

Feb. 7, 1967

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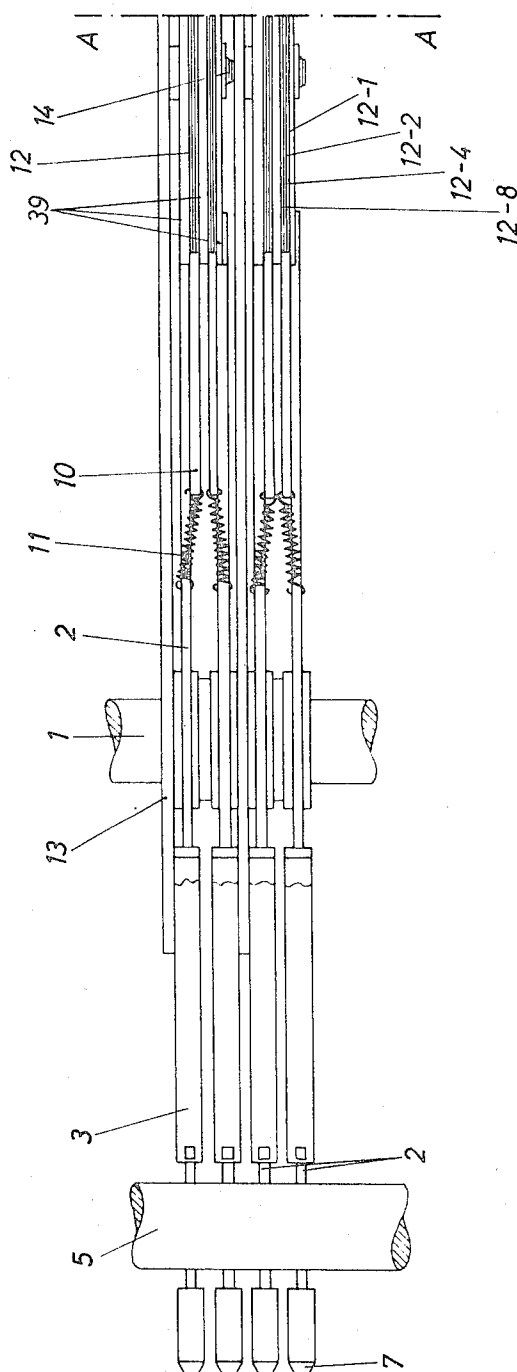
3,303,283

APPARATUS FOR POSITIONING AN INDICATING ELEMENT
IN ACCORDANCE WITH A DIGITAL CODE

Filed March 21, 1963

3 Sheets-Sheet 2

Fig. 2a



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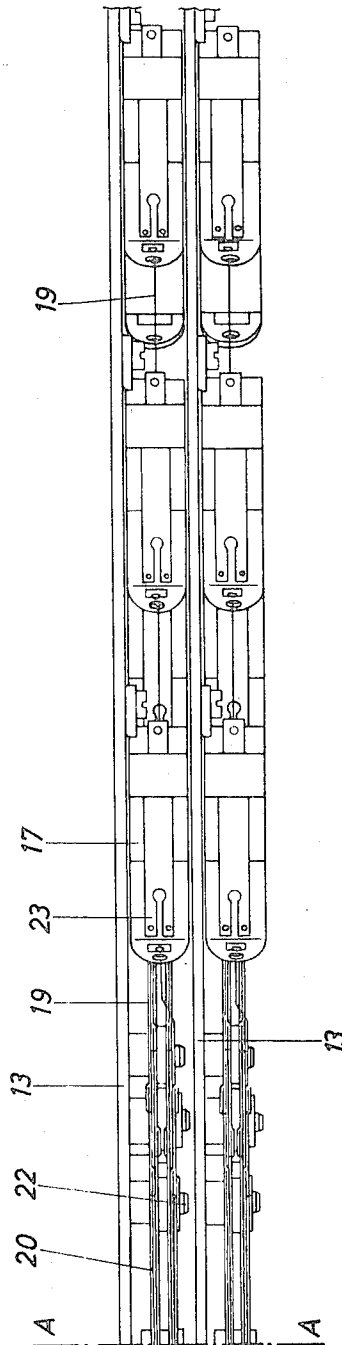
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3 Sheets-Sheet 3

Fig. 2b



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APPARATUS FOR POSITIONING AN INDICATING ELEMENT IN ACCORDANCE WITH A DIGITAL CODE

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Filed Mar. 21, 1963, Ser. No. 267,049

Claims priority, application Germany, Mar. 22, 1962, ST 18,933

4 Claims. (Cl. 178—34)

This invention relates to apparatus for positioning an indicating element, such as a type wheel or bar, in accordance with a digital code. The invention is particularly effective and advantageous when applied to the positioning of a plurality of closely spaced type wheels, as are found, e.g., in parallel line printing arrangements.

Prior art positioning apparatus of the type under consideration includes an indicating element which is operable through a range including a plurality of discrete indicating positions—e.g. for a type wheel or bar, the discrete character printing positions thereof—and either a plurality of selector elements, one for each discrete position of the indicating element, which are selectively interposable into the path of movement of the indicating element, or a single selector element which is operable relative to the indicating element, in synchronism with a predetermined movement of the latter, to engage and hold it at one of its discrete indicating positions. The operation of such apparatus thus involves selection of either a time or a space condition from a plurality of like conditions. Where this selection is required to be made in accordance with a digital code, the usual practice has been to provide an intermediate decoding operation wherein a group of permutation code selector elements translates digital code signals into the required extension or operation of a separate stop member, which is then used to stop the indicating element during a subsequent positioning operation. It has been found that this practice imposes an unnecessary limitation on the size, cost, and operating speed of the associated equipment.

Accordingly, an object of this invention is to provide improved apparatus for positioning an indicating element in accordance with digital code signals, the improvement resulting in apparatus of reduced size, cost, complexity and operating time.

Another object is to provide apparatus including permutation code selector elements which are operable in accordance with a digital code to form a transverse spanning groove, or slot, at one of a plurality of discrete positions, which groove is directly cooperative with a latch element carried on a corresponding indicating element, in a subsequent single discrete step of an operating cycle associated with said indicating element.

These and other related objects are achieved, in accordance with the present invention by the inclusion therein of separate sets of code selector elements, for each indicating element, in the form of a plurality of closely spaced, relatively slidable, wafer-like selector elements, said plurality of selector elements having particular surface configurations which, in combination, present an apparently continuous surface relative to the corresponding indicating element, at all but one discrete position along a path of

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movement associated with the said corresponding indicating element, said one discrete position corresponding to the indicating position which is to be selected. A latch member carried on, and projecting from, the indicating element serves to detect a surface discontinuity in the form of a groove or slot spanning all of the corresponding selector elements at the said one discrete position, and participates in the engagement and retention of the indicating element as it passes through an indicating position corresponding to the said one position. It is particularly advantageous to employ arcuately shaped indicating elements, and correspondingly shaped arcuate selector wafers.

Another feature of the invention resides in the arrangement of the foregoing selector element sets and corresponding indicating elements, in module-like packages, for convenient variation of the size of the combined parallel indication manifested by the indicating elements. This packaging arrangement is particularly applicable to parallel line printing equipment, having a plurality of closely spaced type wheels, and permits convenient modification therein of the length of the printed line indications. According to one particular aspect of the subject module packaging arrangement, a common base-plate is provided for each pair of consecutive indicating elements in a series of such elements to support the associated selector means, and holes are provided in all of the base-plates for receiving common latching structures, one of which coacts simultaneously with all of the indicating elements and another of which cooperates with the selector elements to rigidly secure the indicating elements and selector elements, respectively, to the main supporting structure of the equipment during each cycle of operation of the indicating elements.

Other important features relate to the use of sets of arcuate selector elements the inner peripheries of which are notched so as to form a transverse groove spanning the entire set at one discrete arc position for each code setting, with a latching pawl, biased towards the said inner peripheries, carried on corresponding disc-shaped indicating elements, and spanning the entire set. Each set of selector elements is formed by a plurality of thin wafer-like structures which may be in lateral contact, and which are adapted to slide longitudinally in relation to each other under the control of individual solenoids, flexible wire linkages, and toggle levers. The arrangement is such that a pair of type wheel indicating elements, and all of the associated positional control components, can be arranged side-by-side in a space having the width normally allotted to the printing of adjacent characters.

The foregoing and other objects and features of the invention may be more completely understood and appreciated upon consideration of the following detailed description and claims which are intended to be read in association with the accompanying drawing wherein:

FIGURE 1 is a side view of an arrangement of apparatus constructed in accordance with the invention; and

FIGURES 2a and 2b, placed end-to-end, constitute an expanded view in elevation of the arrangement in FIGURE 1.

Referring to the drawing, a shaft 1, supports a plurality of closely spaced indicating elements 2, shown as type wheels, for individual rotation thereof about the axis de-

finer by the shaft. Individual flexible bands 3 couple the elements 2 to corresponding springs 4 which tend to rotate the corresponding elements in the clockwise direction as viewed in FIGURE 1. In the illustrated position, which represents the initial reference, or quiescent, position of the entire assembly of indicating elements—e.g. prior to a position setting and printing operation—the elements 2 are all prevented from rotating under the influence of the springs 4 by a common control rod 5 extending from a pair of brackets 6, located at extreme positions along the shaft 1, only one of which is shown in the drawing.

As shown in FIGURE 1, the type wheels 2 are each provided with type indications or projections 7, at discrete peripheral positions along one projecting segment thereof, one side 8 of each projecting type segment being contacted by the common control rod 5 as shown in FIGURE 1.

Each type wheel 2 carries a bolt 9 on which there is rotatably supported a swiveling catch member 10 which acts as a discontinuity sensing and latching element. A spring 11, connected between each catch 10 and the main body of the corresponding element 2, exerts a force tending to extend the pointed end of each catch 10 towards a corresponding group of four closely spaced wafer-like selector elements 12 which are transversely spanned by the catch.

The selector elements 12, and other components which enter into the selection of the printing positions of a pair of consecutive type wheels 2, are all supported in a module-like arrangement on a common base plate 13. The eight selector elements 12 in each such module are displaceably supported on studs 14 which are fastened to the plate 13 and which extend into longitudinal slots 15 in the selector elements, the ends of the slots 15 determining basic binary, or toggle, positions of the respective elements 12.

Each selector element, representing one bit element of a four bit binary digital code, is provided with notches 16 along the inner periphery thereof. The inner peripheries of each group of selector elements form an arcuate surface, concentric to the axis of shaft 1 along which the catch 10 may freely slide. The notches of each group are so displaced that the arcuate surface is broken by a transverse groove spanning all four elements, at a different one of a plurality of discrete arcuate positions, for each combination of code positions of the group elements. Each such arcuate position corresponds to a desired angular setting of the corresponding type wheel 2.

If each group of selector elements 12 is constructed to operate in accordance with the well-known 8-4-2-1 binary-decimal code, then, referring to FIGURE 2a, to select the angular position corresponding to the type indication "1," it is necessary to shift the selector element 12-1 to the operated position while the elements 12-2, 12-4, and 12-8 are left in their idle positions, thereby forming a spanning groove at an angular position such that upon engagement of the catch 10 the type wheel 2 would be situated in the angular position required to print a "1." Similarly, to select the print indication 2, element 12-2 must be operated, and elements 12-1, 12-4, and 12-8 must remain idle. Similarly, the print indication "3" requires operation of elements 12-1 and 12-2, and so forth. It will be appreciated that any other binary code may be used with similar results.

Referring again to FIGURE 1 for each selector element 12 there is provided a corresponding magnet 17 which, when energized acts—thru an armature 18, taut wire 19, toggle lever 20, and mating slot 21—to shift the element 12 to its operated position. The toggle lever engaging slots 21 of each pair of laterally adjacent selector elements 12 are arranged at different angular positions to afford lateral clearance for the corresponding pair of toggle levers 20. Each such pair of toggle levers is pivotally mounted on different bolts 22 fastened to com-

mon base plate 13. Upon energization of a magnet 17, the associated armature 18 also actuates a pair of holding contacts 23 which are released by means not shown, upon completion of a printing operation, so that the setting magnets act as storage registers.

The selector elements are connected to springs 24 which act to restore the operated elements to the idle binary position following release of the hold contacts 23. To prevent undue stress on the magnets 17, and the selector elements, a guide bar 25 is actuated by control rod 5 immediately after the start of a position setting operation, to engage one of two slots 26, 27 of each selector element 12. Slots 26 correspond to the idle position and slots 27 to the operated or active position. Guide bar 25, acting through openings in all of the base plates 13 is common to all of the groups of selector elements of the entire bank of type wheels, and is rotatably supported, relative to axle 28, on levers 29. The guide bar is controlled by a cam 30 extending from bracket 6. Upon clockwise rotation of cam 30, a roller 31 of lever 29 is released and the lever 29 is rotated counterclockwise by spring 32 engaging slot 26 or 27 in the selector elements.

Similarly, type wheels 2 are clamped and aligned by a common guide bar 33, acting through openings in all of the base plates 13, which meshes with a notch 34 in each type wheel prior to printing. The bar 33 is fixed to a pair of levers 37, only one of which is shown, having a roller extension 36 which is engaged by the surface 35 of cam 30 during rotation of the bracket 6, the latter acting in opposition to restoring spring 38.

The time sequence of steps leading to a printing operation is as follows: magnets 17 are energized via circuits not shown to hold selector elements 12 in the required positions. Driving means, not shown, then pivot bracket 6 clockwise through a given angle of rotation exceeding the maximum range of movement of the type wheels 2. The type wheels 2 are released and rotate clockwise under the influence of springs 4 while the selector elements are clamped and aligned by the common guide bar 25. As each type wheel rotates, the associated catch member 10 slides along the continuous arc formed by the combined inner peripheries of the selector elements until it reaches the spanning groove formed by the aligned notches, where it engages, stopping the type wheel in the selected character printing position. When rod 5 has moved through an angle sufficient to allow for the setting of all type wheels, common guide key 33 is actuated to secure and align all of the type wheels. Thereafter printing hammers, not shown, are actuated, preferably in parallel, to press a paper and inked ribbon, not shown, against the bank of type wheels, and rod 5 is then restored to its initial position by means not shown. The gradually curved rear surfaces of the catch members 10 permit smooth disengagement of these members, so that the type wheels 2 are free to rotate with the rod 5 to the initial position. During restoration of rod 5, cam 30 acts to restore guide keys 25 and 33 to their initial disengaged states, so as to free the selector elements and type wheels, respectively. The hold contacts 23 of magnets 17 having been released at some time following the engagement of guide key 25, upon release of the latter, the selector elements are all restored to their idle positions by springs 24.

In the illustrated example, each of a plurality of type wheels 2 carries 12 type characters 7, at its assigned indicating positions, these representing the decimal digits 0 to 9, and two special symbols such as plus and minus signs, for example. This arrangement is of course susceptible of modification. For example, a code with more or less than four elements may be used where a greater or lesser number of indicating positions is required.

The use of linearly displaced type segments or bars is also contemplated within the scope of the invention, with the catch members 10 carried on gears acting between the type wheels and the code selector elements.

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Similarly, moving coil magnets, or manually actuated mechanical linkages are considered to be the equivalent of the hinged armature magnets 17 shown in the illustration.

One considerable advantage afforded by the illustrated example of the invention is that each pair of adjacent printing units is packaged as a separate module unit on a separate base plate 13, the Roman numerals assigned to the magnet designations in FIGURE 1 distinguishing the magnets according to the corresponding type wheel of the module pair. It should be clear that for each such module, the type wheels, the magnets, the selector elements, and the components linking the magnets and selector elements, are all neatly packaged in the width of a space corresponding to the width of the space assigned to a pair of printed characters on a line of the resultant print indication.

Other applications will immediately suggest themselves to those skilled in the art; for example, the angular positioning of discs, such as telephone dial members, in accordance with depressed push-buttons where the latter act to position permutation code selecting elements.

Accordingly, while I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention as set forth in the objects thereof and in the accompanying claims.

What is claimed is:

1. Apparatus for positioning each of a plurality of closely spaced indicating elements in accordance with a digital code comprising:

a plurality of indicating elements arranged side-by-side in a compact grouping and individually operable through respective ranges of discrete indicating positions;

a plurality of sets of selector elements corresponding to said indicating elements, each said set including a plurality of thin selector elements arranged in a space having a width comparable to that of the corresponding indicating element, the selector elements of each said set being individually operable in accordance with a digital code to form an intercepting structure at one of a plurality of discrete positions corresponding to one of said discrete indicating positions of the corresponding indicating element;

means carried on each said indicating element and operative in response to said intercepting structure when said indicating element is moved through said respective range of indicating positions, to latch said indicating element in the said corresponding one of said discrete indicating positions, said latching means occupying a space having a width comparable to the width of said corresponding set of selector elements; and

means operative relative to all of said sets of selector elements for simultaneously securing all of said selector elements to a main support structure of said apparatus prior to each operation of said indicating elements through said respective ranges.

2. Apparatus according to claim 1 including:

a base plate associated with a plurality of adjacent ones of said indicating elements, each said base plate carrying all of the said sets of selector elements corresponding to said associated plurality of adjacent indicating elements, each said plate further having a hole therein to permit operation there-through of said selector element securing means.

3. Apparatus for positioning each of a plurality of closely spaced indicating elements in accordance with a digital code comprising:

a shaft;

a plurality of indicating elements mounted for rota-

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tion about said shaft, and arranged in a closely spaced series along said shaft;

a base plate associated with one pair of consecutive indicating elements in said series and positioned intermediate said one pair and the next successive pair of said series;

a pair of permutation code selector element groups, each operable in accordance with a digital code, carried on said base plate and displaceable relative thereto for selectively positioning said associated pair of indicating elements, said selector element groups and base plate each occupying a space having a width comparable to the space between said elements of said associated pair of indicating elements;

means carried on said indicating elements and cooperative with said corresponding selector groups for establishing said respective indicating elements at indicating positions selected by means of said selector groups,

said base plates being provided with corresponding openings permitting convenient access to all of said indicating elements and also to all of said selector groups; said apparatus further including:

first means operative through all of said base plate openings for securing all of the moving parts associated with said selector groups to the main supporting structure of said apparatus;

second means operative through all of said base plate openings for securing all of said indicating elements to said main structure;

means carried on said shaft for maintaining all of said indicating elements at reference angular positions, said shaft carried means being rotatably displaceable relative to said shaft to sequentially operate said first and second means after corresponding first and second predetermined displacements thereof; and

means resiliently biasing said indicating elements for rotation in the direction of said predetermined displacements of said shaft carried means to operate said indicating elements relative to said corresponding selector groups through given respective ranges of discrete indicating positions thereof.

4. In printing apparatus including a main frame, a shaft depending from said main frame and means depending from and operable relative to said main frame for securing otherwise independent structures to said frame, the combination representing a detachable printing unit, comprising:

a base plate supported on said shaft;

a plurality of type wheels rotatably mounted on said shaft;

a set of selector electromagnets, carried on said base plate, for each said type wheel, each said set of magnets being operable in accordance with a digital code;

a set of corresponding arcuate permutation code selector elements linked to respective armatures of said selector magnets, and carried on said base plate; said selector elements having notched inner peripheries facing the outer peripheries of said type wheels, the said notches of each set being relatively displaced in accordance with said code so as to form a transverse groove, spanning one and only one of a plurality of discrete arc positions, for each selected code combination;

a catch member pivotally mounted on each said type wheel, each said catch member being resiliently biased towards, and transversely spanning, the inner peripheries of the corresponding set of selector elements so as to enter and engage the said transverse spanning groove when said type wheels are moved relative to said corresponding selector element sets;

means coupled between said type wheels and said base plate for resiliently biasing said type wheels for

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rotation relative to said corresponding sets of selector elements through given ranges of discrete indicating positions corresponding to the selectable positions of said transverse grooves; and
means individually coupled between said selector elements and said base plate for resiliently biasing the individual elements of said sets of selector elements, into reference code positions, in opposition to the action of said selector electromagnets.

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