, the multivibrator 151 goes over, the cathode 172 of the tube 161 goes positive, and the cathode 188 of the tube 162 goes negative. As a result, all of the screens of the tubes 112 to 117 go to their normal positive voltage. The horizontal deflection current is set at .010 ampere, and the vertical deflection current is set at .020 ampere. This moves the beam in the cathode ray tube 12 to the position "N" on Fig. 9. At the same time, the negative voltage in the lead 191 cuts off the tube 126 so that the deflection remains undisturbed by incoming signals. Correspondingly, the voltage at the cathode 172 of the tube 161 operates a tube similar to the tube 126 (not shown) to the right of the cathode ray tube 12 as it appears in Fig. 5a. This occurs over the lead 198 which corresponds in function to the lead 191. The screens of the tubes corresponding to the tubes 112 to 117, one of which, 199, is shown, are cut off so that these tubes do not interfere with the code already set up in tubes 112 to 117. A multivibrator 201 is the first one of a series of multivibrators which corresponds to the multivibrators 102 to 107. Lead 198 resets these multivibrators through condenser 202 and rectifier 203.

Looking at Fig. 9, it will be seen that combinations of currents from three tubes in the ratio of 1-2-4 can establish eight specific deflections. The code of six units per letter of the illustrative example now under discussion, therefore, can select from 64 characters. It will be understood that one position could be used to call for a "shift function." However, if 64 selections are sufficient, it would not be necessary in the arrangement described to incorporate a shift function.

The letter advance unit 204 in Fig. 3 includes circuits to locate the horizontal position of the small raster (shaded on Fig. 10) on the tube 14. This letter advance unit may be any of the well-known electronic counters such as that described in the "Electronic Digital Counters" article cited in the foregoing. The code converter 66 which has been described in detail in connection with Figs. 5 and 5a of the drawing produces a pulse on the lead 206 through rectifiers 208 and 209 as the raster finishes each letter. These pulses operate on the accumulating counter circuit of the letter advance unit 204 which constantly

moves the raster to the right so that a line of type is printed. This is accomplished by boosting the horizontal deflection current in steps. This continues until a signal is received from the code selector 214 for the "carriage return" function. The code selector 214 may be constructed either as shown in Fig. 6 or Fig. 7 of the accompanying drawing. The disclosures of these figures will be described in more detail herein. The signal from the code selector discharges the accumulated horizontal deflection set up by the counter 204 and starts over for the next line. At the same time, a signal going over to the paper advance control 34, which may be a magnetically-operated ratchet of any well-known kind, moves the sensitized sheet 29 one line.

The code selector 214 (Figs. 3 and 5a) is required to identify a few specific code functions and from them to produce operating currents for apparatus functions other than character printing. Figs. 6 and 7 show novel arrangements in accordance with the invention based on the use of saturation reactors sensitive to certain current valves rather than voltages. Referring to Fig. 6, two transformers 241 and 242 are shown. These transformers are connected in cascade and the primary of the first transformer is fed from an oscillator 240 which may generate alternating current at a frequency of, for example, 100 kc. Each transformer core structure is saturable by a direct current winding. The transformer 241 has a direct current winding 243 on its center leg, as well as the winding 246 which carries horizontal deflection current. This winding also appears in the schematic showing of Fig. 5a. The current in the winding 243 is presettable, for example, by a rheostat 248.

The winding 246 carrying the deflection current is wound to oppose the winding 243. Only when the two direct currents are equal will the core be unsaturated and effective. With special core material, the balance zone will be very sharply defined. The transformer 242 also has two windings 251 and 252 on its center leg. These windings function in the same manner as the windings 243 and 246. In the arrangement of Fig. 6 just described, there will be no current output to a device to be controlled unless both deflection currents are at preselected values. A full wave bridge-type rectifier 255 rectifies the output from the oscillator so that it is available at terminals 256 for application to apparatus which is to be controlled. In the illustrative arrangement, the output is shown as operating the paper advance control 34. Condensers 257 and 258 will short circuit the alternating current from the oscillator 240 and block the alternating current flux from the center legs when the cores are unsaturated.

Fig. 7 shows an arrangement which is similar to Fig. 6 except that the saturable cores 261 and 262 are used as variable inductances in series with a 100 kc. source 264, a resistor 266, and a condenser 268. A second condenser 271 is set to tune the two inductances represented by the coils on the core structures 261 and 262 to parallel resonance at the output frequency of the generator 264 when the cores are unsaturated. Coils 276 and 277 correspond with the coils 246 and 251 of Fig. 6. Coils 278 and 279 provide for direct current saturation. The condenser 268 tunes the system to series resonance when the cores are saturated and the inductance a minimum. This tuning accentuates the sharpness of control. The output signal is rectified by a bridge rectifier 281. The output is opposite to that of Fig. 6 since minimum current flows at the terminals 282 when controlled apparatus is to operate.

Fig. 9 suggests some of the controls which might be required and which could be provided by employing control arrangements such as are illustrated in Figs. 6 and 7. The functional operations to be provided are rest or space position, line advance, carriage return and message start. One reactor-selector combination would be needed to make each selection. All control coils could be in series with the deflection circuits. The currents in the deflection

circuits indicate the coordinates of the displacement of the beam in the tube.

Fig. 8 of the drawing indicates a modified receiver for the coded signals. Similar pieces of equipment will be given similar reference characters to those previously used except that the suffix "a" will be added. The control units are similar to those of Fig. 3 but the two flying spot systems and the raster generator have been replaced by a special tube.

The special tube is designated in its entirety by reference character 291. The pattern of characters shown by Fig. 9 is projected from a slide 293 onto a photocathode 296 which is semi-transparent in the preferred form of the tube. The deflection control, which is set up in the code converter 66a for selecting the desired letter, sweeps the electron image emitted from the photocathode 296 across a barrier 298 until only the image of the chosen letter falls on an aperture 299. The electron image from the photocathode is focussed by a focusing coil 301 and deflection is provided by a yoke shown conventionally at 302. The image of the selected letter passing through the aperture 299 is refocussed on a fluorescent screen 304 with the aid of a focussing coil 306. Deflection currents supplied to a deflecting yoke unit 308 from the letter advance unit 204a place the luminous image of the selected character in the desired position on the screen. The remainder of the system of Fig. 8 is the same as that already described in detail with reference to Fig. 3 of the drawings. As indicated on Fig. 8, the tube 291 is provided with a plurality of focussing and accelerating electrodes shown illustratively in the form of rings.

Fig. 11 of the drawings discloses another embodiment of a receiver for the coded signals which is similar to that shown by Fig. 8. A tube 321 is employed which is identical to 291 of Fig. 8. The pieces of equipment which are similar to those discussed in connection with Fig. 3 of the drawings are given the same reference characters with the suffix "b" added. The code selector 214b includes an additional selector circuit which actuates a message advance device 324 when a complete message or section of selected typescript of a complete message has been received. The code selector 214b, in addition to stepping the position of the scanning raster to provide the letter spacing function, also includes a line advance mechanism so that a counter in the letter and line advance mechanisms 326 will step the raster vertically by a distance of one line. The system of Fig. 11, which operates in accordance with the invention, is preferable when recording at high speeds. For example, at 6,000 words per minute or 100 words per second, the line by line paper advance would occur at about 10 per second. This would be about the maximum for a step-wise movement of a paper web. By recording a number of lines before a paper movement occurs, the frequency of mechanical advance of the paper will be considerably reduced.

In all of the embodiments where a speed of 10,000 words per minute, for example, is to be recorded, the continuous movement of the paper web would be desirable. This can be provided if the type line on the face 304 of tube 291 is slightly skewed and correction voltages are set up in the control units for type lines less than full length. It should be noted that the screen 304 need not retain the image of an entire line or message because each successive letter will expose the photographic paper substantially immediately. High actinic value for the emitted light is required rather than a persistent image in the phosphor.

What is claimed is:

1. A system for the electronic selection of indicia comprising cathode ray beam apparatus, a plurality of indicia producing means operatively associated with said cathode ray beam apparatus, means in said cathode ray beam apparatus for producing a plurality of cathode ray beams, each such beam having a cross-section character-

istic of one of said indicia, fixed means to select one of said beams, means responsive to received coded signals for producing beam deflection in said apparatus selectively along a plurality of deflection coordinates whereby said cathode ray beams in said apparatus are displaced to effect selection of a single indicia by said fixed means, a second beam deflection means for deflecting a selected beam, and means whereby said second deflection means is operable along a single coordinate of deflection in response to repeated operations of said first-named beam deflection means.

2. A system for the electronic selection of indicia comprising a radiant energy source, a cathode ray tube having means on the inner surface of a tube face for producing an electron stream in response to radiant energy excitation, means for maintaining the cross-sectional area of said stream, deflection means for deflecting said cathode ray stream, means associated with the outer face of said tube having characters to be selected applied thereon, said last-named means being in the radiant energy path between said tube face and said radiant energy source, control means operative to control said deflection for deflecting the cathode ray stream of said tube in one coordinate direction, and a further control means operative to control said deflection for deflecting the cathode ray stream of said tube in another coordinate direction.

3. A system for the electronic selection of indicia comprising a radiant energy source, a cathode ray tube having means on the inner surface of a tube face for producing an electron stream in response to radiant energy excitation, means for maintaining the cross-sectional area of said stream, deflection means for deflecting said cathode ray stream, means associated with the outer face of said tube having characters to be selected applied thereon, said last-named means being in the radiant energy path between said tube face and said radiant energy source, control means operative to control said deflection for deflecting the cathode ray stream of said tube in one coordinate direction, a further control means operative to control said deflection for deflecting the cathode ray stream of said tube in another coordinate direction, an apertured mask in the path of said electron stream, said aperture passing a portion of said stream as a cathode ray beam whose cross-section represents a selected character, means for maintaining the cross-sectional area of said beam, a second tube face, means on the inner surface

of said second tube face for providing radiant energy in response to impingement of said beam, and means for deflecting said beam in one direction.

4. A system for the electronic selection of indicia comprising a radiant energy source, a cathode ray tube having means on the inner surface of a tube face for producing an electron stream in response to radiant energy excitation, means for maintaining the cross-sectional area of said stream, deflection means for deflecting said cathode ray stream, means associated with the outer face of said tube having characters to be selected applied thereon, said last-named means being in the radiant energy path between said tube face and said radiant energy source, control means operative to control said deflection for deflecting the cathode ray stream of said tube in one coordinate direction, a further control means operative to control said deflection for deflecting the cathode ray stream of said tube in another coordinate direction, an apertured mask in the path of said electron stream, said aperture passing a portion of said stream as a cathode ray beam whose cross-section represents a selected character, means for maintaining the cross-sectional area of said beam, a second tube face, means on the inner surface of said second tube face for providing radiant energy in response to impingement of said beam, means for deflecting said beam in one direction, and means for deflecting said beam in a coordinate direction.

References Cited in the file of this patent

UNITED STATES PATENTS

1,978,684	McCreary	Oct. 30, 1934
2,098,390	Iams	Nov. 9, 1937
2,219,149	Goldsmith	Oct. 22, 1940
2,251,525	Rosenthal	Aug. 5, 1941
2,275,017	McNaney	Mar. 3, 1942
2,283,383	McNaney	May 19, 1942
2,379,880	Burgess	July 10, 1945
2,433,340	Burgess	Dec. 30, 1947
2,442,403	Flory et al.	June 1, 1948
2,517,986	Dickinson	Aug. 8, 1950
2,538,065	Wallace	Jan. 16, 1951
2,548,049	Olson	Apr. 10, 1951
2,603,418	Ferguson	July 15, 1952