Aug. 17, 1965 W. P. RYAN 3,200,927

POSITIONING MECHANISM

Filed Nov. 18, 1960 2 Sheets-Sheet 1

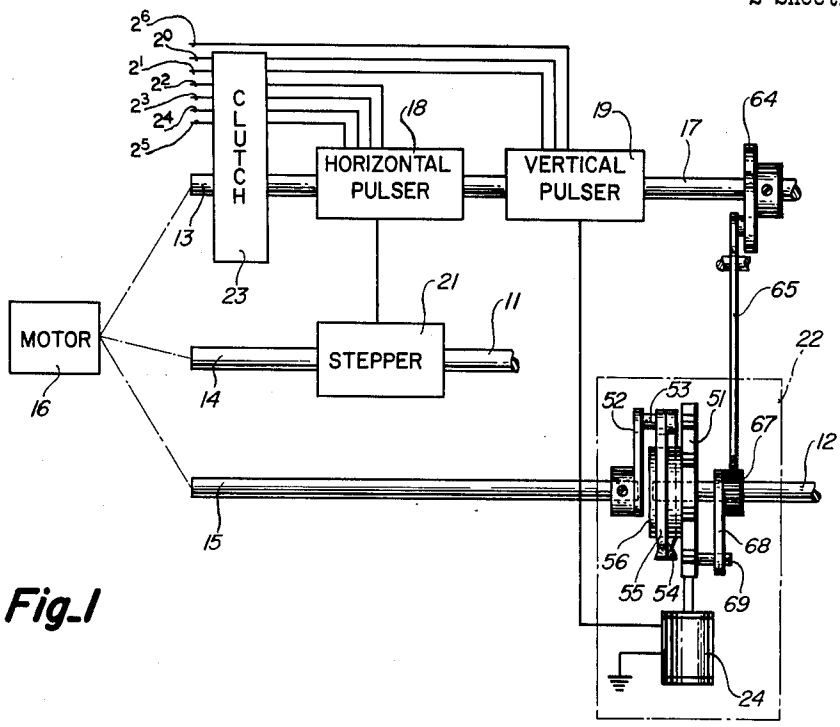
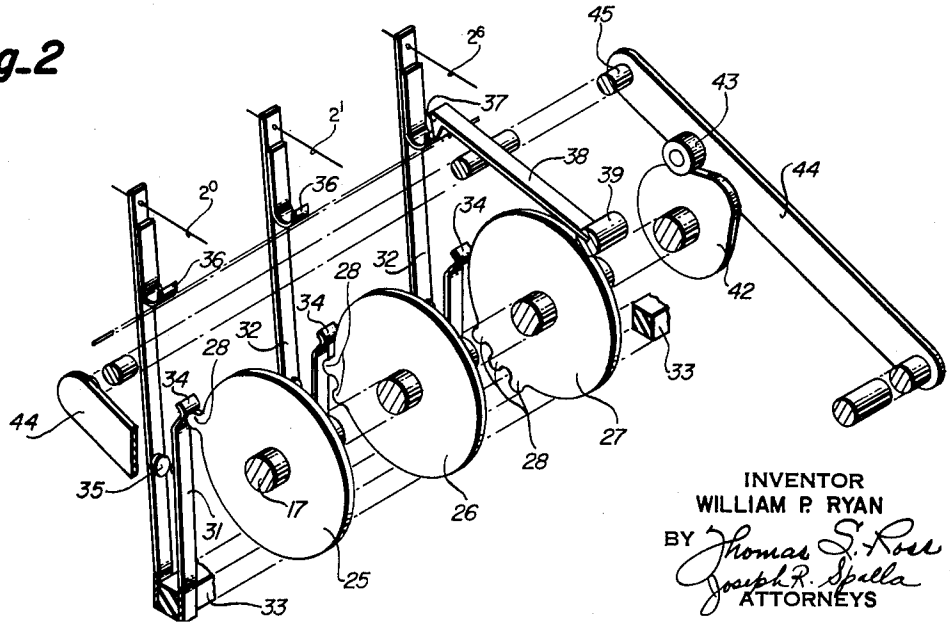


Fig_1

Fig_2



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POSITIONING MECHANISM

Filed Nov. 18, 1960 2 Sheets-Sheet 2

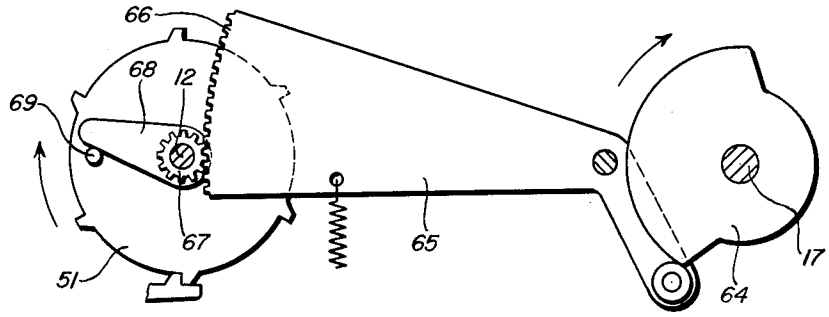


Fig_5

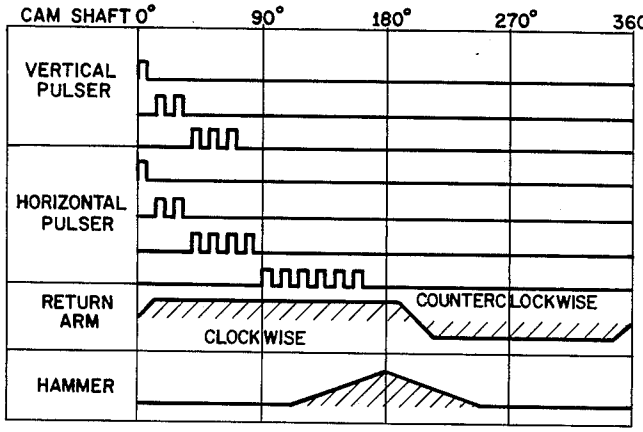


Fig_7

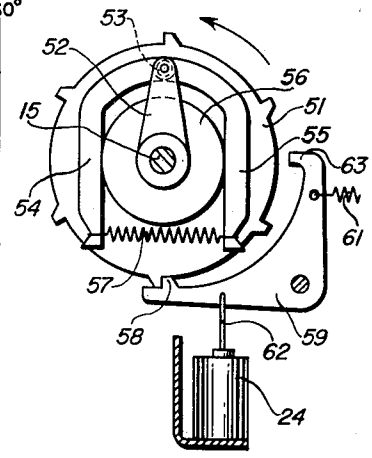
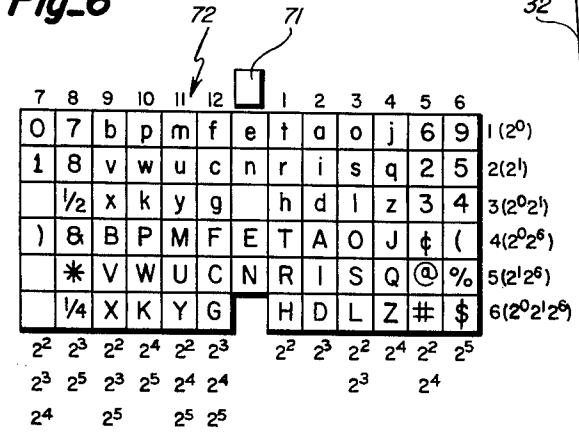


Fig_4

Fig_6



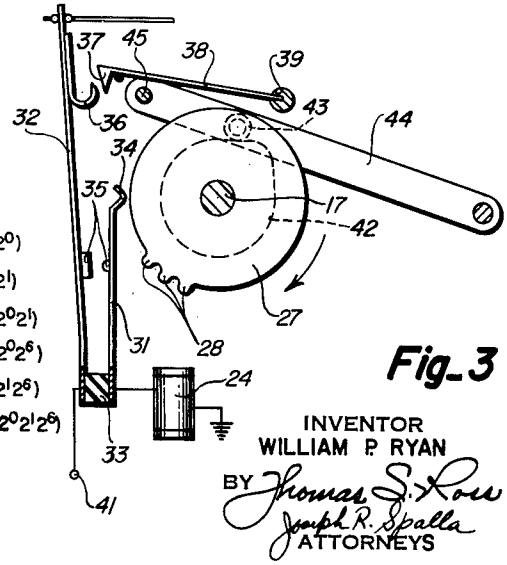


Fig_3

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POSITIONING MECHANISM

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5 Claims. (Cl. 197—16)

This invention relates broadly to mechanisms for variably positioning shafts in response to digital information; more particularly it relates to positioning mechanism for type matrices having stepper mechanisms operable in response to digital codes representative of type on the type matrix for selectively positioning a type matrix; and specifically it relates to a matrix positioning mechanism having stepper mechanisms which are controlled by pulse generators selectively conditioned by digital codes representative of type on the type matrix.

An object of the invention is to provide a simple fast acting digital to analogue device.

Another object of the invention is to provide a novel type matrix positioning mechanism.

Another object of the invention is in the provision of a type matrix positioning mechanism selectively responsive to digital codes representative of type on the type matrix for variably positioning said type matrix to selected positions and back to a home position in rapid fashion.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like reference numerals designate like parts throughout the figures thereof and wherein:

FIGURE 1 is a plan view, partly diagrammatic, of positioning mechanism in accordance with the invention;

FIGURE 2 is a perspective view showing a pulse generator structure diagrammatically illustrated in FIGURE 1;

FIGURE 3 is a side elevational view more clearly illustrating the latching mechanism shown in FIGURE 2;

FIGURE 4 is a side elevational view showing the stepper mechanism of FIGURE 1;

FIGURE 5 is a side elevational view of the stepper homing mechanism shown in FIGURE 1;

FIGURE 6 is a view of a cylindrical type matrix layout; and

FIGURE 7 is a timing diagram.

Referring now to the drawings wherein like reference characters designate like or corresponding parts throughout the several views there is shown in FIGURE 1 positioning mechanism responsive to bit cables 2^0, 2^1, 2^2, 2^3, 2^4, 2^5, and 2^6 respectively for controlling the angular position of horizontal and vertical matrix positioning shafts 11 and 12 respectively. The bit cables may be selectively activated by a keyboard encoder as disclosed in copending application Serial No. 23,079 of W. P. Ryan, now Patent No. 3,032,165. As in said copending application the 2^0, 2^1, and 2^6 (shift bit) cables are operative to position the vertical positioning shaft and the 2^2, 2^3, 2^4 and 2^5 bits are operative to position the horizontal positioning shaft.

As shown in FIGURE 1 three drive shafts 13, 14 and 15 respectively are driven by a motor 16 through suitable gearing at predetermined speeds.

Drive shaft 13 is adapted to be coupled to a cam shaft 17 having associated therewith as will hereinafter appear a horizontal and a vertical pulsing unit 18 and 19 respectively. The horizontal pulsing unit 18 controls a horizontal stepper mechanism 21 whereby drive shaft 14 is variably coupled to the horizontal output shaft 11 and the vertical pulsing unit 19 controls a vertical stepper mechanism 22 whereby drive shaft 15 is variably coupled to positioning shaft 12.

In that the vertical and horizontal positioning mechanisms are identical except as to the number of elements and except as will be pointed out infra only the vertical positioning mechanism is shown in detail in the drawings.

As seen in FIGURE 1 drive shaft 13 is adapted to be coupled to cam shaft 17 upon actuation of a one revolution clutch, generally designated by reference numeral 23, which is responsive to movement of any one or more of bit cables 2^0–2^5 in a manner disclosed in said copending application. Bit cables 2^0, 2^1 are also operative together with the shift or 2^6 bit cable to condition switching circuits in the vertical pulsing unit 19. The bit cables 2^2–2^5 are also operative to condition switching circuits in the horizontal pulsing unit 18. The conditioned switching circuits in units 18 and 19 are operative by elements on the cam shaft, as will be apparent with reference to FIGURE 2, to deliver electrical pulses to solenoids, the vertical solenoid being designated by reference numeral 24, which are operative to control associated escapement or stepper mechanisms 21 and 22 to thereby connect drive shafts 14 and 15 to the horizontal and vertical positioning shafts 11 and 12.

Referring now to FIGURE 2 the vertical pulser comprises three discs 25, 26, and 27, respectively, fixed for rotation with cam shaft 17 and having respectively 1, 2 and 3 switching lobes 28, adapted to produce a train of up to 6 electrical pulses. Associated with each disc is a switch assembly comprising a pair of spaced resilient front and back contact arms 31 and 32 respectively joined to an insulating base 33 common to all of the switch assemblies. As seen more clearly in FIGURE 3 each front contact arm 31 is formed with an arcuate tip 34 which is adapted to be engaged and moved toward a back contact arm 32 by the switching lobes 28 on its associated disc. The front and back contact arms are normally spaced such that the movement of the front contact arms 31 by the switching lobes 28 is not sufficient to bring the contacts 35 on associated contact arms together. As seen in FIGURES 2 and 3 each back contact arm 32 is connected to an associated bit cable and is provided with a hooked portion 36 on its upper end which, when the contact arm 32 is displaced toward contact arm 31 by the bit cable, will latchingly engage the hooked end 37 of a flexible latch 38 that is fixed at its other end to a stationary cross shaft 39. With a contact arm 32 in latched position, movement of its associated front contact arm 31 by switching lobes 28 will complete a circuit between a voltage source 41 and ground through the solenoid 24. As shown in FIGURE 2 and as is evident from the timing diagram of FIGURE 7 the lobes 28 on each disc are angularly displaced such that pulses from switches associated with discs 25, 26 and 27 occur serially in time. After a predetermined period sufficient for all the lobes 28 to pass the arcuate tip 34 on associated contact arms 31 (90° in the vertical pulsing unit as seen from FIGURE 7), a cam 42 on the cam shaft 17 operates on a cam follower 43 on one of two spaced arms 44 to raise a bail 45 secured between the arms, thereby to unlatch all of the latched contact arms 32 preparatory to another cycle.

The horizontal pulsing unit is similar except that it comprises four discs having 1, 2, 4 and 6 switching lobes operative on associated switches to produce a train of up to 13 electrical pulses as is evident from FIGURE 7. The resetting of latched contacts in the horizontal pulsing unit is similarly accomplished after 180° of cam shaft rotation.

The vertical stepper mechanism 22 comprises as shown in FIGURES 1 and 4 a six toothed escapement wheel 51 (the horizontal positioning mechanism will be provided

with a 13 toothed escapement wheel having the same tooth spacing as the vertical escapement wheel) fastened to positioning shaft 12. A drive arm 52 is fastened to the drive shaft 15. Pivoted on a pin 53 which is fastened to the drive arm 52 is a connecting member betwen friction drive shoes 54 and 55 which are loaded into frictional engagement with a drum 56 forming part of the escapement wheel 51 by a spring 57. As the crank arm 52 rotates, the friction shoes 54 and 55 also rotate and tend to turn the escapement wheel 51. The wheel 51 is normally held in position by the lower tooth 58 of an escapement pawl 59 which is rotatively biased into engagement with the escapement wheel by a spring 61. The pawl 59 is connected to the armature of solenoid 24 by a link 62 so that upon energization of the solenoid by a pulse generated by pulser 19 pawl 59 is rotated counterclockwise and releases the escapement wheel 51. Rotation of the escapement wheel brings one of its teeth into engagement with the upper tooth 63 of the escapement pawl rocking or camming the pawl clockwise about its pivot a distance sufficient to effect a reduction of the magnetic force exerted by the solenoid on the pawl thereby permitting the spring force to rotate the pawl back into escapement arresting position; the solenoid 24 being deenergized at this time. Subsequent pulses effect further incremental rotation of shaft 12.

Referring to FIGURE 5 the escapement wheel 51 is homed during the 180°–360° interval of each cycle of cam shaft 17 by a cam 64 which acts on a cam follower arm 65 having a sector gear 66 on the opposite end which cooperates with a gear 67 freely pivoted on shaft 12. Secured to gear 67 is a return arm 68 which cooperates with a pin 69 on the escapement wheel to return the escapement wheel. During the first half of a cam shaft cycle the return arm 68 is rotated clockwise in front of the pin 69 on the escapement wheel so that the escapement wheel is free to escape, and during the latter part of the cycle it rotates counterclockwise back to home position carrying with it the escapement wheel through engagement of pin 69. The horizontal stepper is similarly homed.

The cam shaft 17 also carries a cam (not shown) adapted to actuate a hammer 71 (FIGURE 6) after a matrix 72 has been positioned by shafts 11 and 12. The hammer is caused to strike at 180° as shown in FIGURE 7. Referring more particularly to FIGURE 6 there is illustrated a layout of a cylindrical matrix in a home position showing the different positions to which the matrix may be moved and the codes necessary to accomplish the movement. As is illustrated the matrix may be moved upwardly from one to six positions and simultaneously rotated from the home position shown to one of 12 other positions. It is to be noted that the matrix must always move vertically.

The operation of the instant apparatus may be followed with reference to the matrix layout and timing diagram. Assume that the upper case character W is called. This requires 5 units of vertical movement and 10 units of rotation to bring the W in front of hammer 71. Depression of the shift key and the character W on a keyboard will pull cables 2^1, 2^6 and 2^4 and 2^5.

The actuation of these cables will condition the switches associated therewith and couple shaft 13 to the cam shaft 17. Since the switches associated with cables 2^1 and 2^6 were conditioned the vertical pulser will deliver 5 pulses to vertical stepper solenoid 24 and the horizontal pulser will deliver 10 pulses to the horizontal stepper solenoid. Shafts 12 and 11 will therefore be driven by associated shafts 15 and 14 five and ten increments respectively thereby positioning, through mechanism such as disclosed in said copending application, the W before the print hammer which will be activated at 180° cam shaft rotation. Thereafter the vertical and horizontal stepping devices will be homed by their associated cam follower arms 65 preparatory to another print cycle.

It should be understood that the foregoing disclosure relates to only a preferred embodiment of the invention and that it is intended to cover all changes and modifications of the example of the invention herein chosen for the purposes of the disclosure, which do not constitute departures from the spirit and scope of the invention.

The invention claimed is:

1. Mechanism for converting combinations of simultaneously generated signals to corresponding rotary movements of an output shaft comprising in combination, a driven shaft, escapement means adapted when actuated to operably couple said driven and output shafts, a control shaft, one revolution clutch means responsive to said signals for connecting said driven and control shafts, switch means selectively conditionable by said signals, switch operating means on said control shaft operable on conditioned switch means to generate a train of electrical pulses, and means operable to actuate said escapement means in response to each pulse in the train of pulses generated.

2. Matrix positioning mechanism of the character described comprising a shaft drive source, a control shaft, a matrix positioning shaft, clutch means responsive to combinations of simultaneously generated signals collectively representing information operable to couple said drive source to said control shaft, escapement means adapted to couple said drive source to said positioning shaft, and means selectively conditionable by said signals and operable in timed relation to the rotation of said control shaft for operating said escapement means.

3. Matrix positioning mechanism of the character described comprising a shaft drive source, a control shaft, first and second matrix positioning shafts, clutch means responsive to combinations of simultaneously generated impulses collectively representing characters on said matrix operable to couple said drive source to said control shaft, first and second escapement means adapted to couple said drive source to said matrix positioning shafts, and means selectively conditionable by said impulses and operable by said control shaft for operating said escapement means for predetermined periods corresponding to said impulse combinations whereby said first and second matrix positioning shafts are rotated through predetermined arcs.

4. Matrix positioning mechanism of the character described comprising a motive source, a cam shaft having a plurality of cams thereon, a matrix positioning shaft, switch means selectively conditionable by combinations of simultaneously generated impulses collectively representing information, clutch means responsive to said impulses for coupling said motive source and cam shaft, switching lobes on said cams adapted to close selectively conditioned switch means a predetermined number of times related to said information, escapement means adapted to couple said motive source to said matrix positioning shaft, and means responsive to each closure of said switch means for operating said escapement means.

5. Type matrix positioning mechanism of the character described for converting combinations of simultaneously generated impulses representing characters on a type matrix into movement of an output shaft adapted to selectively position characters on the type matrix opposite a printing plane, said mechanism comprising a drive source,

a cam shaft,

means responsive to impulses of each combination of impulses for coupling a cycle of said source to said cam shaft,

means responsive to impulses of each combination of impulses and to the operation of said cam shaft for generating electrical pulse trains during the initial half cycle of said cam shaft,

escapement means connected between said output shaft and drive source,

means responsive to each pulse generated for releasing said escapement one increment,

and means associated with said cam shaft and said out-

put shaft for homing said escapement means and said output shaft during the final half cycle of said cam shaft.

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