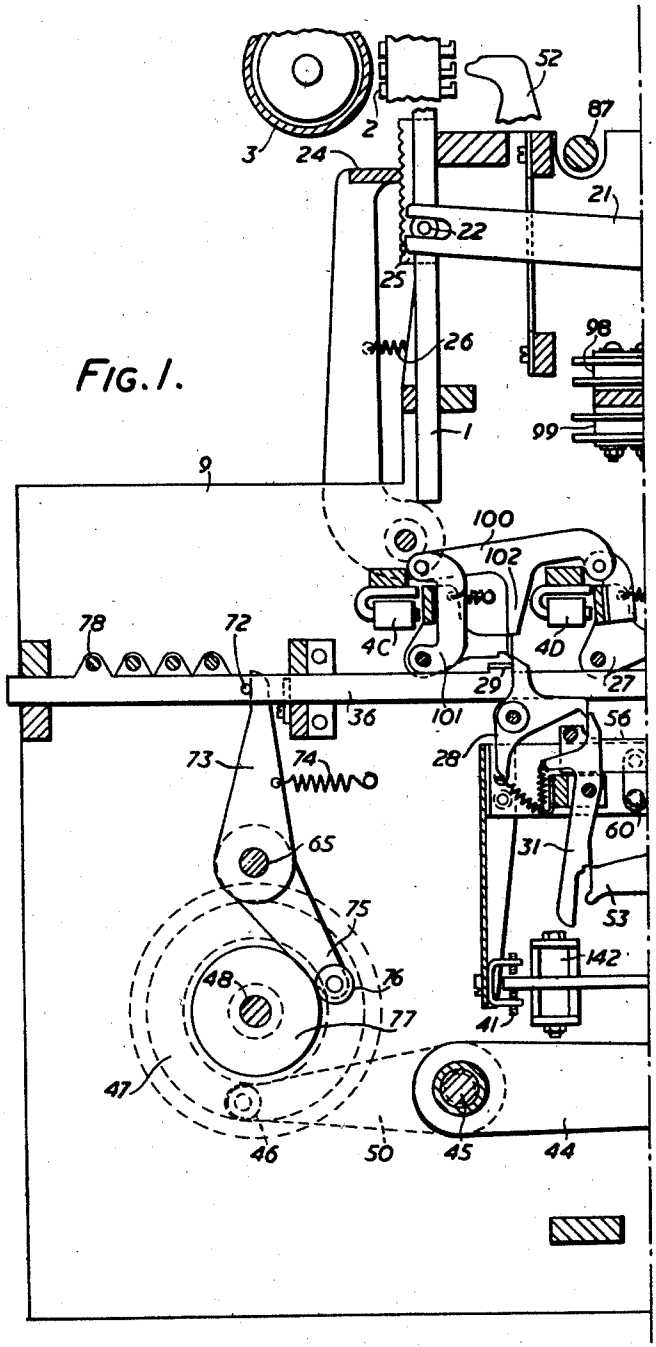
March 12, 1957 D. BROIDO 2,784,667

SETTABLE TYPESETTING MEANS IN DATA PRINTING MECHANISMS

Filed March 25, 1955 5 Sheets-Sheet 1

FIG. 1.



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SETTABLE TYPESETTING MEANS IN DATA PRINTING MECHANISMS

Filed March 25, 1955 5 Sheets-Sheet 2

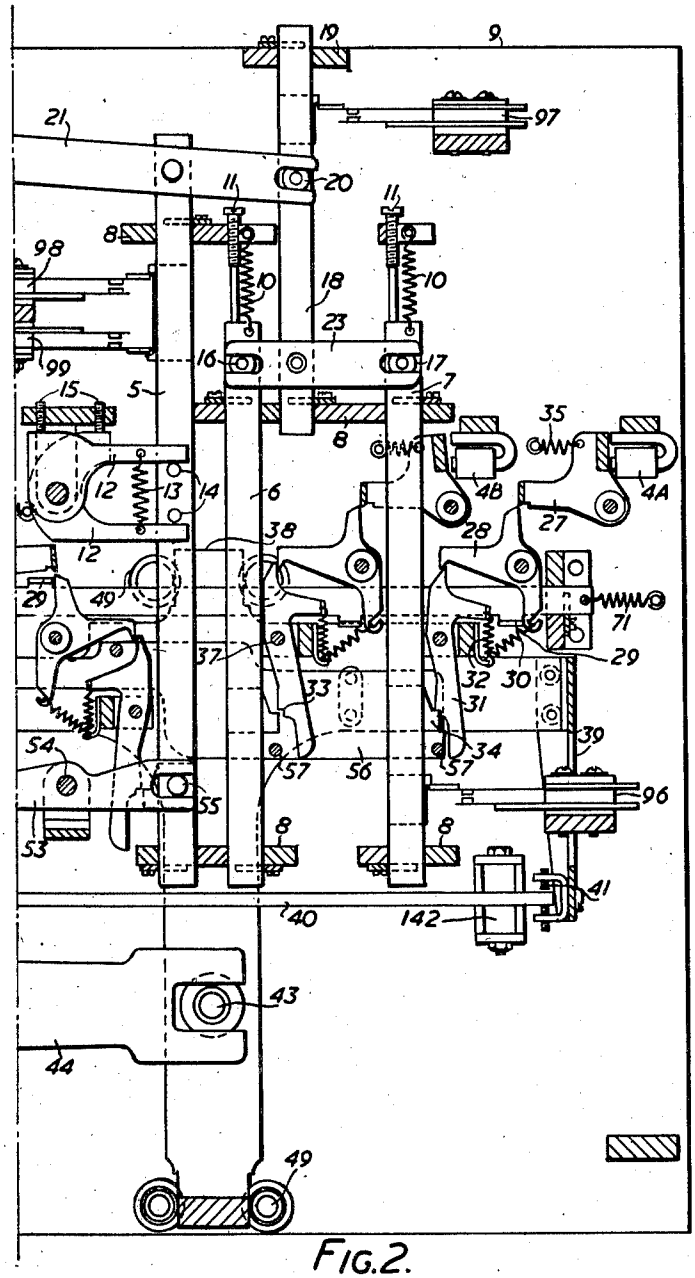


FIG. 2.

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SETTABLE TYPESETTING MEANS IN DATA PRINTING MECHANISMS

Filed March 25, 1955 5 Sheets-Sheet 3

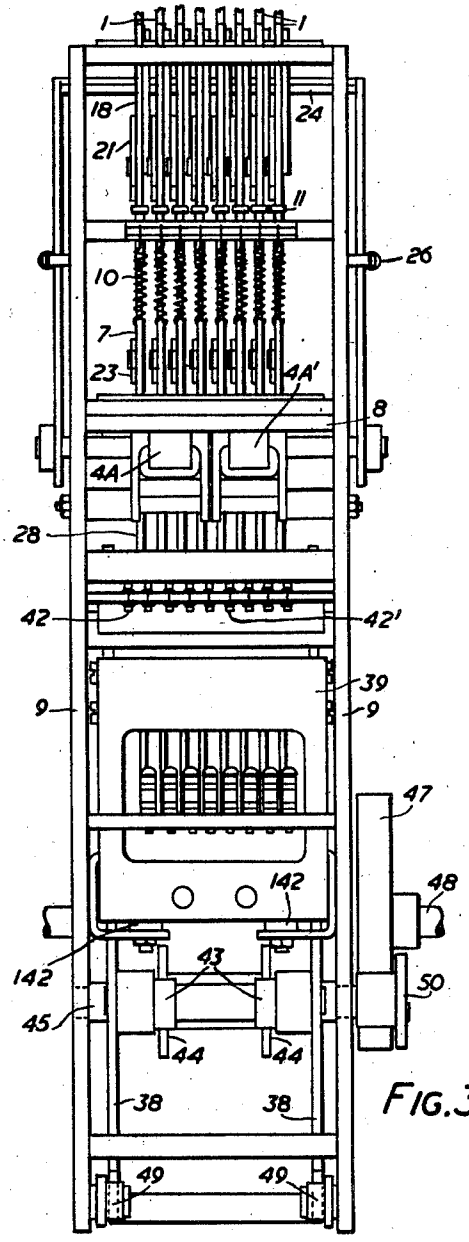


FIG. 3.

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SETTABLE TYPESETTING MEANS IN DATA PRINTING MECHANISMS

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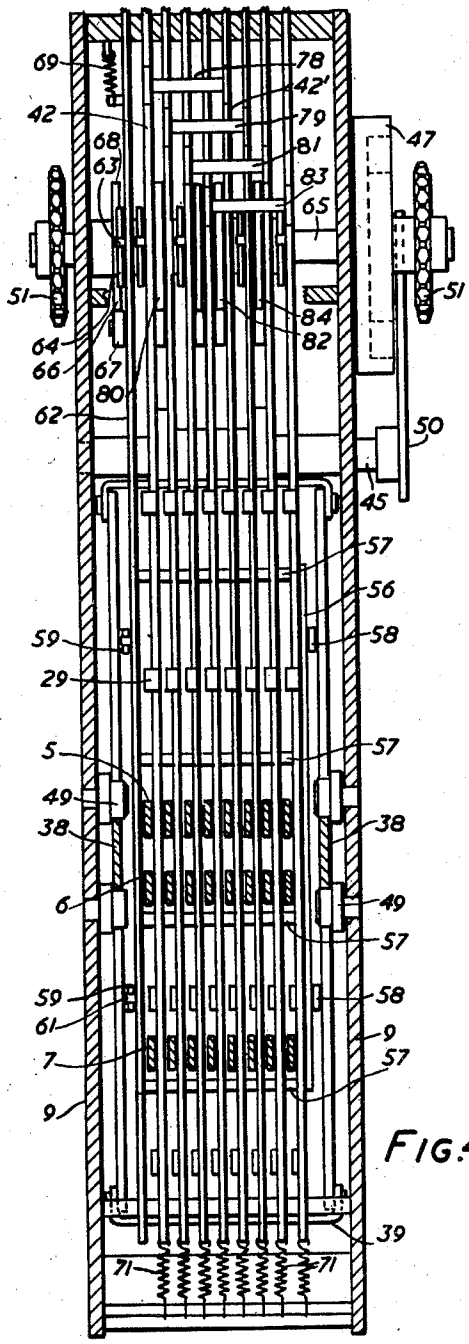


FIG. 4.

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SETTABLE TYPESETTING MEANS IN DATA PRINTING MECHANISMS

Filed March 25, 1955 5 Sheets-Sheet 5

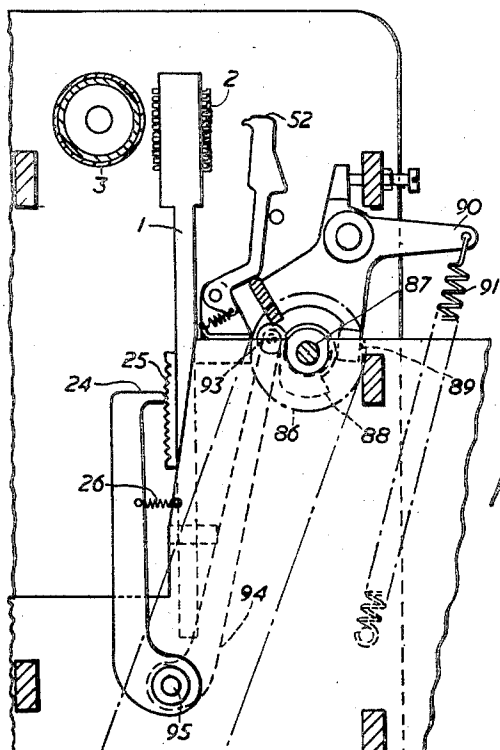


FIG. 6.

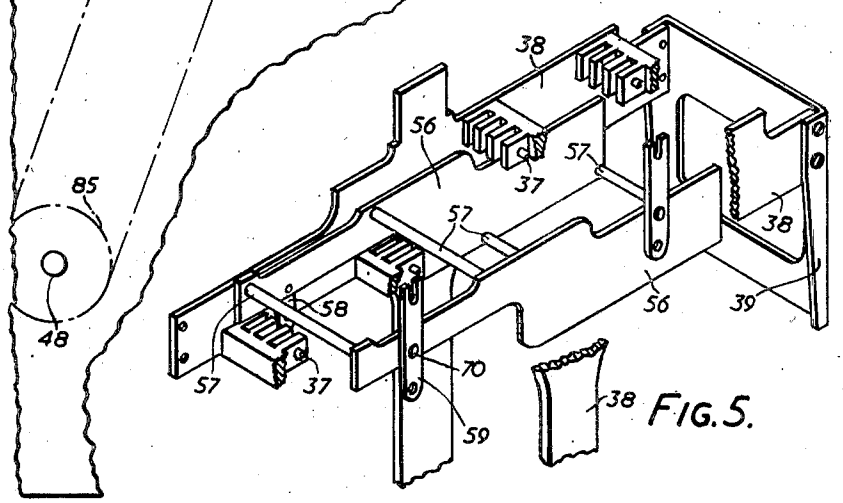


FIG. 5.

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United States Patent Office 2,784,667 Patented Mar. 12, 1957

2,784,667

SETTABLE TYPESETTING MEANS IN DATA PRINTING MECHANISMS

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Application March 25, 1955, Serial No. 496,872

Claims priority, application Great Britain June 13, 1955

12 Claims. (Cl. 101—93)

This invention relates to printing apparatus, of the kind in which a type bearing member is selectively positioned under control of elements set in accordance with a combinational character representing code.

An object of the invention is to provide a printing mechanism which is simple and cheap to construct, by effecting the setting of a type bearing element under control of a plurality of setting bars which are linked together and to the type bearing member and which, when selected, move a fixed distance.

It is a further object to reduce the number of devices required for selecting the setting bars in a multi-column printing mechanism, by associating each such device sequentially with the setting bars of two or more columns.

According to the invention a printing mechanism has a plurality of latch pawls, means for operating the latch pawls in accordance with an additive combinational code, a latch releasable by each latch pawl, an operating pawl settable by each latch, a plurality of setting bars, a type bearing member, links connecting the setting bars together and to the type bearing member, means for moving all the operating pawls a fixed distance, each set operating pawl moving a setting bar a fixed distance, the links transmitting the additive movement of the setting bars to the type bearing member to bring the type character corresponding to the combination of operated latch pawls opposite a platen, and means for printing the selected character. In a multi-column printing mechanism, the corresponding latch pawls in two or more columns have a common operating means, and means are provided for making the operating means effective sequentially for the different columns.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figures 1 and 2 taken together constitute a sectional side elevation of the printing mechanism;

Figure 3 is an end elevation of the printing mechanism;

Figure 4 is a sectional plan view showing the sequence bars;

Figure 5 is a detail perspective view of part of the resetting frame;

Figure 6 is a detail view showing the hammer operating mechanism.

The invention will be described as applied to a multi-column printing mechanism suitable for recording data punched in a record card or cheque.

The printing mechanism has eight type bars **1** (Figures 1 and 3). Each type bar carries twelve type slugs **2**. The type slug at the top of the bar bears the character 8 and the other characters in order from top to bottom are 9, 10, 11, 0, 1, 2, 3, 4, 5, 6, 7. The reset position of the type bar is with the character 0 opposite the printing line of a platen **3**.

The positioning of a type bar to print a selected character is controlled by four electromagnets. Four of the type bars are controlled by magnets 4A, 4B, 4C and 4D

(Figures 1, 2 and 3), and the other four type bars are controlled by four similarly arranged magnets 4A', 4B', 4C' and 4D'. In order to select the characters, the magnets are energised in various combinations as set out below:

Digit	0	1	2	3	4	5	6	7	8	9	10	11
Magnets	–	A	B	AB	C	CA	CB	CAB	D	DA	DB	DAB

The coding is additive, in that the components, A, B, C and D have the fixed values 1, 2, 4 and 8 respectively, and the value of each combination is the sum of the component values.

The type bar may be moved either up or down from the reset position, depending upon which character is selected. This arrangement simplifies the setting mechanism and also reduces the maximum travel of the bar from the reset position. From the coding and the arrangement of the type slugs, it will be appreciated that the movements of the type bar effected under control of the magnets A, B, C and D will be 1, 2, 4 and −4 units respectively, the negative sign indicating downward movement of the type bar.

The movement of each type bar is determined by three setting bars **5**, **6** and **7**. The setting bars are limited to vertical movement by four guide plates **8**, which are fixed between side plates **9** of the printing mechanism. The bars **6** and **7** are pulled upward against adjustable stops **11** by springs **10**. The bar **5** is positioned by two arms **12**, which engage pins **14** on the bar **5**. The two arms are drawn together by a spring **13**, but their movement is limited by their engagement with adjustable stops **15**. This allows the bar **5** to be moved either up or down from the normal position.

The forked ends of a link **23** engage rotatable studs **16** and **17**, which are carried by the bars **6** and **7** respectively. A link **18** is pivotally connected to the link **23** at a point which is distance from the stud **16** by an amount equal to one third of the separation of the studs **16** and **17**. The link **18** is guided for vertical movement by one of the plates **8**, and by a further plate **19**.

This link **18** and the type bar **1** carry studs **20** and **22** respectively. These are engaged by the forked ends of a link **21**. The link **21** is pivotally attached to the setting bar **5**. This pivot point is one quarter of the way along the link and is nearer to the link **18**.

The links **18**, **21** and **23** transmit any movement of the setting bars **5**, **6** and **7** to the type bar **1**. Suppose that the bar **7** alone is moved downwards one unit, that is, a distance equal to that between adjacent slugs **2**. The spring **10** will hold the bar **6** stationary, so that the link **23** will act as a lever fulcrummed on the bar **6**. The slide **18** will be moved one third of a unit. The bar **5** is held by the arms **12**, so that the link **21** acts as a lever with a ratio of 3:1, and the type bar will therefore be moved one unit.

When the setting bar **6** alone is moved one unit, the slide **18** will move two thirds of a unit, so that the type bar is moved two units.

When the bar **5** is moved alone, the slide **18** is held by the bars **6** and **7** and the link **23**, so that the link **21** acts as a lever with a ratio of 4:1, and the type bar is moved four units. If more than one setting bar is moved, then the movement of the type bar is the sum of the movements due to the individual bars.

The selected character is accurately aligned by an aligning bail **24** (Figure 1), the nose of which is held lightly against a toothed plate **25**, which is attached to the type bar, by a spring **26**.

The three setting bars **5**, **6** and **7**, for any particular type bar, are selected and moved in essentially the same way. The magnet 4A (Figure 2) is shown with the armature at-

tracted, which rocks upwards the end of a latch pawl **27**, against the pull of a spring **35**. This movement disengages the pawl **27** from a three-armed latch **28**. The latch **28** is urged clockwise by a spring **30**, but is normally retained both by the latch pawl **27**, and by a lug **29** on a sequence bar **36**, which engages the second arm of the latch. If the sequence bar is moved to the left, the lug **29** is positioned so that the latch **28** is free to move if the latch pawl **27** is operated.

The third arm of the latch normally engages an operating pawl **31**. If the latch rotates clockwise, the operating pawl is released and also moves clockwise under the action of a spring **32**. This movement of the operating pawl brings a notch **33** thereon into engagement with a lug **34** which is fixed to the setting bar **7**, as shown in Figure 2.

The magnet **4A** can be de-energised and the sequence bar **36** returned to the right. This will re-engage the latch **28** with the latch pawl **27**, leaving the operating pawl **31** in the operated position. If the magnets **4A** and **4D**, for example, are now operated, the latch pawls **27** will release the latches, but the latches will still be held by the lugs **29**, as shown in Figures 1 and 2.

The operating pawl **31** is pivoted on a spindle **37**, which is carried in a box frame formed by two side plates **38** (Figures 1, 2, 3, 4 and 5) and two end plates **39**. The two side plates **38** have upper and lower extensions which are engaged by rollers **49**, to guide the frame vertically. The lower extensions of the plates **38** are connected by a shaft carrying rollers **43**, which are engaged by the forked end of arms **44**. The arms **44** are secured to a shaft **45** which is journalled in the side plates **9**.

An arm **50** is secured to one end of the shaft **45**. The other end of the arm carries a roller **46**, which runs in an internal cam track on a cam **47**. The cam **47** is mounted on a shaft **48**, which is continuously driven through chains and sprockets **51** (Figure 4). When the printing mechanism is used for printing data from record cards, the shaft **45** is driven in synchronism with the card feeding mechanism, so that it revolves once for each card fed.

At a time after the operating pawls have been set, the cam **47** drives the arm **50** (Figure 1) clockwise through such an angle that the frame **38** and **39** is moved downward one unit. This carries the operating pawls **31** down, and consequently the setting bar **7** is also forced down. As already explained, this will move the type bar **1** up one character from the reset position. When the selected character has been positioned, a hammer **52** is rocked forward to impel the slug against the platen.

The end plates **39** of the box frame have extension brackets which carry adjustable stop screws **41**. At the extreme positions of the frame, these stops engage bars **40** which are supported by rubber shock absorbing members **142**, so that the movement of the frame is cushioned.

The arrangement of pawls and latches for the magnets **4B** and **4D** is similar to that for the magnet **4A**. In the case of the magnet **4C**, the operating pawl engages one end of a lever **53**. The lever **53** is pivoted on a spindle **54** which is journalled in brackets attached to the side plates **9**. The other end of the lever **53** is forked to engage a pin **55** on the setting bar **5**. The ratio of the lever **53** is 1:1, so that if the magnet **4C** is energised, the bar **5** will be moved up one unit by the downward movement of the box frame.

As the box frame rises, the operated setting bar or bars are returned to their reset position, but they are still engaged by the operating pawls. Re-engagement of the operating pawls with their latches is effected by a resetting frame comprising side plates **56** joined by four rods **57** (Figures 1, 2, 4 and 5).

The resetting frame is supported by two short links **58** and two long links **59**, which are pivotally attached to the side plates **38** of the box frame by studs **60** and to the

plates **56** by studs **70**. The upper ends of the long links **59** are forked to engage pins **61** on a resetting bar **62** (Figure 4). The resetting frame is normally urged towards the left, as seen in Figure 1, by a spring **69** (Figure 4), which pulls the bar **62** in the same direction.

The bar **62** also carries a pin **63** which is engaged by the forked end of an arm **64**, which is free to rotate on a shaft **65**. A further arm is attached to the arm **64**. This further arm carries a cam roller **67**, which rides on the periphery of a cam **68**. The cam **68** is secured to the shaft 48, and therefore makes one revolution for each printing operation. The arm **64** is urged in a clockwise direction by a spring (not shown). After the box frame has been returned, a low point on the cam **68** causes the arm **66** and **64** to move further in a clockwise direction, thus shifting the bar **62** and the resetting frame to the right. The four rods **57** engage any set operating pawls and rotate them a small amount so that they are re-engaged by the latches. The cam **68** and the spring **69** then move the rod **62** back to the left.

So far the construction and operation of the mechanism for one type bar has been described. It was noted that each group of four magnets for the components A, B, C and D control the character selection for four type bars. This is effected through the use of four pairs of sequence bars. When considering the release of the latch **28** by the latch pawl **27** (Figure 2), it was pointed out that this could not occur unless the sequence bar **42** had been shifted to the left. The latch pawls for four adjacent columns are all operated simultaneously by the energisation of the magnet, for example, magnet **4A**, but only one latch is released, that for which the sequence bar has been moved to the right.

All the sequence bars are urged towards the right by springs **71** (Figures 2 and 4). The bar **42** carries a pin **72**, which is engaged by an arm **73**. The arm **73** is attached to an arm **75**, and they are both free to rotate on the shaft **65**. The arm **75** carries a cam roller **76** which is held against a cam **77** on the shaft **48** by a spring **74**. A high point on the cam **77** causes the arms **75** and **73** to rock anti-clockwise, which moves the bar **42** to the left.

The other sequence bar **42'** of the pair is joined to the bar **42** by a rod **78**, so that the two bars move together. Each bar has four lugs **29**, so that the latches for the first and fifth columns will be freed for control by the latch pawls when the bars move to the left. The latch pawls for the first column are controlled by the magnets **4A**, **4B**, **4C** and **4D**, whilst those for the fifth column are controlled by the magnets **4A'**, **4B'**, **4C'** and **4D'**, so that the operating pawls for the first and fifth columns may be set simultaneously, but independently, in accordance with any desired characters. The magnets are now de-energised and the cam **77** allows the bars **42** and **42'** to move back to the right.

The sequence bars for the second and sixth columns are joined by a rod **79** and are controlled by a cam **80**. This cam is timed to allow this pair of bars to move to the left just after the bar **42** returned to the right. Thus the two groups of magnets may be energised again to set the operating pawls for two more columns.

The next pair of sequence bars to operate are joined by a rod **81** and are controlled by a cam **82**. The last pair of bars are joined by a rod **83** and are controlled by a cam **84**.

After the last pair of sequence bars has operated, the operating pawls in all the eight columns will have been set as necessary. In fact, they are not only the means for operating the setting bars, but they also provide the storage of data necessitated by the sequential method of setting up. The box frame is now moved down to set up the type bars through the setting bars. Finally, the resetting frame resets the operating pawls and the mechanism is then ready for a new cycle.

The details of the hammer operating mechanism have been omitted from the main drawings of the printing

mechanism for the sake of clarity, and they are shown in schematic form in Figure 6.

A sprocket **85** is secured to the shaft **48** and drives a sprocket **86** through a chain. The sprocket **86** is secured to a shaft **87**, which also carries a cam **88**. As the cam rotates in a clockwise direction, it engages a block **89** on a pivoted plate **90** and turns the plate anti-clockwise.

When the block **89** drops off the high point of the cam **88**, the plate **90** is returned by a spring **91**. During the return movement a hammer bail **92** which is carried by the plate **90** engages all the hammers **52** and impels them forward, against spring tension, to strike the slugs **2** which are aligned with the printing line.

The cam **88** is also engaged by a roller **93** which is mounted on an arm **94**. This arm is secured to a shaft **95** to which are also secured the arms which support the aligning bail **24**. The cam timing is such that the bail **24** is lifted out of contact with the plates **25** on the type bars during the time when the type bars are being set. The bail **24** is re-engaged with the plates **25** before the hammers are operated.

In order to check that the setting bars have been correctly operated, four contacts sets **96**, **97**, **98** and **99** (Figures 1 and 2) are provided for each column. The contacts **96** are closed by a lug on the bar **7** when it moves. The contacts **97** are closed by a lug on the bar **18** when it moves more than one third of a unit, that is, when the bar **6** has moved. The contacts **98** and **99** are closed when the bar **5** moves down and up respectively.

If the data which is to be printed is held in a storage device of some kind, then the settings of the contacts are compared with the settings of the storage device. If the data is entered on a pair of channels sequentially, then two additional groups of four magnets are connected in parallel with the magnets **4**. These additional magnets control pawls and latches in the same way as the magnets **4**, but each operating pawl is released to close a pair of contacts instead of to engage a setting bar. These latter contacts are then compared with the check contacts for identity of setting. The release of the latches is sequenced by extensions of the existing sequence bars. The occurrence of an error causes the circuit of a motor driving the shaft **48** to be broken.

The checking for correct operation does not take place until after the setting bars have been moved. In the case of the bar **5** it is also necessary to ensure that both of the magnets **4C** and **4D** are not energised at the same time, as they control positive movement of the bar in opposite directions.

One end of a link **100** (Figure 1) is pivotally attached to the latch pawl **27** of the magnet **4D**. The other end of the link **100** is attached to a link **101**, which is pivoted on the same spindle as the latch pawl of the magnet **4C**. When the magnet **4D** is energised, a depending portion **102** of the link **100** is shifted so that it prevents movement of the latch pawl of the magnet **4C** as shown in Figure 1. A similar arrangement, which has been omitted for the sake of clarity, is operated by the magnet **4C** to lock the latch pawl of the magnet **4D**.

Although the setting bars have been shown as controlling a type bar, they could equally well set a print wheel. For this purpose, the type bar **1** is replaced by a rack bar which engages either with teeth cut in the periphery of the print wheel, or with a pinion secured to the print wheel.

What I claim is:

1. A printing mechanism comprising a plurality of latch pawls, means for operating said latch pawls in accordance with an additive combinational code, a plurality of latches each releasable by a different one of said latch pawls, a plurality of operating pawls each settable by a different one of said latches in its released condition, a plurality of setting bars each movable over a fixed distance by a different one of said operating pawls in its set condition, a type-bearing member, links connecting said settings bars together and to said type-bearing member so as to transmit movement of said setting bars additively to said type-bearing member, means for moving all said operating pawls a fixed distance so as to move those setting bars associated with operating pawls which are in their set condition and thus to bring the type character corresponding to the combination of operated latch pawls into printing position, and means for printing the type character so selected.

2. A multi-column printing mechanism having for each column a plurality of latch pawls, a latch releasable by each latch pawl when operated, an operating pawl settable by each latch, a plurality of setting bars, a type bearing member, links connecting the setting bars together and to the type bearing member to form an additive differential linkage, means common to two or more columns for operating the latch pawls in accordance with an additive combinational code, sequencing means for normally preventing the operation of the latch pawls by said common means, means for operating the sequencing means to allow operation of the latch pawls column by column, means for moving all the operating pawls a fixed distance, each set operating pawl moving a setting bar a fixed distance, the links transmitting the movement of the setting bars to the type bearing member to bring the type character corresponding to the combination of operated latch pawls opposite a platen, and means for printing the selected character.

3. Apparatus as claimed in claim 2 having means for resetting all the latches of a column, and further means for resetting all the operating pawls of a column.

4. Apparatus as claimed in claim 3 having a driving frame carrying the operating pawls, means for moving the driving frame said fixed distance, a resetting frame carried by said driving frame and movable relative to it, resetting means mounted on the resetting frame, and means for moving the resetting frame to bring the resetting means into engagement with the operating pawls.

5. Apparatus as claimed in claim 4 in which the type bearing member is adapted to be moved in either of two directions from a normal reset position, depending upon which character has been selected.

6. Apparatus as claimed in claim 5 having three setting bars and four operating pawls for a column, and means for controlling the movement of a first one of said setting bars by either one of two operating pawls, one of said two pawls moving the first bar said fixed distance in one direction and the other of said two pawls moving the first bar said fixed distance in the opposite direction.

7. Apparatus as claimed in claim 6 in which the ratios of the links connecting the setting bars and the type bearing member are such that movement of the first setting bar causes the type bearing member to be displaced four character positions on either side of the reset position, and that movement of the other two setting bars causes displacements of two character positions and one character position respectively.

8. Apparatus as claimed in claim 7 wherein the movement of the first setting bar in one or the other direction causes the type bearing member to be displaced so as to bring the character associated with value 4 or 8, respectively, into the printing position, and wherein the movement of the other two setting bars in said one direction causes the type bearing member to bring the character associated with value 1 or 2, respectively, into the printing position, whereby the combined movements of more than one setting bar cause the type bearing member to bring into the printing position the character associated with the value equal to the arithmetic sum of the above values, respectively.

9. Apparatus as claimed in claim 2 having a group of electromagnets, each electromagnet operating the corresponding latch pawls in two or more columns, a sequence bar for each column which normally holds all the latch pawls of the column against operation, means for retract-

ing the sequence bars in succession to release the related latch pawls for operation, and means for returning each sequence bar to the normal position before the next sequence bar is retracted.

10. Apparatus as claimed in claim 9 having two or more groups of electromagnets and means for simultaneously retracting two or more sequence bars, to allow each group of electromagnets to control the latch pawls for one column at a time.

11. Apparatus as claimed in claim 10 having a constantly rotating shaft and a plurality of cams mounted thereon for controlling the retraction and return of the sequence bars.

12. Apparatus as claimed in claim 11 having further cams mounted on said shaft for controlling the movement and resetting of the operating pawls.

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