June 7, 1955 H. S. BEATTIE 2,709,959

FOUR-LINE PRINTING MECHANISM

Filed Aug. 19, 1950 10 Sheets-Sheet 1

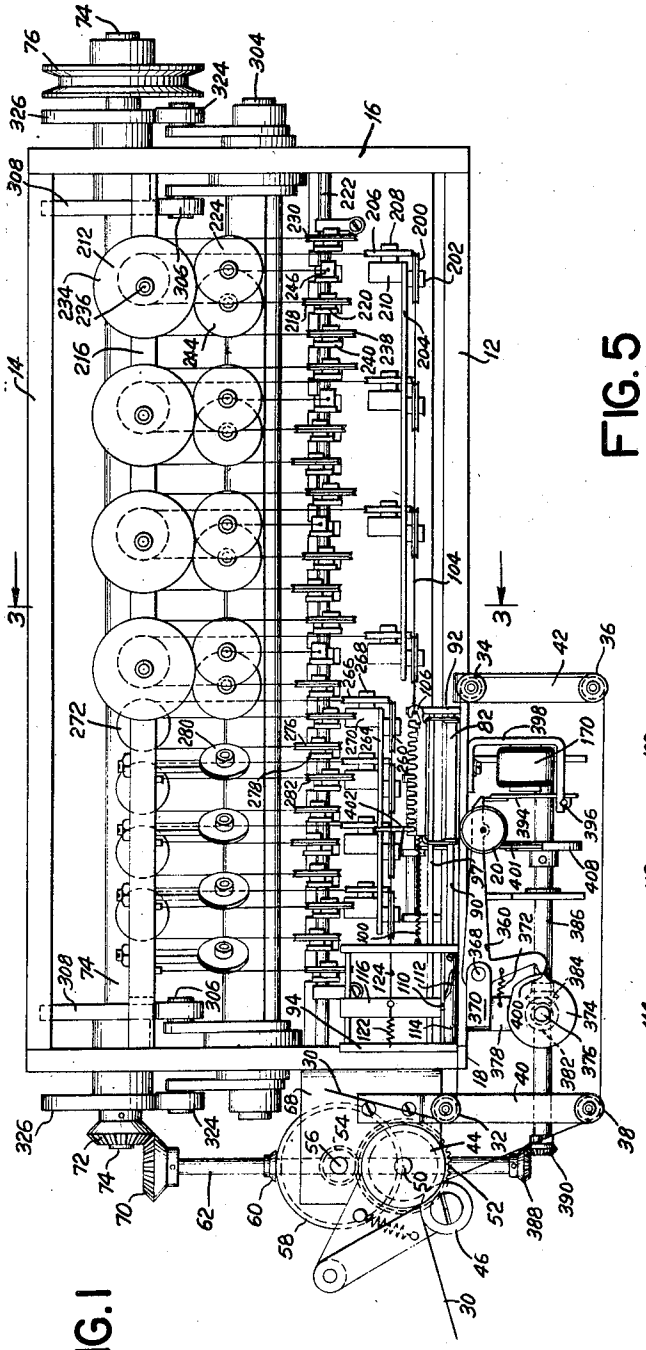


FIG. 1

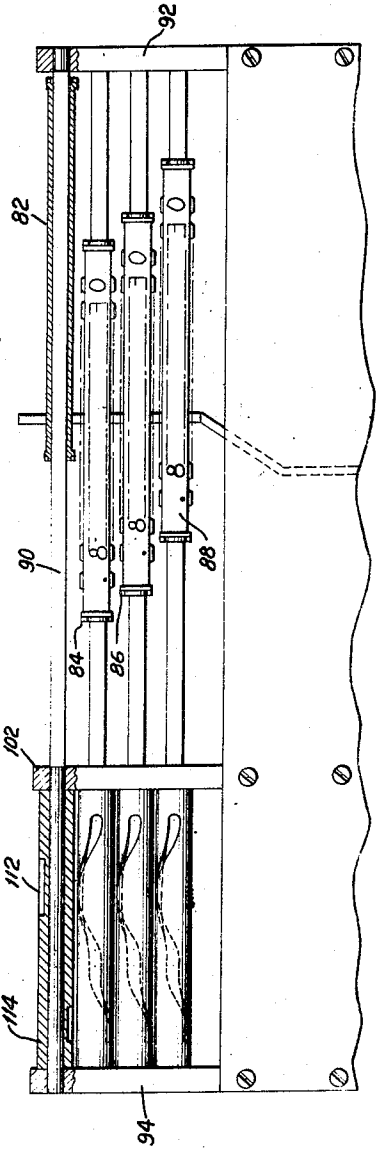


FIG. 5

INVENTOR.
HORACE S. BEATTIE
BY Robert L. Dunham
ATTORNEY

June 7, 1955 H. S. BEATTIE 2,709,959

FOUR-LINE PRINTING MECHANISM

Filed Aug. 19, 1950 10 Sheets-Sheet 2

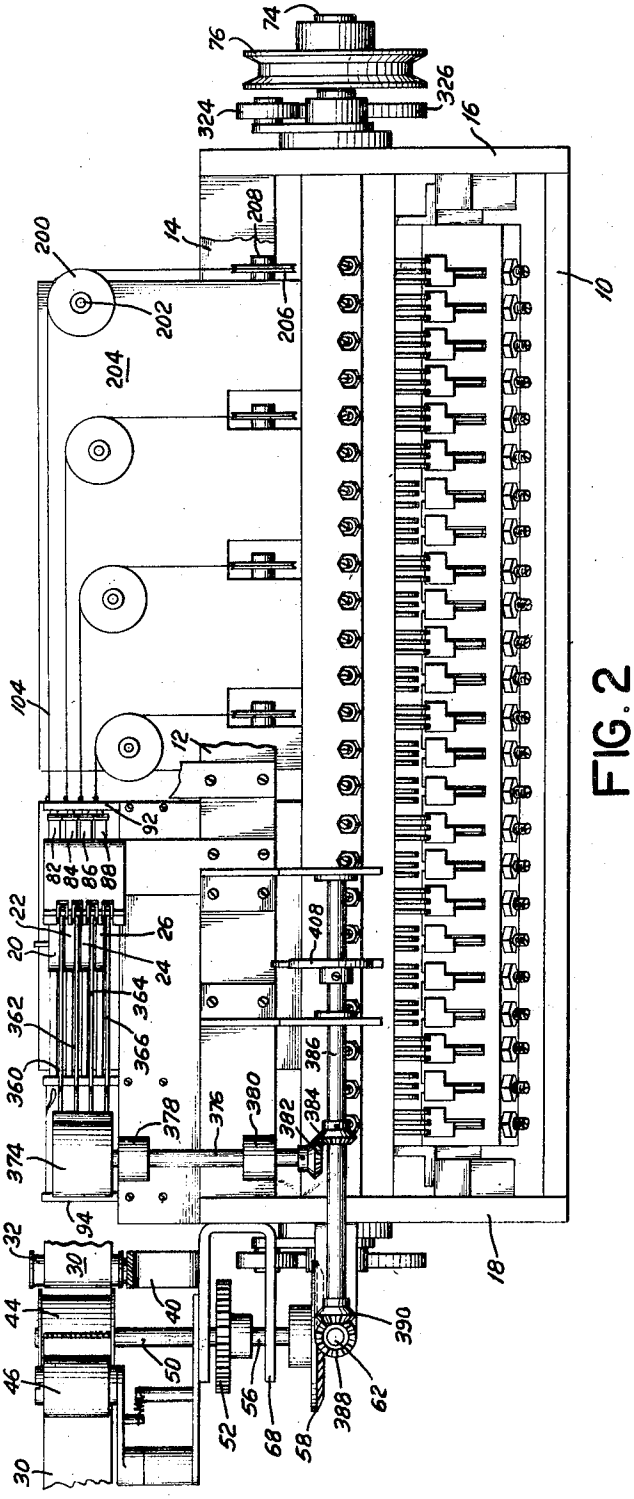


FIG. 2

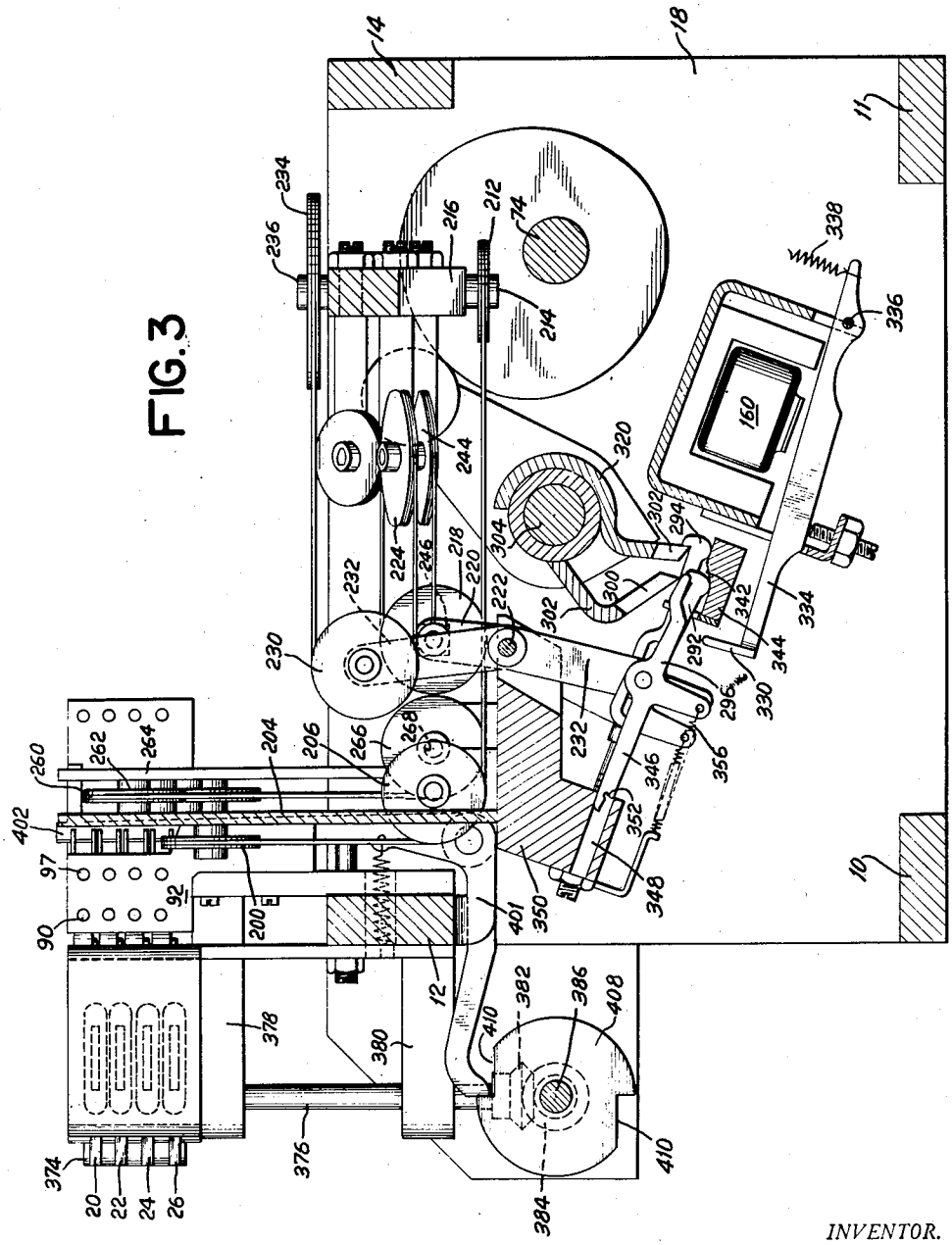
INVENTOR.
HORACE S. BEATTIE
BY Robert S. Dunham
ATTORNEY.

June 7, 1955 H. S. BEATTIE 2,709,959

FOUR-LINE PRINTING MECHANISM

Filed Aug. 19, 1950 10 Sheets-Sheet 3

FIG. 3



INVENTOR.

HORACE S. BEATTIE

BY Robert L. Dunlap

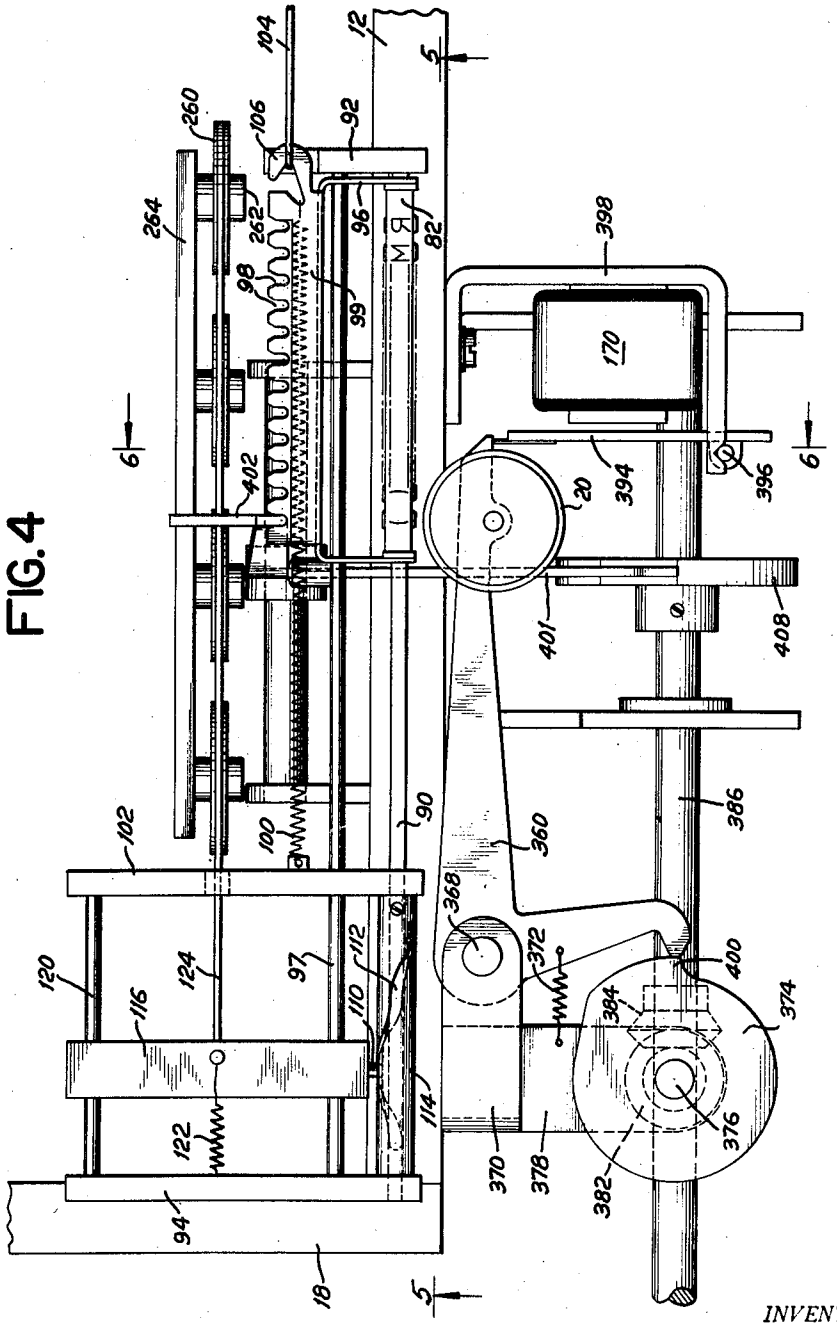
ATTORNEY.

June 7, 1955 H. S. BEATTIE 2,709,959

FOUR-LINE PRINTING MECHANISM

Filed Aug. 19, 1950 10 Sheets-Sheet 4

FIG. 4



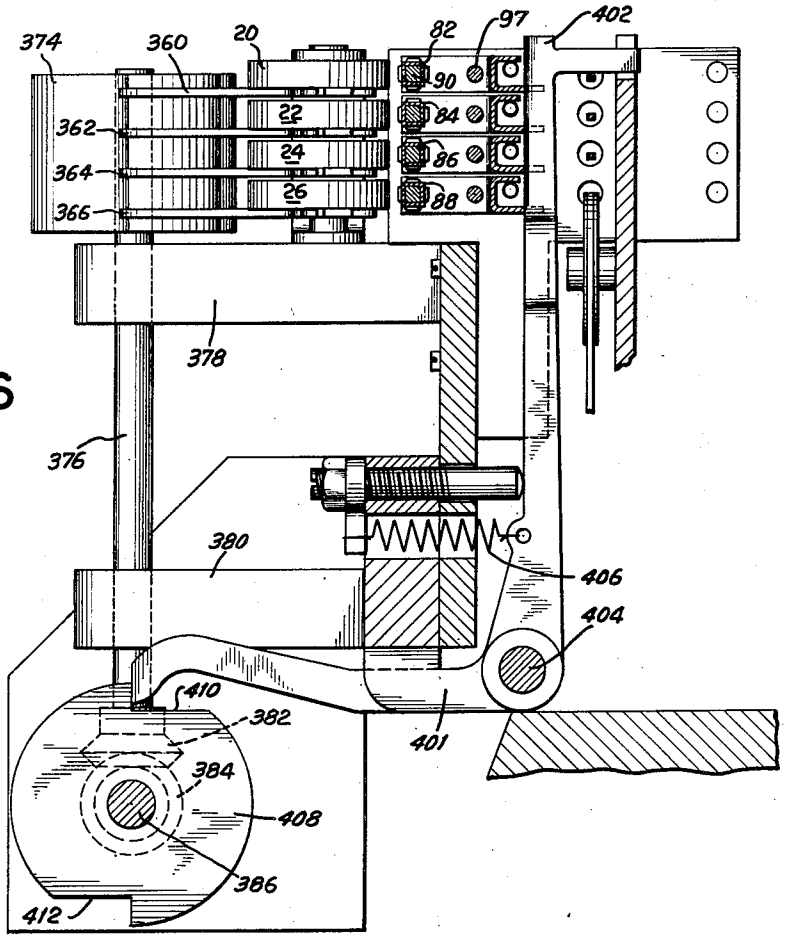
INVENTOR.
HORACE S. BEATTIE
BY Robert L. Dunlam
ATTORNEY.

June 7, 1955 H. S. BEATTIE 2,709,959

FOUR-LINE PRINTING MECHANISM

Filed Aug. 19, 1950 10 Sheets-Sheet 5

FIG. 6



INVENTOR.

HORACE S. BEATTIE

BY Robert S. Dunham

ATTORNEY.

June 7, 1955 H. S. BEATTIE 2,709,959

FOUR-LINE PRINTING MECHANISM

Filed Aug. 19, 1950 10 Sheets-Sheet 6

FIG. 7

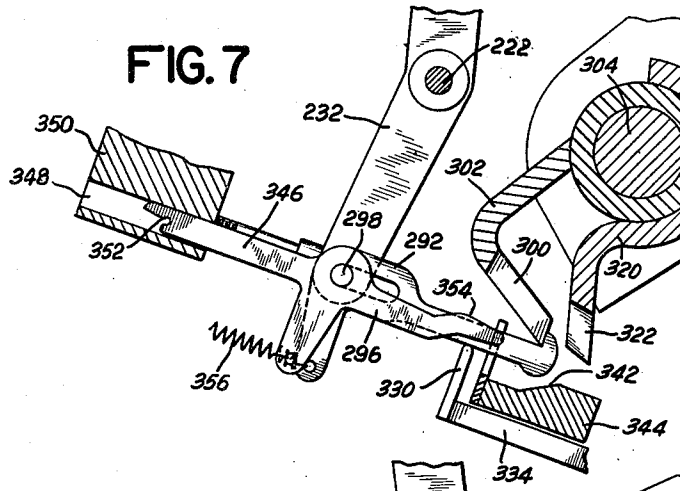


FIG. 8

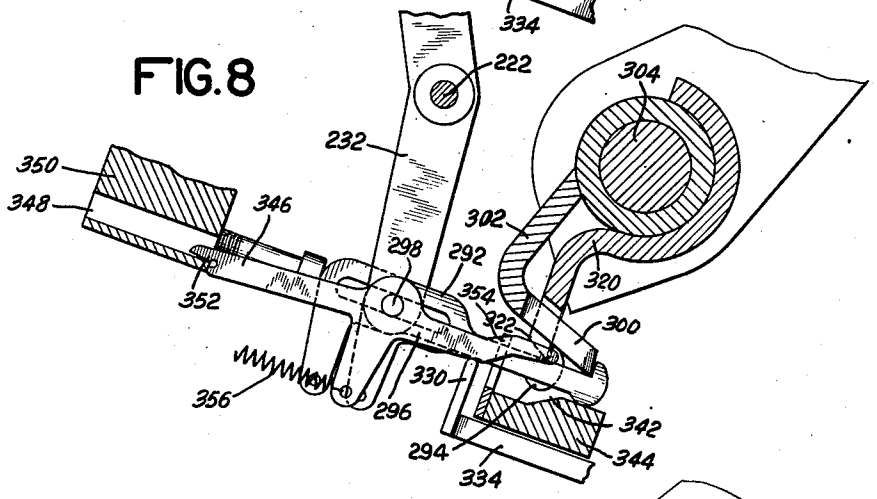
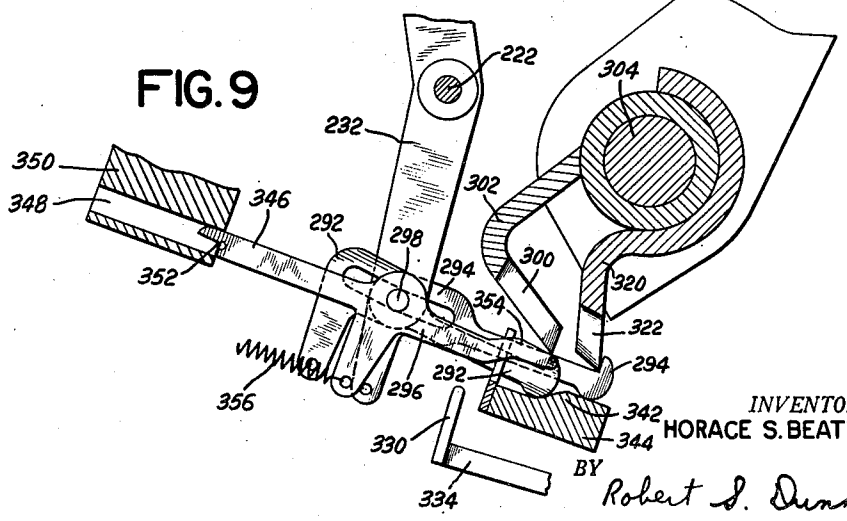


FIG. 9



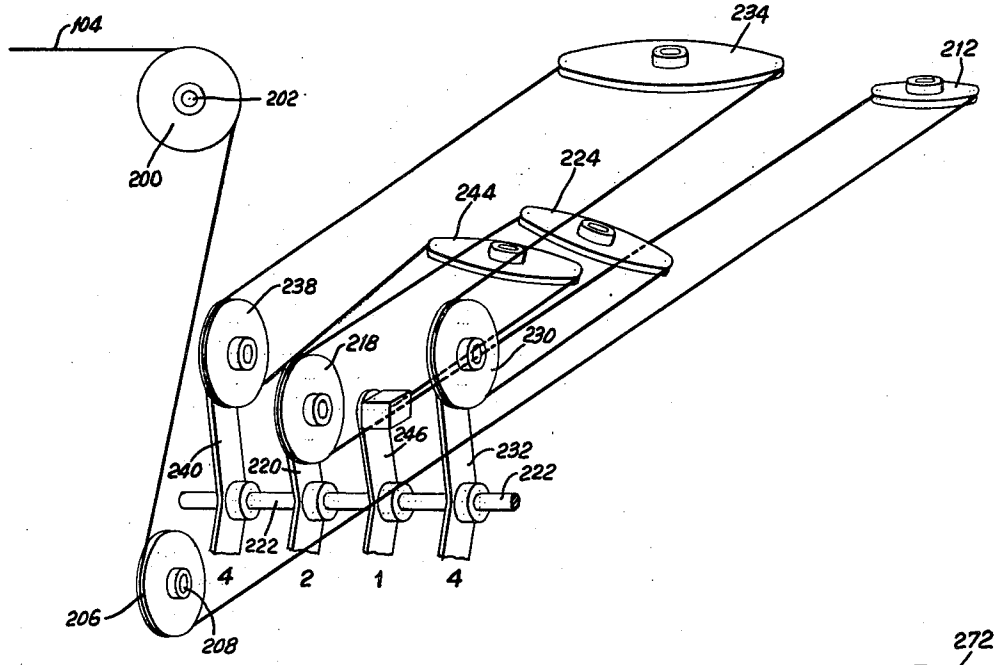
INVENTOR.
HORACE S. BEATTIE
BY Robert S. Dunham
ATTORNEY.

June 7, 1955 H. S. BEATTIE 2,709,959

FOUR-LINE PRINTING MECHANISM

Filed Aug. 19, 1950 10 Sheets-Sheet 7

FIG. IC



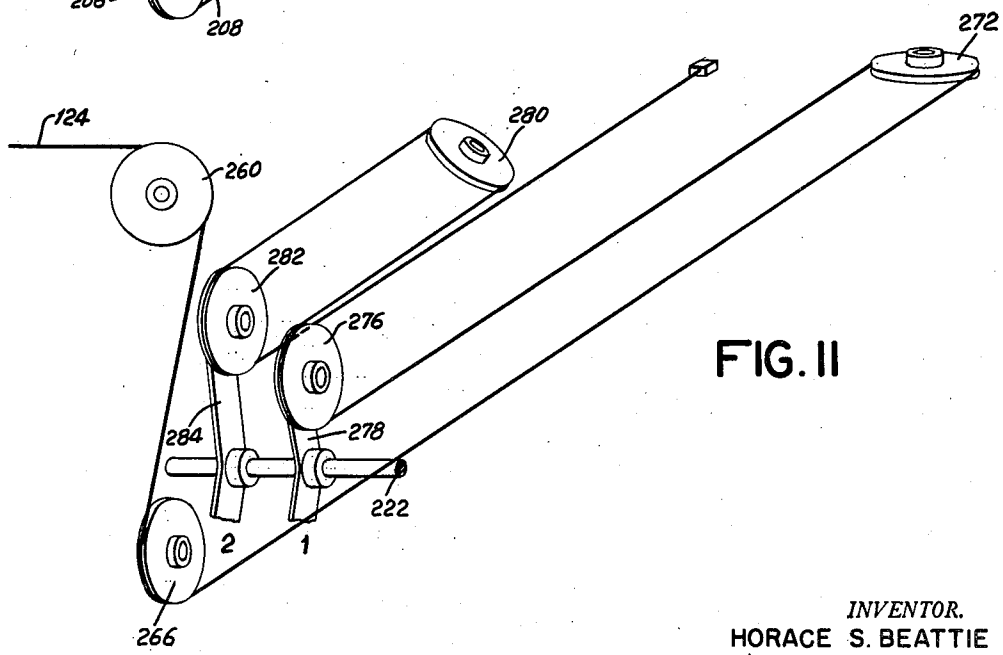


FIG. II

INVENTOR.
HORACE S. BEATTIE
BY Robert S. Dunlam
ATTORNEY.

June 7, 1955 H. S. BEATTIE 2,709,959

FOUR-LINE PRINTING MECHANISM

Filed Aug. 19, 1950 10 Sheets-Sheet 8

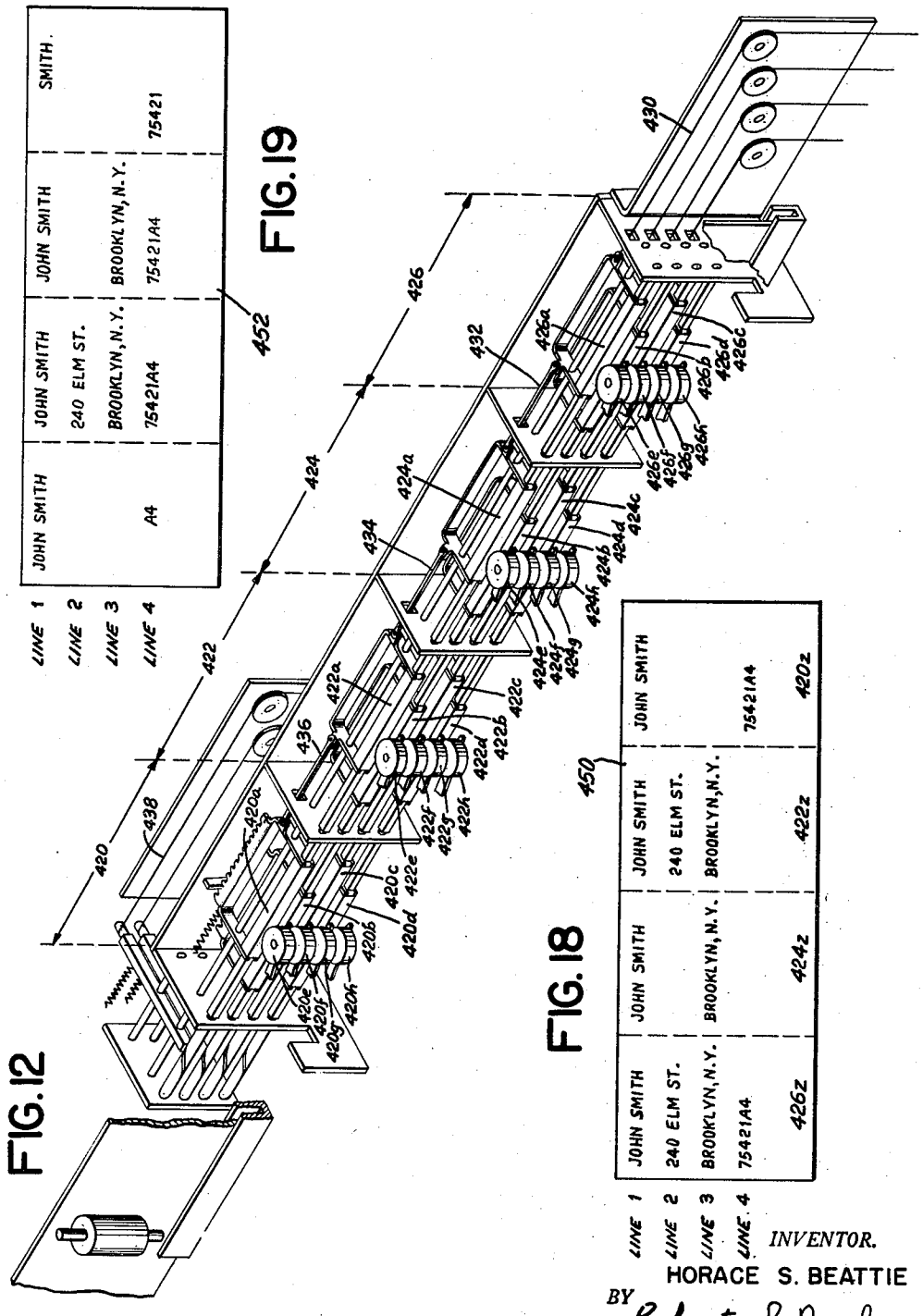


FIG. 19

FIG. 12

FIG. 18

INVENTOR.
HORACE S. BEATTIE
BY Robert L. Dunham
ATTORNEY.

June 7, 1955 H. S. BEATTIE 2,709,959

FOUR-LINE PRINTING MECHANISM

Filed Aug. 19, 1950 10 Sheets-Sheet 9

FIG. 14

FIG. 15

FIG. 16

FIG. 17

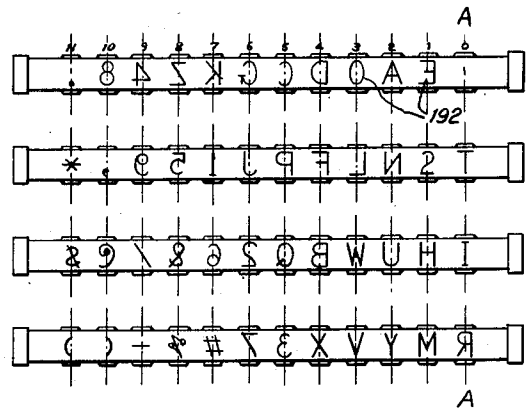


FIG. 13

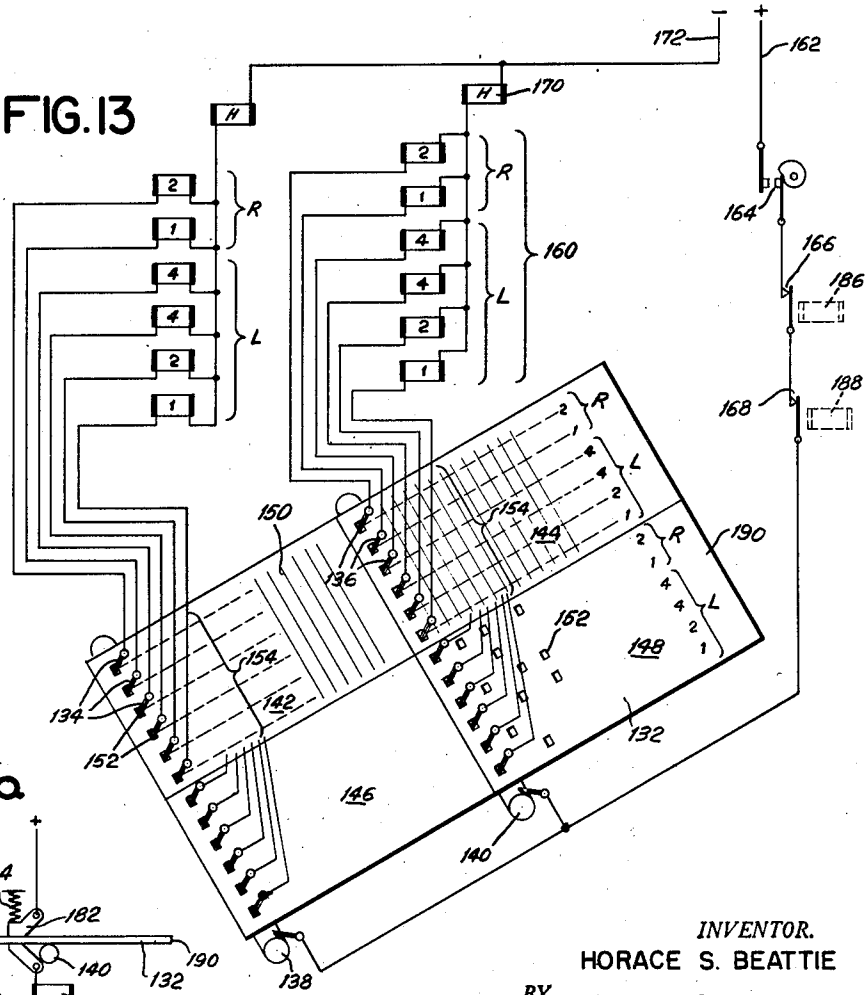
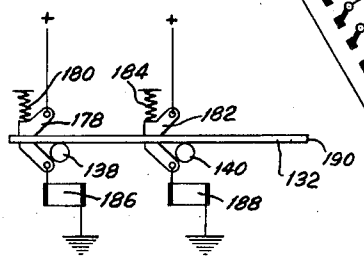


FIG. 13a



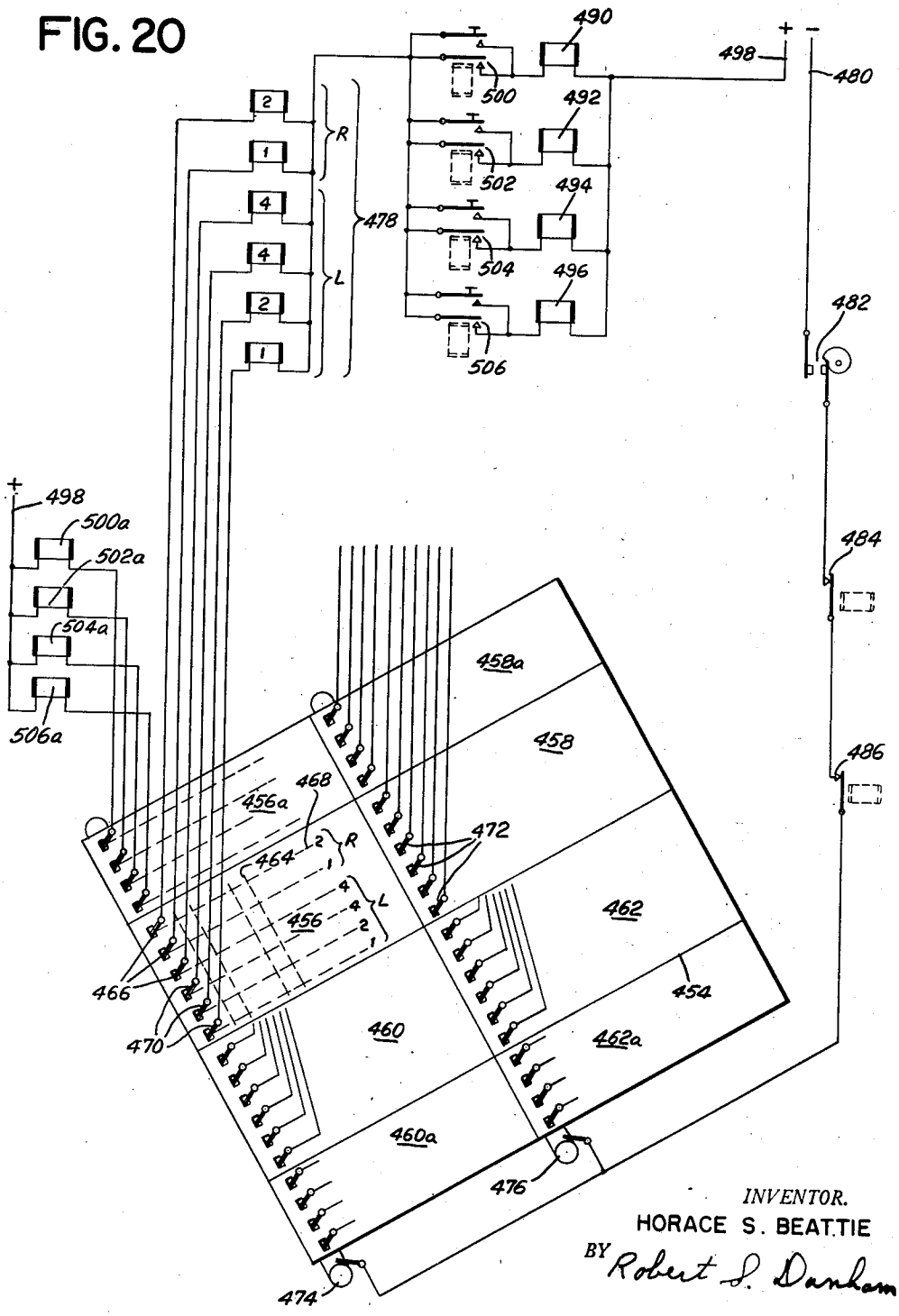
INVENTOR.
HORACE S. BEATTIE
BY Robert S. Dunham
ATTORNEY.

June 7, 1955 H. S. BEATTIE 2,709,959

FOUR-LINE PRINTING MECHANISM

Filed Aug. 19, 1950 10 Sheets-Sheet 10

FIG. 20



INVENTOR.
HORACE S. BEATTIE
BY Robert S. Dunham
ATTORNEY.

United States Patent Office 2,709,959 Patented June 7, 1955

2,709,959

FOUR-LINE PRINTING MECHANISM

Horace S. Beattie, Poughkeepsie, N. Y., assignor to International Business Machines Corporation, New York, N. Y., a corporation of New York

Application August 19, 1950, Serial No. 180,479

25 Claims. (Cl. 101—93)

This invention relates to printing apparatus and particularly to high-speed multiple-operation printing apparatus controlled by character designations in a record.

The invention may be briefly described as a novel high-speed printing device controlled by character designations in a record for effecting multiple printing operations, i. e. multi-line column-by-column printing, or multi-column, line-by-line printing. The printing device includes a plurality of lineally and rotatably displaceable type slides associated with a control mechanism responsive to sensed character designations in a record for selectively and positively displacing the type slides in accordance with the sensed character designations. The control mechanism includes means for selectively positioning the type slides intermediate successive sensing operations so that the type slides move directly from one character to the next without returning to their normally biased position. Also included in the invention are a plurality of printing hammers associated with the type slides for effecting individual impression transfers of the type on the slides to an intermittently or continuously moving strip or web of impression-receiving material. The invention also embodies a record sensing mechanism for sensing character designations in a record or strip in successive order and during uninterrupted movement thereof with the character selecting devices coordinated so that each succeeding designation is sensed while an impression is being taken in accordance with the preceding selection.

The principal object of this invention is the provision of a novel, high-speed printing apparatus for effecting multiple printing operations.

Another object of this invention is the provision of a novel, high-speed printing apparatus for effecting multiline column-by-column printing.

Another object of this invention is the provision of novel, high-speed printing devices in which a plurality of characters are positioned in a predetermined array on type slides past which a strip or web of impression-taking material is intermittently or continuously moved. To select characters for printing, the type slides are lineally and/or rotatably displaced to present the desired characters at a printing or impression-taking locality.

Another object of this invention is the provision of a control mechanism for selectively positioning the type slides in accordance with the sensed character designations.

Another object of this invention is the provision of a latching mechanism included in the control mechanism for latching the displaced type slides intermediate successive printing or impression-taking operations so that they move directly from one character to the next without returning to their initial or biased position.

Another object of this invention is the provision of an improved printing or impression-taking assembly for printing or transferring impressions on to a continuously moving web or strip of impression-receiving material.

Another object of this invention is the provision of

an improved record sensing mechanism for simultaneously sensing character designations effecting each of the type slides in uninterrupted order with the control mechanism coordinated so that each succeeding character designation is sensed while an impression is being taken in accordance with the preceding selection.

Other objects of the invention will be pointed out in the following disclosure and claims and illustrated in the accompanying drawings which disclose, by way of example the principle of the invention and the presently preferred embodiment of the printing device applying that principle.

Referring to the drawings:

Fig. 1 is a plan view of the presently preferred embodiment of the invention;

Fig. 2 is a side elevational view of the presently preferred embodiment of the invention;

Fig. 3 is a sectional view, generally on the line 3—3 of Fig. 1;

Fig. 4 is an enlarged plan view of a portion of the embodiment of the invention illustrated in Fig. 1;

Fig. 5 is a sectional view on the line 5—5 of Fig. 4;

Fig. 6 is a sectional view on the line 6—6 of Fig. 4;

Figs. 7, 8 and 9 are detailed views, partially in section, of a portion of the control mechanism including the latching mechanism.

Fig. 10 is an isometric, schematic view of the portion of the control mechanism for lineally displacing a type slide;

Fig. 11 is an isometric view of a portion of the control mechanism for rotatably displacing a type slide;

Fig. 12 is an isometric view of the arrangement of multiple type slides for use in a gang printer embodying the principles of this invention;

Fig. 13 is a schematic view illustrating the details of the record sensing mechanism;

Fig. 13*a* is a schematic representation of a switching mechanism adapted for use with the record card feeding mechanism;

Figs. 14 through 17 are side elevational views of a type slide illustrating an arrangement for the type characters on each of the sides thereof;

Fig. 18 illustrates a bill of the type that might be printed on the gang printer illustrated in Fig. 12;

Fig. 19 illustrates another type of bill that might be printed on the gang printer illustrated in Fig. 12; and

Fig. 20 is a schematic illustration of the sensing mechanism adapted for use with the gang printer illustrated in Fig. 12.

The drawings enumerated above illustrate a multiline column-by-column printing device adapted to effect successive columnar presentations of four lines of print. However, it should be clearly understood that the principles of this invention apply generally to multi-line printing irrespective of the actual number of lines of printing to be effected. In addition, the principles of the invention are applicable to a printing device for effecting successive linear presentation of multiple columns of print.

Referring to Figs. 1, 2 and 3, the apparatus is supported on the base plates **10** and **11** to which are secured the vertical side plates **16** and **18** tied together by a back plate **14** and a front plate **12**. The front plate **12** and the side plate **18** support a paper and transfer ribbon assembly. The printing platens in the preferred embodiment of the invention as illustrated in the drawings consist of four individual circular printing hammers **20**, **22**, **24** and **26**, positioned at and defining a printing or impression transfer locality. As the embodiment of the invention set forth in the drawings illustrates a four-line printer, a printing hammer is provided for each line of print. The construction and operation of the print-

ing hammer assembly will be described in detail at a later point in this specification.

A paper strip and ink ribbon **30** is fed from a suitable supply source (not shown) and advanced past the printing locality, as defined by the printing hammers **20**, **22**, **24** and **26**, by a feed roller **44** mounted on a shaft **50** and spring pressed follower **46** and is guided in its path of travel by suitable guide rollers **32**, **34**, **36** and **38** mounted on extending guide roller supporting arms **40** and **42**. Mounted on the shaft **50** below the feed roller **44** is a gear **52** which meshes and is driven by a pinion **54** mounted on an auxiliary shaft **56**. The auxiliary shaft **56** also mounts a large bevel gear **58** which meshes with and is driven by beveled pinion **60** mounted on a drive shaft **62** disposed externally of and parallel to the side wall **18**. The shafts **50** and **56**, together with the members mounted thereon and the spring pressed follower **46** are supported by a U-shaped mounting bracket **68** extending outwardly from the side plate **18**. The U-shaped mounting bracket **68** also supports the extending guide roller supporting arm **40** having the paper and ink ribbon guide rollers **32** and **38** mounted thereon.

The drive shaft **62** is driven through the bevel gears **70** and **72** by the main drive shaft **74** which is positioned between and is rotatably supported by the side plates **16** and **18** and is provided with a driving gear or pulley **76** on the portion thereof extending outwardly from the side plate **16**. The main drive shaft **74** is adapted to be continuously driven, by means such as a motor (not shown) when the machine is in operation. Through the chain of gearing traced above, it will be noted that when the main drive shaft **74** is in motion, the paper strip and ink ribbon **30** is continuously and uninterruptedly advanced past the printing locality as defined by the positioning of the printing hammers **20**, **22**, **24** and **26**.

Referring to Figs. 1, 4 and 5, the printing elements utilized are four four-sided type slides, **82**, **84**, **86** and **88** positioned for multi-line column-by-column printing. The type slides have raised type characters positioned on each of the sides thereof and the disposition of the characters on each of the sides of one of the type slides is illustrated in Figs. 14 through 17.

Selection of characters for printing is accomplished by lineally and/or rotatably displacing the individual type slides to advance the characters to be printed to the printing locality as defined by the location of the printing hammers **20**, **22**, **24** and **26**.

In the interest of brevity, the mounting of the uppermost type slide **82** will be explained in detail with the understanding that a similar mounting is provided for the remaining three type slides **84**, **86** and **88**.

The type slide **82** is slidably mounted on a horizontally disposed shaft **90** of square cross section which is rotatably supported at one end by an upright mounting plate **92** secured to the front plate **12**, and rotatably supported at its other end by a plate **94** secured to and extending upwardly from the side plate **18**. The type slide **82** is contained within the forked ends of the arms of a U-shaped positioning bracket **96** slidably mounted on a shaft **97** supported by said plates **92** and **94**. The back of the U-shaped positioning bracket **96** supports a plate **99** having a plurality of positioning indentations **98** aligned with the type characters on the face of the type slide **82** for centering the characters presented at the printing locality during printing operations. The type slide **82** is normally biased in a lineal rest position by the biasing spring **100** secured to a frame member **102** and to said U-shaped positioning bracket **96**. The U-shaped positioning bracket **96** is lineally displaceable along the axis of the shaft **97** by the action of a steel pull tape **104** secured to a hook **106** at the end of said bracket. As the type slide **82** is positioned between the arms of said U-shaped bracket **96**, the type slide is displaced along the shaft **90** in accordance with the displacements of the bracket **96** on the shaft **97**.

The type slide **82** is independently rotatably displaceable by the action of a horizontally displaceable pin **110** riding in a suitably shaped guiding channel **112** in a cylindrical sleeve **114** secured to the shaft **90** and positioned between the mounting plate **94** and frame member **102**. The pin **110** is mounted in and extends outwardly from a bar **116** slidably mounted on the shaft **97** and a parallel shaft **120** positioned between the frame member **102** and the mounting plate **94**. The bar **116** is biased in a rest position by a spring **122** secured to said bar and to the bracket **94** and is horizontally displaced through the action of the steel pull tape **124** connected thereto. The horizontal displacement of the bar **116** by the pull tape **102** rotates the sleeve **114** through the cam action of the pin **110** riding in the channel **112**. Rotation of the sleeve **114** results in rotation of the shaft **90** and the type slide **82** mounted thereon. The above described construction permits the simultaneous lineal and rotatable displacement of the type slide **82** through the action of the steel pull tapes **104** and **124** in order to present a character to be printed located on any of the faces of the type slide at the printing locality as defined by the location of the printing hammer **20**.

Referring now to Fig. 13, the power source utilized to continually rotate the main drive shaft **74** may also conveniently be synchronized to a drive system utilized to advance successive record cards, such as the record card **132**, past dual rows of sensing brushes **134** and **136** and their adjacent respective contact rollers **138** and **140**.

The record card **132** is illustrated as being subdivided into four sensing areas designated **142**, **144**, **146** and **148**, one sensing area being provided for each of the type slides **82**, **84**, **86** and **88**. Each of these sensing areas is provided with columns designated **150** in which perforations **152** are combinationally made in six rows designated **154** to represent particular characters to be printed by each of the type slides. As the device illustrated in the drawings is for four-line column-by-column printing operations, the four sensing areas **142**, **144**, **146** and **148** in the card **132** are each utilized to control a single line of print.

For the purposes of description, the arrangement of the combinational perforations in sensing area **144** will be explained in detail, with the understanding that a similar arrangement is provided for the remaining sensing areas **142**, **146**, and **148**. The rows **154** in the sensing area **144** are divided into an upper set of two, designated generally as "R," representing rotative displacement, with the individual rows in that set being designated as "2" and "1," and a lower set of four, designated generally as "L," representing lineal displacement, with the individual rows therein being designated as "4," "4," "2" and "1."

The following table I lists the characters that may be represented, i. e. those presented on the type slide illustrated in Figs. 16–19, and the particular perforational combinations required for each. Thus, for example, the letter "E" is represented by a perforation in the "1" row of set "L" indicating that a lineal displacement of the type slide of one unit is required to present the character "E" at the printing locality and the number "9" is represented by a perforation in the "1" row of set "R" indicating a rotative displacement of one unit and by perforations in the "1," "4" and "4" rows of set "L" indicating a lineal displacement of nine units, the combined rotative displacement and lineal displacement resulting in the presentation of the type character number "9" at the printing locality.

Table I

	R		L			
	2	1	1	2	4	4
E			X			
A				X		

Table I—Continued

	R		L			
	2	1	1	2	4	4
O			X	X		
D					X	
C			X		X	
G				X	X	
K			X	X	X	
Z					X	X
4			X		X	X
8				X	X	X
•			X	X	X	X
T		X				
S		X	X			
N		X		X		
L		X	X	X		
F		X			X	
P		X	X		X	
J		X		X	X	
1		X	X	X	X	
5		X			X	X
9		X	X		X	X
;		X		X	X	X
*		X	X	X	X	X
I	X					
H	X		X			
U	X			X		
W	X		X	X		
B	X				X	
Q	X		X		X	
2	X			X	X	
6	X		X	X	X	
&	X				X	X
/	X		X		X	X
@	X			X	X	X
$	X		X	X	X	X
R	X	X				
M	X	X	X			
Y	X	X		X		
V	X	X	X	X		
X	X	X			X	
3	X	X	X		X	
7	X	X		X	X	
#	X	X	X	X	X	
%	X	X			X	X
-	X	X	X		X	X
(	X	X		X	X	X
)	X	X	X	X	X	X

Each of the brushes in the row of brushes **136** positioned for sensing the sensing area **144** is connected to one of a group of magnets **160** which are designated with the letters "R" and "L" and suitable numbers to identify the respective magnets with the rows with which each is associated. The groups of magnets **160** associated with the sensing areas **142** and **144** are illustrated in the drawings. However, it will be understood that similar groups of magnets are provided for the rows of brushes sensing the areas **146** and **148**.

Thus, as the successive columns **150** of the record card **132** pass the rows of brushes **134** and **136**, with the record card **132** positioned as illustrated in the drawing, the magnets **160** will be repeatedly energized in combinations corresponding to the perforational arrangements in each of the columns **150** in each of the sensing areas **142**, **144**, **146** and **148**.

The sensing circuit extends from one side of the power line **162** through cam controlled synchronizing contacts **164** (operated by cams conveniently mounted on the main drive shaft **74** to synchronize the sensing activity with the rotation of the drive shaft), the relay contact points **166** and **168**, the contact rolls **138** and **140**, the perforations in the record card **132**, the brushes **134** and **136**, the magnets **160** in accordance with the perforational arrangement of the perforations **152**, the printing hammer control magnet **170** and back to the other side of the power line **172**.

As the record card **132** is provided with four separate sensing areas **142**, **144**, **146** and **148**, means are provided to prevent the sensing of the areas **144** and **148** by the brushes **134** which are adapted to only sense the areas **142** and **146** and to prevent the sensing of areas **142** and **146** by the brushes **136** which are adapted to only sense the areas **144** and **148**. Referring to Fig. 13*a*, a simple switching mechanism is there illustrated for energizing the

sensing circuits only when the sensing areas **142** and **146** are being sensed by the brushes **134**, and the sensing areas **144** and **148** are being sensed by the brushes **136**. There is provided a switch **178** normally biased in a closed position by a spring **180** and positioned adjacent the contact roll **138**. Positioned adjacent the contact roll **140** is a second switch **182** normally biased in a closed position by a spring **184**. Included in series with the switch **178** is a relay energizing coil **186**. Included in series with the switch **182** is a relay energizing coil **188**.

When a record card **132** is positioned as illustrated in Fig. 13, i. e. at the start of sensing operations, with the first column **150** in the sensing areas **142** and **146** positioned beneath the brushes **134** and with the first column **150** in the sensing areas **144** and **148** positioned beneath the brushes **136**, the presence of the card **132** will maintain both switches open and the relay energizing coils **186** and **188** will be in a de-energized condition with the relay contact points **166** and **168** responsive thereto, respectively, closed and completing the sensing circuits. When the trailing edge **190** of the record card **132** advances through the switch **182**, the spring **184** will close the switch and the completion of the circuit energizes the coil **188**, resulting in the opening of the relay contact points **168**. The opening of the contact points **168** opens the sensing circuits as described above. Further advance of the trailing edge **190** past the switch **178** results in the opening of the contact points **166**. The switch **182** will remain closed until the leading edge of the next card to be sensed opens the switch **182** and opens the energizing circuit for the coil **188**. The de-energizing of the coil **188** resulting from the opening of the switch **182** results in a closure of the relay contact points **168**. In a similar manner this leading edge, after opening the switch **182**, will next open the switch **178**, which through the de-energization of the coil **186** closes the relay points **166**. The sensing circuit is again completed and sensing operations may then take place on this next successive record card.

The above described switching arrangement thus prevents the sensing of the areas **144** and **148** by the brushes **134** and the sensing of the areas **142** and **146** by the brushes **136**, and therefore limits the sensing activities of the brushes **134** to the sensing of the areas **142** and **146** and the sensing activities of the brushes **136** to the sensing of the areas **144** and **148**.

The mechanism for successively advancing the record card **132** is not shown in the drawings as such card advancing mechanisms are well-known in the art. However, the record card **132** should be advanced past the brushes **134** and **136** at a rate so that a column **150** on said card passes the line of brushes **134** and **136** for each half revolution of the main drive shaft **74**. This relationship may be conveniently obtained by introducing suitable gearing between the main drive shaft **74** and the card advancing mechanism. The contacts **164** are adjusted to make and break the sensing circuits while the columns are being sensed in accordance with the rotative position of the main drive shaft **74**.

In the embodiment of the invention illustrated in the drawings, a printing hammer magnet **170** is connected in series with each series of magnets **160** and hence said magnet **170** will only be energized for printing operations if one of the group of magnets **160** is also energized.

Referring to Figs. 14 through 17, a plurality of type characters **192** are disposed longitudinally on each of the four surfaces of the type slide there illustrated as viewed from the position of the printing hammers. Fig. 14 illustrates the type slide in its normal or rest position and it will be noted that there is a blank space disposed beneath the line A—A which represents the location of the printing locality as defined by the position of the printing hammers as described above.

To select a desired character for printing, the type slide is lineally displaced to the right, i. e. in the direction of the arrow identified by the letter L and/or rotatively dis-

placed from its normal rest position illustrated in Fig. 14 to bring the character to be printed to the position initially occupied by the blank space described above. Fig. 14 illustrates the type slide in its normal or rest position. Fig. 15 illustrates the positioning of the type slides after rotation of 90 degrees from the rest position. Figs. 16 and 17 illustrate the positioning of the type slide after rotations of 180 and 270 degrees, respectively, from the rest position.

The amount of lineal displacement of the type slide required for presentation of any given type character 192 is indicated by the reference numeral positioned above the lines of type characters 192 illustrated in Figs. 14 through 17. These numerical designations correspond to the punching positions in the rows 154 of the record card 132 identified by the letter L representing linear displacement.

In a similar manner, the presentation of type occasioned by a rotation of the type slide through 90 degrees, which may be described as one unit of rotative displacement, is illustrated in Fig. 15 and the presentation of type occasioned by rotations of 180 and 270 degrees, which may be designated as two and three units of rotative displacement, respectively, are illustrated in Figs. 16 and 17.

The rotative designations correspond to the punching positions in the rows 154 of the record card 132 identified by the letter R. The necessary displacement for the presentation of any specific type character at the printing locality is obtained by adding the designated lineal and rotative displacement values for the character as set forth in Table I. For example, the letter "C" (see Table I) is represented by lineal displacement values of one and four. An examination of the type arrangement on the face of the type slide illustrated in Fig. 14 shows that the type slide must be displaced five units to the right to present the letter "C" in the printing locality. Taking another example, a reference to Table I shows that the presentation of the numeral "7" at the printing locality requires a rotative displacement of three units and a lineal displacement of six units. In a similar manner, other characters may be inspected and from Table I the extent and direction of movement of the type slide necessary to present such characters to the printing locality may be determined.

The lineal displacement mechanism

There is provided a separate mechanism for effecting the lineal displacement of the type slides and this will be first described. For the purposes of simplicity, the mechanism for lineally displacing the type slide 82 will be described in detail, with the understanding that a similar mechanism is provided for displacing each of the remaining type slides 84, 86 and 88.

Referring to Figs. 1, 2, 3, 4, 10 and 11 (Note: although Fig. 3 illustrates the positioning mechanism for type slide 88, it is identical in construction with that for type slide 82 and will be so used for descriptive purposes) the tape 104 horizontally extends from the hook 106 and just passes around a grooved wheel 200 rotatably mounted on a stud 202 on a vertical plate 204, thence around a grooved wheel 206 rotatably mounted on a stud 208 supported on an upright supporting standard 210 for the plate 204, thence around a grooved wheel 212 rotatably mounted on a stud 214 suspended from the underside of a beam 216 extending between the side plates 16 and 18, thence around a grooved wheel 218 rotatably mounted on the upper end of a lever 220 which is pivotally mounted on a shaft 222 extending between the side plates 16 and 18, thence around a grooved wheel 224, thence around a grooved wheel 230 rotatably mounted on the upper end of a lever 232 pivotally mounted on the shaft 222, thence around a grooved wheel 234 rotatably mounted on a stud 236 on the upper side of the beam 216, thence around a grooved wheel 238 rotatably mounted on the upper end of a lever 240 which is pivotally mounted on the shaft 222, thence around a grooved wheel 244 and thence to the upper end of a lever 246 pivotally mounted on the shaft 222 to which it is secured.

The levers 220, 232, 240 and 246 are all spring biased in a clockwise direction and may be rocked singly or in combination through the same angle in a counterclockwise direction. The parts are so proportioned that if lever 220 is rocked alone, tape 104 will be drawn an amount to lineally displace the type slide 82 two units to the right so as to present the character "A" at the printing locality. If the lever 232 is rocked alone, the cable 104 will be drawn a sufficient amount so as to lineally displace the type slide four units to the right. In a similar manner a rocking of the levers 240 and 246 results in a lineal displacement of the type slide of four units and one unit as illustrated in the drawings. If the levers are rocked in combination the total displacement of the type slide is represented by the sum of the individual displacements obtained by the rocking of each of the levers. An examination of the displacement values of the levers 220, 232, 240 and 246 shows that the various combinations permit a displacement of the type slide from one through eleven units in accordance with the particular combinations of the levers to be rocked.

The rotative displacement mechanism

There is provided a separate mechanism for effecting the rotative displacement of the type slides. The cable 124 extends from the bar 116 and passes over a grooved wheel 260 rotatably mounted on the stud 262 secured to a vertical plate 264, thence around a grooved wheel 266 rotatably mounted on a stud 268 secured to a vertical standard 270 for the plate 264, thence around a grooved wheel 272 mounted on a stud 274 secured to the under side of the beam 216, thence around a grooved wheel 276 rotatably mounted on the upper end of a lever arm 278 pivotally mounted on the shaft 222, thence around a grooved wheel 280, thence around a grooved wheel 282 rotatably mounted on the upper end of a lever arm 284 pivotally mounted on the shaft 222, and thence to the beam 216 to which it is secured.

The levers 278 and 284 are biased in a clockwise direction similar to that described above for the levers 220, 232, 240 and 246 for the lineal displacement mechanism and each may be rocked in a counterclockwise direction to draw the tape 124 a predetermined amount. A rocking of the lever 278 causes the tape 124 to be drawn an amount sufficient to rotate the type slide 82 through 90 degrees and a rocking of the lever 284 causes a displacement of the type slide 82 through 180 degrees. Rocking both levers results in a displacement of 270 degrees.

Referring now particularly to Figs. 3, 7, 8 and 9, each of the levers 220, 232, 240 and 246 for the lineal displacement mechanism and each of the levers 278 and 284 for the rotative displacement mechanism have pivoted thereto at their lower extremities a pair of interposer hooks such as the hooks 292, 294 for the lever 232 and a latching hook, such as the latching hook 296 for said lever 232.

These hooks are illustrated in various operational positions in Figs. 7, 8 and 9 where it is seen that the hooks 292 and 294 are slotted for limited sliding action on a pin 298 mounted in the end of the lever arm 232, while the latching hook 296 is not slotted but is mounted on said pin 298. Each of the hooks 292, 294 and 296 are spring biased in a clockwise direction.

The above description relates to the positioning and arrangement of the hooks on the lower portion of the lever 232, but it should be clearly understood that each of the levers arms is provided with a similar arrangement.

The hooks 292 for all of the lever arms are disposed in line and are individually positioned beneath the teeth 300 of a bail 302 which is mounted for angular recipro-

cation about a shaft 304 extending between and supported by the side plates 16 and 18. The bail 302 is reciprocated through a predetermined angular displacement by action of the cam followers 306 (see Fig. 1) engaging drive cams 308 mounted on the main drive shaft 74. There is an individual tooth 300 for each of the individual hooks 292 and the parts are proportioned so that as the bail 302 reciprocates through its predetermined angular displacement, in response to the rotation of the main drive shaft 74, and as a hook 292 is rocked about its mounting pin 298, the hook will be engaged by the tooth 300 and advanced thereby. As the hook 292 is advanced, the related lever 232, for example, will be forcibly rocked or pivoted about the common shaft 222 through a predetermined angle.

The hooks 294 for all of the lever arms also are disposed in line and are individually positioned beneath the teeth 322 of a bail 320 which is mounted for angular reciprocation about the shaft 304 independent of the reciprocation of the bail 302. The bail 322 is reciprocated through a predetermined angular displacement by the action of the cam followers 324 (see Fig. 1) engaging drive cams 326 mounted on the main drive shaft 74. The drive cams 326 and 308 have the same configuration but are mounted on the shaft 74 with a 180 degree displacement so that the bails 302 and 320 are alternately reciprocated. The bail 320 is provided with an individual tooth 322 for each hook 294 and if one of these hooks is rocked about its mounting pin 298, it will be engaged by its related tooth 322 on the bail 320 to displace its lever, i. e. 232, in a counterclockwise direction.

The mechanism for rocking the hooks 292 and 294 to place them into operative relationship with the teeth 300 and 322 on the bails 302 and 320, respectively, comprises an arm 330 mounted at the end of an armature lever arm 334 pivoted at 336. The armature lever arms 334 are responsive to the selective energization of the magnets 160 and are normally biased in a counterclockwise direction by springs such as 338. The magnets 160 are selectively energized, as explained above in connection with the circuit of Fig. 13 in accordance with the punched character designations on the record card 132.

The sequence of operations is as follows. When a perforated column 150 in one of the sensing areas on the record card 132 is beneath the sensing brushes, the magnets 160 are selectively energized in accordance with the coding of the character, and the corresponding armatures 334 will be rocked to tilt the related hooks 292, 294 upwardly into the path of the teeth 300 and 322 of the bails 302 and 320, respectively. Shortly thereafter one or the other of the bails 302 and 320 (said bails being alternately reciprocated) will move, engage, and advance the tilted hooks and thus rock the levers connected thereto. These, through the differential pulley wheel and cable connections to the type slide, as explained above, will thereupon selectively lineally and/or rotatably displace the type slide an amount sufficient to present the type character 192 corresponding to the combination of perforations sensed, at the printing locality. It will be noted, that as a hook 292 is advanced by a tooth 300 in its related bail 302, the end of the hook rides up the inclined surface 342 of a stationary block 344 which effectively locks the hook in engagement wtih the tooth 300 and enables restoration of the armature 334 shortly after engagement of the hook by the tooth.

When the advancing bail 302 reaches its limiting position and just prior to the initiation of its return movement, the circuit through the control card column will have been broken and the next card column will be at the sensing brushes. At this point the other bail 320 will be initiating its advance and circuits will be completed to the magnets 160 in accordance with the combinational punching in this next card column in order to rock a new set of hooks, i. e. 294, for advance by the bail 320, while those previously advanced, i. e. 392, return, under the influence of their individual biasing springs, to their rest position as the bail 302 moves backwardly.

Provision is made so that where a particular selected and advanced hook is again selected in response to the advance of the next column on the record card 132, such hook is not restored to its rest position but is maintained in its advanced position. For this purpose each of the levers is provided with a latching hook, such as the latching hook 296 mounted on the lever 232 which has an extending arm 346 slidably contained within a slot 348 in a block 350 extending between the side plates 16 and 18. When the lever 232 is rocked, the latching hook 296 will be advanced and the extended arm 346 will be moved outwardly of the slot 348 to the position illustrated in Fig. 9. If the particular lever is selected to be rocked on the next sensing cycle, the upward movement of the armature 334 in response to the energization of magnet 160 will rock said latching hook 296 about the pin 298 and cause the hooked end 352 mounted at the end of the extended arm 346 to engage the edge of the slot 348 as illustrated in Fig. 8. The latched postion is illustrated in Fig. 8 and it is there seen that the lever arm 232 cannot be returned to its normal or rest position by its biasing spring. The lever arm will thus be maintained in latched displaced position during the return movement of the previously engaged hook and during the advancing movement of the alternate hook which is moved relative to the pin 298.

The latching of the displaced hook results in the particular type slide being maintained in a displaced position and thus is not returned to its rest position intermediate successive identical sensing operations. The latching hook will maintain the lever in displaced position until the advancing bail engages its hook and reaches the limit of its forward movement. The limit of the forward movement is sized so that the hooked end 352 of the latching hook 296 is moved slightly out of engagement with the edge of the slot 348. When the hooked end 352 is moved slightly out of engagement with the edge of the slot 348, the biasing spring 356 rotates the latching hook 296 clockwise to the unlatched position as illustrated in Fig. 9.

The net effect of this latching action is to obviate the return of the type slide to its rest position intermediate successive printing operations and, where the same character is sensed in successive columns, the type slide will be positioned upon the first sensing of the character and then latched in said position for repeated printing.

By providing alternately reciprocating bails 302 and 322 a high operational speed is effected since while one bail is effecting a selection the other is being restored and by providing the further latching mechanism, restoration of the levers required for the next selection is obviated and the extent of movement of the type slide is only that required to move directly from one character to the next without an intervening return of the type slide to the rest position. Due to the high speed so obtainable, the record cards may be sensed in motion and the printing operation may be effected on a continuously moving paper and ink ribbon.

In the above portions of this specification the mounting of the type slides and the means for selectively and positively displacing said type slides for effecting the presentation of type at the printing locality in accordance with sensed character designations has been described in detail.

The impression transfer or actual printing operation is effected on the continually moving paper strip and ink ribbon 30 (Fig. 1) by impelling said strip against the type characters presented at the printing locality by a rocking of the printing hammers 20, 22, 24 and 26.

The printing hammers 20, 22, 24 and 26 are rotatably mounted on the arms of cranks 360, 362, 364 and 366, respectively. The cranks are pivotally mounted on a common vertically disposed shaft 368 supported at its extremities by arms of a U-shaped mounting bracket 370. The other arms of the cranks are adjacent the surface of a ver-

tically disposed hammer actuating cam 374 mounting on a shaft 376 which is supported by the mounting brackets 378 and 380 extending outwardly from the front plate 12.

The hammer actuating cam 374 is continuously rotated through the action of bevel gear 382 mounted on the end of the shaft 376 meshing with a bevel gear 384 mounted on a horizontally disposed auxiliary drive shaft 386. The horizontally disposed auxiliary drive shaft 386 is continuously rotated by the auxiliary drive shaft 62 (see Fig. 1) through the bevel gears 388 and 390. The auxiliary shaft 62, as described above in the earlier portions of this specification, is continuously driven by the main drive shaft 74 through the bevel gears 70 and 72. The printing hammers 20, 22, 24 and 26 are adapted to be rocked about the shaft 368 by the action of the hammer actuating cam 374. The printing hammers are spring biased by, for example, the springs 372, in a counterclockwise direction and are individually latched out of engagement with the actuating cam 37 by interposer armatures, such as the interposer armature 394 for the printing hammer 20 (see Fig. 4). The armature 394 is pivotally mounted and is displaceable in response to the energization of the hammer magnet 170 associated with the type slide 82 (see Fig. 13) mounted in a U-shaped mounting bracket 398.

When the printing hammer is latched as illustrated in Fig. 4, the arm thereof is maintained in position clearing the surface of the hammer actuating cam 374. Actuation of the hammer magnet 170 results in the piovtal displacement of the latching armature 394 which causes the arm of the crank 360, under influence of the biasing spring 372, to engage the surface of the hammer actuating cam 374 so that the hammer 20 may be driven into printing relationship as the arm rises past the high lobe 400 of said actuating cam 374. The contour of the cam 374 and the positioning of the crank 360 is such that the cam 374 does not drive the hammer 20 fully into the striking position but relies on the overdrive beyond the high lobe 400 of the cam to obtain a hammer-like action for producing an impression of the type presented at the printing locality on the continuously moving paper strip and ink ribbon 30.

The above portion of the disclosure relates to the actuating mechanism for the printing hammer 20 and it should be understood that a similar mechanism with individual hammer magnets 170 is provided for each of the remaining printing hammers 22, 24 and 26 associated with the type slides 84, 86 and 88, respectively.

Associated with the printing hammer mechanism described above is a positioning mechanism for the type slides which serves to accurately position the type characters presented at the printing locality. The positioning mechanism includes a crank 401 having an extended positioning arm 402 adapted to engage the indentations 98 on the positioning plate 99 associated with each of the type slides (see Figs. 1, 4 and 6). The crank 401 is rocked by a cam 408 having dual dwells 410 and 412 mounted on the horizontally disposed auxiliary drive shaft 386. The positioning arm 402 is rocked into engagement with the indentations 98 on the positioning plate 99 by the action of the biasing spring 406 when said movement is permitted by the dwells 410 and 412. The arm 402 serves to accurately align the type characters presented at the printing locality on each of the four type slides 82, 84, 86 and 88 immediately prior to the actuation of the printing hammers 20, 22, 24 and 26.

Fig. 12 schematically illustrates a gang printing mechanism constructed in accordance with the principles of the invention. This type of printer finds utility in printing bills and other commercial forms wherein multiple sections receiving the same information may be simultaneously printed.

In the embodiment illustrated in Fig. 12 four separate printing sections 420, 422, 424 and 426 are provided for the purposes of example, however any number of sections could be utilized. Each printing section is provided with four type slides, identified by the printing section numeral and the letters *a, b, c* and *d*, respectively. The type slides 420*a*, 422*a*, 424*a* and 426*a* are slidably mounted on a common shaft 428 and are lineally displaceable as a unit by the action of a single pull tape 430 through the connecting links 432, 434 and 436. The lineal displacing mechanism associated with the pull tape 430 is similar to that described above in the earlier portions of this specification. As the type slides 420*a*, 422*a*, 424*a* and 426*a* are mounted on a common shaft 428, they may be rotatably displaced as a unit in conjunction by the action of a single rotatable displacing mechanism associated with the single pull tape 438 of the type described in the earlier portions of the specification. Through the above construction the same type character presentation will be effected on each of the four type slides. The remaining type slides identifiable by similar letter designations are similarly arranged. Each of the type slides in each of the printing sections 420, 422, 424 and 426 is provided with an individual printing hammer identifiable by the numerical designation of the printing section, and the letters *e, f, g* and *h*, respectively.

Figs. 18 and 19 illustrate, for the purposes of example, two types of bills that might be printed on the gang printing mechanism illustrated in Fig. 12.

The bill 450 illustrated in Fig. 18 is provided with four sections 420*z*, 422*z*, 424*z*, and 426*z* corresponding to the printing sections 420, 422, 424 and 426 of the gang printing mechanism. In the section 426*z* four lines of printing are illustrated. Line 1 is used for a name, line 2 is used for a street address, line 3 is used for the city and state designation, and line 4 is utilized for a code number. In section 424*z* the first and third lines only are utilized. In section 422*z* the first three lines are utilized, and in section 420*z* the first and fourth lines are utilized. The bill 452 illustrated in Fig. 19 is also provided with four sections having either no printing, full line printing or partial line printing for each of the lines in each of the sections. For example, the first section (taken from left to right) has full line printing for the first line, the second and third lines are blank, and partial line printing on the fourth line.

The selective printing as illustrated in Figs. 18 and 19 is effected by the selective energization of the printing hammer magnets for each of the printing hammers associated with each of the type slides in each of the printing sections of the gang printing mechanism illustrated in Fig. 12.

The circuits for the selective energization of the printing hammers are illustrated in Fig. 20 and reference will now be had thereto. The record card 454, therein illustrated as advancing past dual rows of sensing brushes 470 and 472 and their adjacent contact rollers 474 and 467, is subdivided into four sensing areas designated 456, 458, 460 and 462, one sensing area being provided for each line of printing. Each of these sensing areas is provided with columns 464 in which perforations 466 are combinationally made in six rows designated 468 to represent the particular characters to be presented at the printing localities by the type slides associated with each line of print.

The arrangement of combinational perforations within each of the sensing areas is similar to that described above in the earlier portions of this specification in conjunction with the record card 132 of Fig. 13 and will not be described again at this point.

Each of the brushes in the row of brushes 470 positioned for sensing the sensing area 456 is connected to one of a group of type slide positioning magnets 478 (similar to the group of magnets 160 of Fig. 13) which are designated with the letters "R" and "L" and suitable numbers to identify the respective magnets with the rows with which each is associated. Although only the circuits associated with the sensing area 456 are illustrated in the drawings, it will be understood that similar groups of type slide positioning magnets are provided for the rows of brushes sensing the areas 458, 460 and 462.

The sensing circuit extends from one side of the power line 430 through the cam controlled contacts 482 (operated by cams conveniently mounted on the main drive shaft 74 to synchronize the sensing activity with the rotation of the drive shaft), the relay contact points 484 and 486 (from a switching mechanism such as that illustrated in Fig. 13*a*), the contact rolls 474, 476, the perforations in the record card 454, the brushes 470 and 472, the magnets 478 in accordance with the perforational arrangement of the perforations 466, through the printing hammer control magnets 490, 492, 494 and 496 and back to the other side of the power line 498. The printing hammer control magnets 490, 492, 494 and 496 control the printing hammers 422*e*, 424*e*, 426*e*, and 428*e* for the upper line of type slides in the printing sections 420, 422, 424 and 426, respectively, of Fig. 12.

Included in series with each of the printing hammer control magnets are a set of relay actuated switch points, such as the relay contact points 500, 502, 504 and 506. As these relay contact points are selectively closed, the respective printing hammer control magnets will be selectively energized to effect the impression transfers of the type characters presented at the printing localities for the first line of print in the printing sections 420, 422, 424 and 426.

To effect the selective opening and closing of the relay operable switch points 500, 502, 504 and 506 each of the sensing areas on the record card 454 is provided with an auxiliary printing hammer magnet control area, such as the areas 456*a*, 458*a*, 460*a* and 462*a*. Each of the printing hammer magnet control areas is provided with four rows 508, one row for each of the printing magnets, in which perforations may be made to represent the desired columnar actuation of the respective printing hammer control magnets.

Each of the brushes in the row of brushes 470 positioned for sensing the printing hammer magnet control area 456*a* is connected directly to the power line 498 in series with a relay energizing coil such as the relay energizing coils 500*a*, 502*a*, 504*a* and 506*a*. The selective energization of these relay energizing coils, in response to the perforations in the printing hammer magnet control area 456*a*, results in the selective closing of the relay contact points associated therewith (for example, the energization of coil 500*a* results in a closing of contact point 500) and the selective energization of the respective printing hammer control magnets.

It will be understood that, although Fig. 20 only illustrates the circuits associated with the sensing area 456 and the printing hammer magnet control area 456*a*, similar circuits are provided for each of the other sensing areas and their respective printing hammer magnet control areas.

In the embodiment illustrated in the drawings a manually operable switch, such as the switches 500*b*, 502*b*, 504*b* and 506*b*, is shunted across each of the relay contact points 500, 502, 504 and 506. This provides an additional switching arrangement whereby, if and when desired, similar printing presentations may be effected in each printing section of the gang printing apparatus.

Through the above described control system, full line printing, partial line printing, or no printing at all may be effected in each of the lines in each of the printing sections of the gang printing apparatus.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a four-line, column-by-column printing mechanism, it will be understood that various omissions and substitutions and changes in form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

Having thus described my invention, I claim:

1. In a printing apparatus, a plurality of lineally and rotatably displaceable type slides positioned for multi-line printing operations, each of said type slides having a plurality of type positioned on each of the sides thereof, means for sensing a record for character designations affecting each of said type slides, a cyclically operable drive, a pair of bails, means actuated by said drive for alternately oscillating said pair of bails through predetermined limits, first displaceable means selectively engageable with said bails in response to the sensed character designations, means connecting said first displaceable means with said type slides for positively rotatably displacing said type slides in response to and in accordance with the selective displacement of said first displaceable means, second displaceable means selectively engageable with said bails in response to the sensed character designations, means connecting said second displaceable means with said type slides for positively lineally displacing said type slides in response to and in accordance with the selective displacement of said second displaceable means, whereby a multi-line columnar prsentation of type representing the sensed character designations is effected at a printing locality.

2. The invention as set forth in claim 1 including means for latching said first and second displaceable means in displaced position intermediate successive sensing operations to avoid the necessity of returning to a rest position after every sensing operation.

3. The invention as set forth in claim 1 including a printing hammer associated with each of said type slides and responsive to said sensing means for effecting an impression transfer of the type presented at the printing locality.

4. In a printing apparatus, a plurality of lineally and rotatably displaceable four-sided type slides positioned for multi-line printing operations, each of said type slides having a plurality of type positioned on each of the sides thereof, means for simultaneously sensing a record for character designations affecting each of said type slides, a cyclically operable drive, a pair of bails, means actvated by said drive for alternately oscillating said pair of bails through predetermined limits, a plurality of pivotally mounted lever arms associated with each of said type slides, said lever arms being selectively engageable with said bails in response to the sensed character designations and displaceable thereby, and means connecting said lever arms with said type slides for positively displacing said type slides in response to and in accordance with the selective displacement of said lever arms, whereby a multi-line columnar presentation of type representing the sensed character designations is effected at a printing locality.

5. The invention as set forth in claim 4 including a printing hammer associated with each of said type slides and responsive to said sensing means for effecting an impression transfer of the type presented at the printing locality.

6. In a printing apparatus, a plurality of lineally and rotatably displaceable four-sided type slides positioned for multi-line printing operations, each of said type slides having a plurality of type positioned on each of the sides thereof, means for simultaneously sensing a record for character designations affecting each of said type slides, a cyclically operable drive, a bail, means actuated by said drive for oscillating said bail through predetermined limits, displaceable means selectively engageable with said bail in response to the sensed character designations, means connecting said displaceable means with said type slides for positively lineally displacing said slides in response to and in accordance with the selective displacement of said displaceable means, a plurality of pivotally mounted lever arms associated with each of said type slides, said lever arms being selectively engageable with said bail in response to the sensed character designations and adapted for pivotal displacement thereby, and means connecting said lever arms with said type slides for positively rotatably displacing said type slides in

response to and in accordance with the selective displacement of said lever arms, whereby a multiline columnar presentation of type representing the sensed character designations is effected at a printing locality.

7. In a machine of the class described, means for sensing a record for designations representing a plurality of multi-character items and for selection control designations, said sensing means being arranged to sense the item designations concurrently, character by character, a printing mechanism including a plurality of printing sections each including a type carrier for each item, said type carriers being controlled concurrently by said sensing means for positioning the carriers in accordance with the concurrently sensed characters of the related items, a set of like printing elements on each carrier in each printing section, means for concurrently taking an impression from each carrier in each printing section, and means controlled by said sensing means in response to the sensing of said selection control designations for rendering said impression taking means selectively effective for printing selectively from any carrier in any of said printing sections.

8. In a machine of the class described, a plurality of printing sections, a plurality of type slides having type thereon positioned for multi-line column-by-column printing in each of said printing sections and disposed in alignment with the type slides in the remaining printing sections, means for concurrently sensing a record for a plurality of character designations each representative of a character to be printed in a single column by each of said type slides, and means responsive to the sensed character designations for selectively displacing each of said type slides in each of said printing sections to effect a multi-line columnar presentation of type representative of the sensed character designations at a related printing locality associated with each of said printing sections.

9. The combination as set forth in claim 8, including means responsive to the sensed record for effecting selective printing from any type presented at any printing locality.

10. The combination as set forth in claim 8, including means for sensing said record for selective printing designations, and means responsive to said last mentioned means for effecting selective printing from any type presented at any of the printing localities.

11. In a machine of the class described, a plurality of printing sections, a plurality of lineally and rotatably displaceable type slides positioned for multiple printing operations in each of said printing sections and disposed in alignment with the type slides in the remaining printing sections, means for sensing a record for designations representing a plurality of multi-character items and for selection control designations relating to each of said items, said sensing means being arranged to sense the item designations concurrently, character by character, simultaneously with the sensing of the selection control designations related to each item, means responsive to the concurrently sensed characters of the related items for selectively and positively displacing the type slides in each of said printing sections to effect the presentation of type representing the sensed designations at related printing localities within each of said printing sections, means for taking concurrent impressions from each type slide, and means controlled by the sensing means in response to the sensing of said selection control designations for rendering said impression taking selectively effective for printing selectively from any of said type slides in any of said printing sections.

12. A printing apparatus for effecting concurrent multi-line column-by-column printing operations, comprising a platen member defining a printing locality, a plurality of displaceable printing members having type thereon positioned for concurrent multi-line printing, means associated with each of said displaceable printing members for displacing the same to present a selected type at the printing locality, means for concurrently reading a plurality of character designations each representative of a character to be printed in a single column in each of the lines of print, and means responsive to the reading means for concurrently actuating said printing member displacing means to effect presentation the type on each of the printing members representative of the read character designations at the printing locality, whereby multi-line column-by-column type presentation is effected at said printing locality.

13. A printing apparatus in accordance with claim 12 wherein said printing members are type slides with the type thereon being so that each type character has its vertical axis disposed transverse to the longitudinal axis of the type slide.

14. A printing apparatus in accordance with claim 12 including means responsive to the successive reading of identical character designations for latching said printing members in displaced position, whereby a return of the printing members to a rest position is avoided.

15. In a printing apparatus, a printing locality, a plurality of displaceable printing members having type thereon positioned for multiple printing operations adjacent said printing locality, means for concurrently sensing a record for a plurality of character designations each representative of the intelligence to be printed by one of said printing members, combinational means selectively and positively displaceable in predetermined amounts in response to the sensed character designations, and means connecting said combinational means and each of said printing members for positively displacing said printing members by an amount equal to the total of the displacements of said selectively displaced combinational means to present type representative of the sensed character designations at the printing locality.

16. In the printing apparatus as set forth in claim 15, a printing hammer associated with each of said printing members and positioned at the printing locality, and means controlled by the sensed character designations for effecting relative movement between said printing hammers and the displaced printing members for obtaining an impression from the type on said members presented at the printing locality.

17. In the printing apparatus as set forth in claim 15, means responsive to the successive sensing of identical character designations for latching the printing members in displaced position to maintain the type representative of the sensed character designations at the printing locality.

18. In a printing apparatus, a plurality of displaceable type slides having type thereon, a cyclically operable drive, a bail, means actuated by said drive for oscillating said bail through predetermined limits, means for concurrently sensing a record for a plurality of character designations each representative of the intelligence to be printed by one of said type slides, means selectively engageable with said bail and arranged to be positively displaced in predetermined amounts thereby, means responsive to the sensed character designations for selectively engaging said displaceable means and said bail, and means connecting said displaceable means and said type slides for positively displacing said type slides by an amount equal to the total displacement of said selectively displaced displaceable means to present type representative of the sensed character designations at a printing locality.

19. In a printing apparatus, a plurality of displaceable type slides having type thereon, sequential means for concurrently sensing a record for a plurality of discrete character designations each representative of the intelligence to be printed by each of said type slides, cyclically operated and alternately actuated driving means, means selectively engageable with said alternately actuated cyclic driving means and arranged to be positively displaced predetermined amounts thereby, means

responsive to the sensed discrete character designations for selectively engaging said displaceable means with said actuated driving means, and means connecting said displaceable means and said type slides for positively displacing said type slides by an amount equal to the total displacement of said selectively displaced displaceable means to present a type representative of the sensed character designations at a printing locality.

20. In a printing apparatus, a plurality of displaceable type slides having type thereon, sequential means for concurrently sensing a record for a plurality of discrete character designations each representative of the intelligence to be printed by each of said type slides, cyclically operated and alternately actuated driving means, means selectively engageable with the actuated member of said alternately actuated driving means and arranged to be positively displaced predetermined amounts thereby, means responsive to a set of the sensed discrete character designations for selectively engaging said displaceable means with said actuated driving means prior to the disengagement of the displaceable means from the driving means resulting from the immediately preceding set of sensed discrete character designations, and means connecting said displaceable means and said type slides for positively displacing said type slides by an amount equal to the total displacement of said selectively displaced displaceable means to present type representative of the sensed character designations at a printing locality.

21. The invention as set forth in claim 20 including means for latching said displaceable means in displaced position in response to successive sensing of identical character designations in order to avoid the necessity of returning the type slides to a rest position.

22. The invention as set forth in claim 20 wherein said cyclically operated drive includes a pair of bails and actuating means for alternately oscillating said pair of bails through predetermined limits.

23. In a printing apparatus, a plurality of displaceable type slides having type thereon positioned for multi-line column-by-column printing operations, means for concurrently sensing a record for a plurality of character designations each representative of a character to be printed in a single column in each of the lines of print, a cyclically operable drive, a pair of bails, means actuated by said drive for alternately oscillating said pair of bails through predetermined limits, displaceable means selectively engageable with said bails in response to the sensed character designations, and means connecting said displaceable means with said type slides for positively displacing said slides in response to and in accordance with the selective displacement of said displaceable means to present type representative of the sensed character designations at a printing locality.

24. In a printing apparatus, a plurality of lineally and rotatably displaceable four-sided type slides positioned for multi-line printing operations, each of said type slides having a plurality of type positioned on each of the sides thereof, each individual character of type being oriented with its vertical axis transverse to the longitudinal axis of the type slide, means for simultaneously sensing a record for columnar character designations affecting each of said type slides, a cyclically operable drive, a pair of bails, means actuated by said drive for alternately oscillating said pair of bails through predetermined limits, displaceable means selectively engageable with said bails in response to the sensed character designations, means connecting said displaceable means with said type slides for positively displacing said slides in response to and in accordance with the selective displacement of said displaceable means, whereby a multi-line columnar presentation of type representing the sensed character designations is effected at a printing locality, and means for latching said displaceable means in displaced position intermediate successive sensing operations in order to avoid the necessity of returning to a rest position after every sensing operation.

25. The invention as set forth in claim 20 including a printing hammer associated with each of said type slides at the printing locality, means for continuously advancing web material intermediate said type slides and said printing hammers at a rate in accordance with the rate of operation of said cyclically operating driving means, and means responsive to the sensed character designations for selectively actuating said printing hammers including means for producing an overdriven contact with said web material over the type representative of the sensed character to effect multi-line columnar printing on said continuously moving web.

References Cited in the file of this patent

UNITED STATES PATENTS

406,437	Felt	July 9, 1889
497,177	Heine et al.	May 9, 1893
752,795	Moya	Feb. 23, 1904
1,333,890	Wright	Mar. 16, 1920
1,542,223	Dolph	June 16, 1925
1,608,145	Tingley	Nov. 23, 1926
1,685,685	Smith	Sept. 25, 1928
1,896,538	Bryce	Feb. 7, 1933
1,968,386	Gubelman	July 31, 1934
1,971,859	Knutsen	Aug. 28, 1934
1,997,167	Bryce	Apr. 9, 1935
2,089,447	Sundstrand	Aug. 10, 1937
2,464,561	Dickinson	Mar. 15, 1949