

July 19, 1960

L. J. LAPOINTE ET AL  
ROTARY PRINTING DEVICE

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3 Sheets-Sheet 1

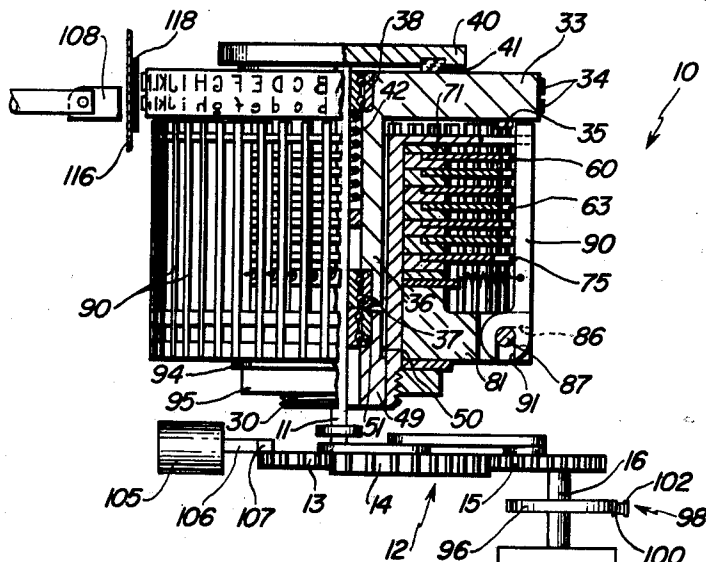


Fig. 1

Fig. 7

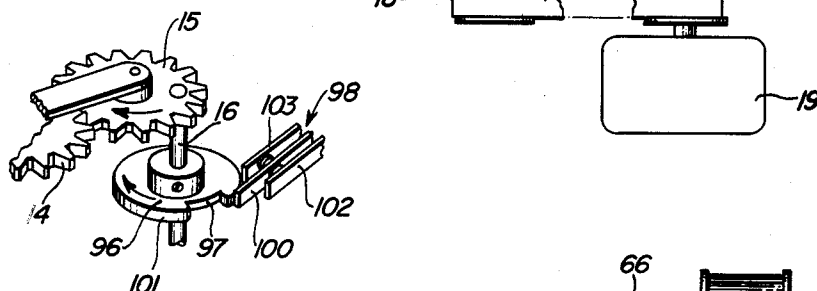


Fig. 3

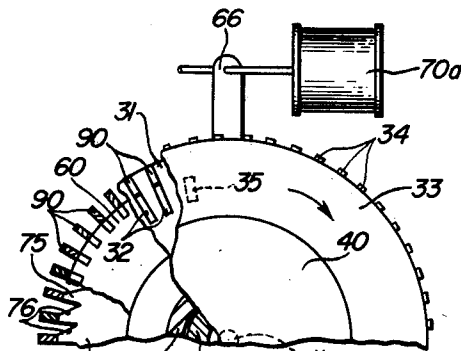
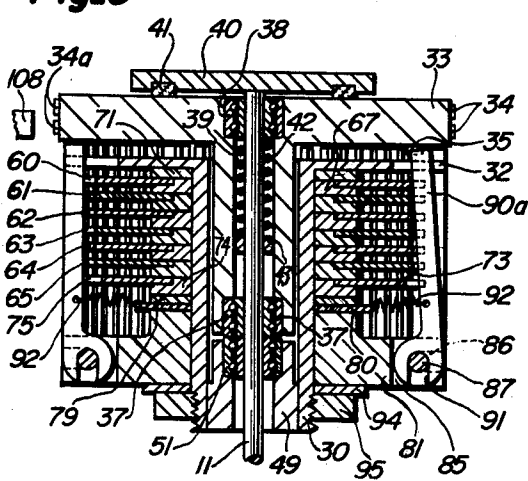


Fig. 4

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3 Sheets-Sheet 2

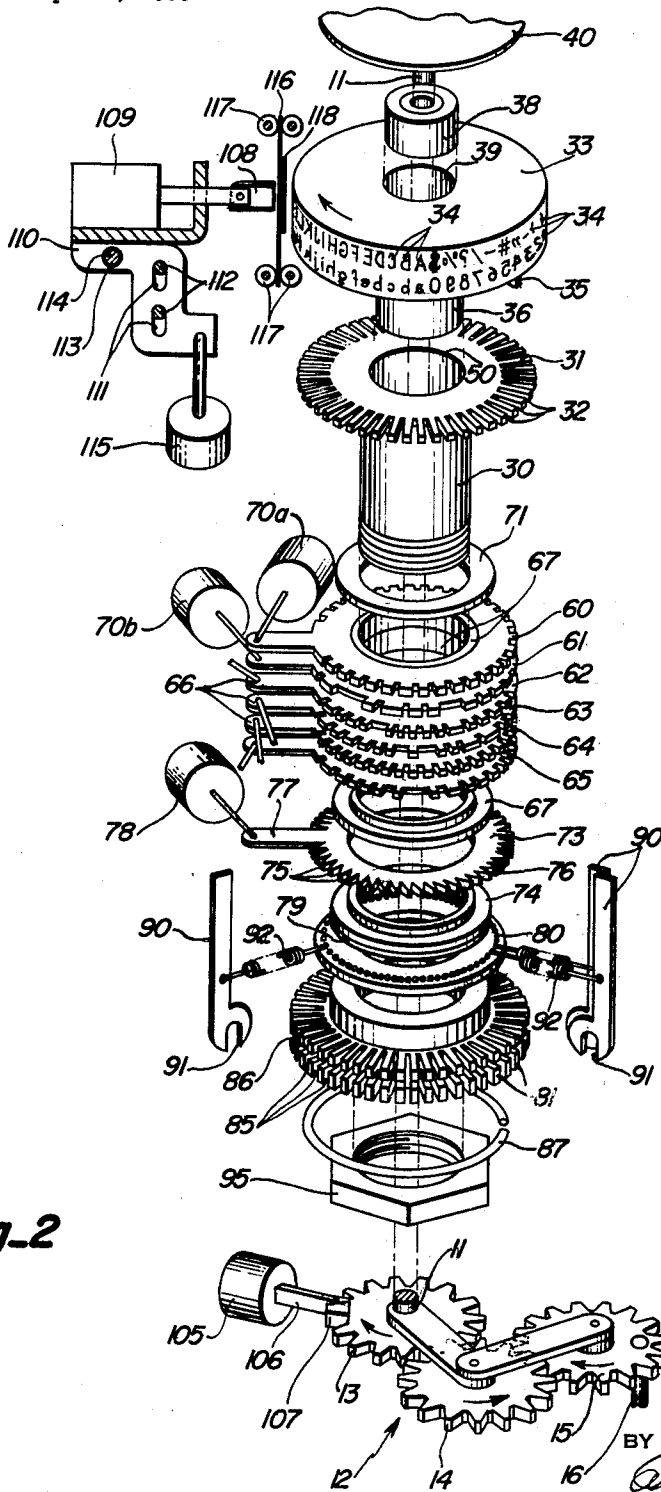


Fig. 2

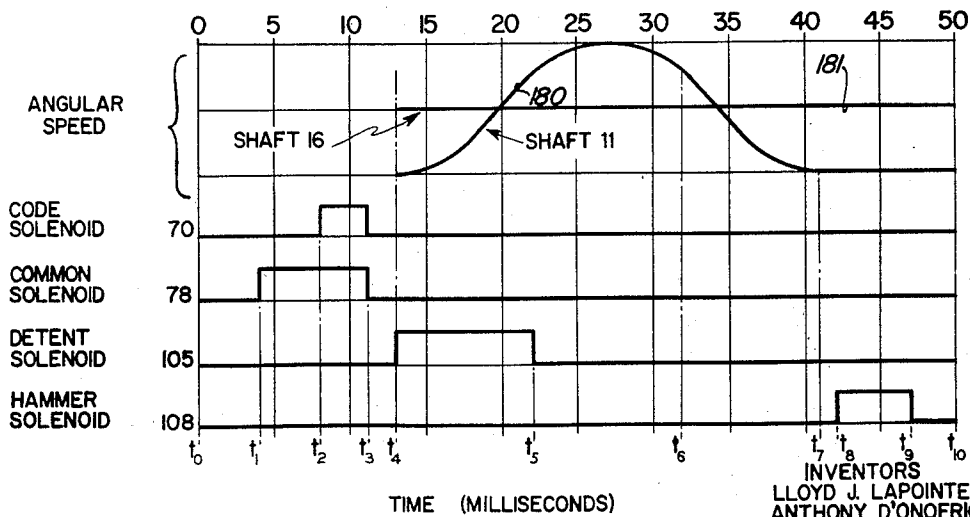
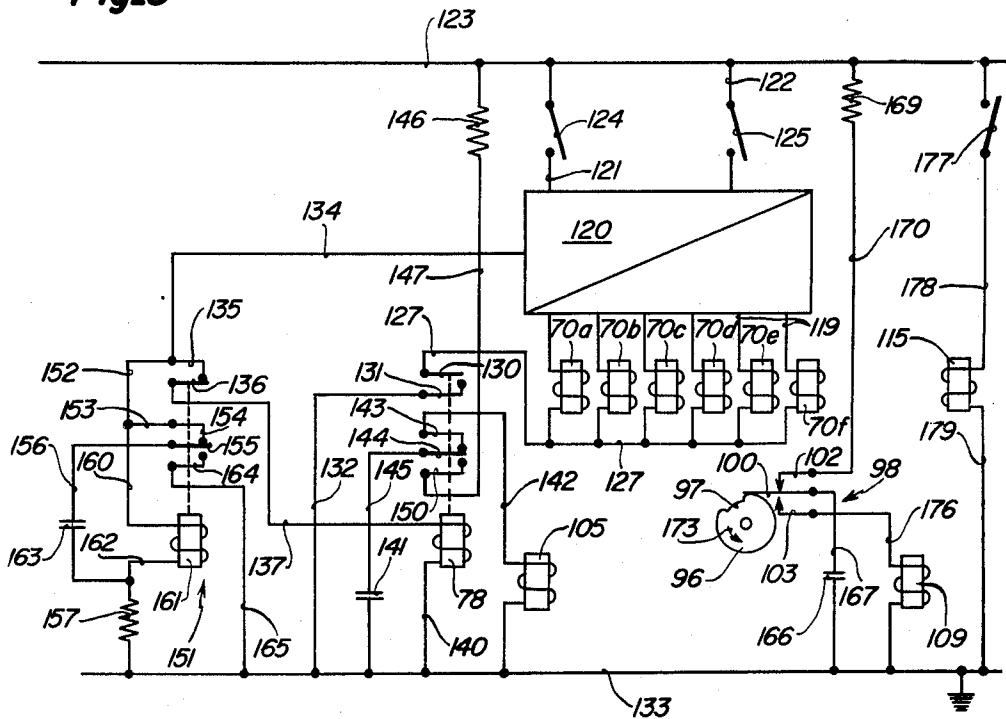
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***Fig\_5***



**Fig\_6**

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## ROTARY PRINTING DEVICE

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12 Claims. (Cl. 197—12)

This invention relates to a rotary type printing device and more particularly relates to a novel typing or printing device that employs a rotary type printing head which is successively indexed to selective printing positions in an efficient and predetermined timed relation to the operation of the other elements of the device.

In many conventional rotary type printing devices the printing head is yieldably driven by a shaft which is continuously rotated at a substantially constant speed. Here there is little, if any, possibility of controllably varying the acceleration and deceleration of said printing head during each of its intermittent cycles of rotation. Furthermore the sequential timing of operation of the various parts of these devices is not efficiently controlled to the extent necessary to insure the attaining of the maximum potential overall speed of operation of the apparatus.

One object of the instant invention is to provide a rotary type printing device which has a novel construction and an improved means for more efficiently synchronizing the operation of the various parts thereof.

Another object of the invention is to provide a relatively simple rotary type printing device having a printing head which is frictionally driven by a shaft that partakes of a predetermined intermittent cyclic movement.

Another object of the invention is to provide a novel printing device having a cylindrical printing head which is yieldably driven by a cyclically operated drive means which is intermittently rotated.

Another object of the instant invention is to provide a very compact inexpensive rotary type printing device having a printing head which is frictionally driven by a shaft whose rotational speed varies during each intermittent cycle of operation.

Another object of the invention is to provide a rotary type printing device having a printing head which is driven at predetermined varying speeds during each cyclic 360 degrees of rotation; said cyclic rotation starting and ending with a zero speed which is created independently of the operation of any stop means that positively terminate each cyclic movement of the printing head.

Another object of the invention is to provide an improved yieldably driven rotary type printing head which cooperates with a print hammer that is operated after completion of an entire cycle of the rotation of the main shaft driving said head.

Still another object of the invention is to provide an improved rotary type printing device having a pair of yieldable drive means which actuate a rotary type head and which are serially connected by a gearing means that drive said head at predetermined varying speeds.

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:

Fig. 1 is a front elevational view in partial diametral

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section showing the constructional nature and the general drive means for the rotary printing device constituting the instant invention.

Fig. 2 is an exploded perspective view of the principal parts of the instant rotary printing device.

Fig. 3 is a diametral sectional view of the instant printing device.

Fig. 4 is a fragmentary plan view of the instant device taken in partial three level section.

Fig. 5 defines the circuit diagram for the instant apparatus.

Fig. 6 illustrates a typical timing diagram for the operation of the various solenoids and certain other parts of the instant apparatus.

Fig. 7 is a fragmentary perspective view illustrating the construction and operation of a cam and an associated hammer control switch.

Referring to Figs. 1 and 2 the instant rotary printing device 10 is driven by the main shaft 11 that is operated by a gear train 12 comprising three gears 13, 14 and 15 having equal pitch diameters and which are respectively interconnected as are gears  $d$ ,  $l$  and  $h$  of U.S. Patent 1,052,542. Gear 13 is rotatably secured to the main shaft 11 while gear 15 is eccentrically fixed to the output shaft 16 of a conventional friction type slip clutch 17. The input shaft 18 of the clutch is driven by a constantly running motor 19 through any suitable means such as a pulley-belt arrangement 20. When the slip clutch 17 is permitted to drive gear train 12 the main shaft 11 will be yieldably driven through successive 360 degree cycles of rotation thereby operating the printing device 10 as will be further described below. The operational nature of gear train 12 is such that during each cycle of operation of the instant device, shafts 11 and 16 will each make one revolution but the rotational movement of shaft 11 will start with and end before that of shaft 16. The length of the time overlap of the movement of shaft 16 with respect to shaft 11 may be adjusted as desired by varying the degree of eccentricity of gear 15 with respect to shaft 16.

A detailed description of the construction of the rotary printing device 10 will be made with reference to Figs. 2-4. As is best illustrated in Fig. 2 said device comprises a main tubular support member 30 the upper end of which is provided with a flange 31 having a plurality of circumferentially spaced and radially disposed slots 32 formed therein. Rotatably mounted in the support member 30 is a cylindrical printing head 33 having a plurality of type 34 fixed to or formed in the periphery thereof. The printing head 33 is provided with a depending radially disposed stop 35 and a tubular hub portion 36 which extends into the upper end of the tubular support member 30. Radial bearings 37 and 38 which are secured at either end of a central aperture 39 of said tubular hub portion, provide a bearing support for the main shaft 11. Secured to the upper end of shaft 11 is a disc 40 which is provided on its lower face with an annular friction element 41 that is biased into frictional engagement with the upper face of said printing head 33 by means of a compression spring 42 which is operatively disposed between bearing 38 and a shoulder 43 formed on shaft 11. A tubular insert 49, Fig. 3, is press fitted into the lower end of the central aperture 50, Fig. 2, of the main tubular support member 30 and is provided with a bearing 51 which radially supports and positions shaft 11. The bearing 51 axially abuts bearing 37 and thereby maintains the printing head 33 in fixed axially spaced relation with respect to the tubular support member 30.

Supported on the member 30 are six coaxially disposed and axially spaced permutation members or discs 60, 61, 62, 63, 64 and 65, Fig. 2, each of which is provided with an outwardly extending radial arm 66. Said

permutation members have a conventional type coded pattern of notches formed in their respective peripheries and are respectively rotatably mounted on six axially abutting spacer bushings 67, Figs. 2 and 3. Each of said radial arms 66 is connected to and actuated by the armature of one of the code solenoids 70a, 70b, 70c, 70d, 70e and 70f, Figs. 2 and 5. A washer 71 is disposed between the uppermost permutation disc 60 and the flange 31 of the tubular support member 30. A stop control disc 73, which is rotatably mounted on its associated spacer bushing 74, is disposed immediately beneath the lowermost permutation disc 65 and is provided with a plurality of equally and circumferentially spaced ratchet type teeth 75 whose respective clockwise sides, as seen in Fig. 2, define inclined camming surfaces 76, Figs. 2 and 4. The number and the pitch of teeth 75 correspond to that for the notches 32 formed in the flange 31 of support member 30. The stop control disc 73 is also provided with a radially extending arm 77 which is connected to and operated by the armature of a common or stop control solenoid 78.

A washer 79, Fig. 3, separates said spacer bushing 74 from a spring anchoring ring 80 which is disposed immediately above a stop supporting block 81. The block 81 has a plurality of circumferentially spaced and radially disposed slots 85 which are respectively axially aligned with the said slots 32 formed in flange 31 of member 30. Each radial projection formed by each successive pair of slots 85 is provided with a radially extending U-shaped groove 86, Figs. 2 and 3; these grooves collectively defining a circular seating trough for a stop mounting pivot ring 87. A plurality of movable stops 90 are disposed in the respective slots 85 and are pivotally mounted on said ring 87. Each stop 90 is provided with a slot 91 for ease in assembly with ring 87, and each of said stops is individually biased radially inwardly by a spring 92 which is anchored to said ring 80. Said stops are adapted to be selectively moved so that the respective upper ends thereof may be individually and selectively positioned in the circular path of movement of the single stop 35 on said rotatable printing head 33; the positioning of the respective stops occurring in timed relation to the operation of the other parts of the device as will be hereinafter explained. The seven spacer bushings 67, 74 and the two washers 71 and 79 together with the anchor ring 80 and stop mounting block 81 are axially clamped against the flange 31 of the main support member 30 by means of the washer 94 and the nut 95 which threadably engages the lower end of said member 30.

When solenoid 78 is energized the stop control disc 73 is rotatably indexed from a normal counterclockwise position to a clockwise position, as seen in Fig. 2, whereby stops 90 are respectively swung radially outwardly against the action of springs 92 by the camming action of the said tooth surfaces 76 as the latter move relative to the inner edges of said stops. When the stop control disc 73 attains its clockwise position all of the stops 90 will be held in their radially outer positions by the outer flats on the control disc teeth 75, as illustrated in Figs. 1 and 4. Here the upper ends of all of the stops 90 will be disposed in the outer portions of the radial slots 32 of member 30 and the intermediate portion of said stops will be out of engagement with the peripheral notches in the permutation discs 60—65; thus making it possible to rotatably index the latter by selectively energizing the code solenoids 70a, 70b, etc. When the solenoid 78 is deenergized and the stop control disc 73 is restored to its normal counterclockwise position, Fig. 2, the tooth camming surfaces 76 will permit springs 92 to move stops 90 radially inwardly so as to engage and to sense the peripheral portions of permutation discs 60—65 and thereby allow one (90a, Fig. 3) and only one of said

stops to move to an extreme inner radial position wherein the upper end of this selected stop lies in the circular path of travel of the single stop 35 depending from the rotatably mounted printing head 33.

Rotatably secured to the shaft 16 is a circular cam 96, Figs. 1 and 7, which has a notch 97 of predetermined circumferential length formed in the periphery thereof. Fixedly mounted for cooperation with cam 96 is a form C type switch 98 having a movable contact arm 100 which engages and is operated by the periphery of said cam 96. When movable arm 100 is riding on the circular portion 101 of the cam periphery said arm will be in operative engagement with the stationary switch contact 102. When movable arm 100 falls into the notch 97 of the rotating cam 96 the arm will then be permitted to flex to its "normal" position wherein it operatively engages the other stationary switch contact 103.

A clutch or detent solenoid 105, Figs. 1 and 2, is fixedly mounted so that the armature 106 thereof is radially movable into and out of the circular path of movement of a lug 107 laterally formed adjacent the periphery of the gear 13. The detent or clutch solenoid 105 in cooperation with lug 107 will selectively permit and positively prevent the initiation of each cyclic movement of shaft 16, gear train 12 and shaft 11.

A printing hammer 108 is provided for cooperation with the type 34 on said printing head 33. Hammer 108 is power operated by any suitable means such as a solenoid 109. Operation of solenoid 109 is controlled by means of said form C type switch 98, Fig. 7. The solenoid and hammer are suitably supported on a bracket 110 which is provided with a pair of slots 111. Slidably engaging the walls of slots 111 are two studs 112 which are suitably secured to the frame of the machine. The bracket 110 is provided with an aperture 113 through which extends an elongated rod 114 which is secured at its ends to the carriage of the instant printing device; said carriage being of any usual and well known type. A solenoid 115 is adapted to shift bracket 110 from a lower position, wherein said hammer cooperates with a set of lower case type, to an upper position wherein hammer 108 cooperates with a set of upper case type on said printing head. Here the rod 114 will move through the bracket aperture 113 during the letter spacing operations of the carriage, however when the solenoid 115 is energized both the hammer supporting bracket 110 and the carriage will be vertically shifted so that the desired areas of the record sheet 116 will be in print receiving position.

It will be understood that the record sheet 116 is supported by a set of paper feed rolls 117 operatively secured to the instant carriage which is movably mounted and controlled so as to be letter spaced after each printing operation. Any suitable ribbon feed mechanism may be used to position and actuate the inked ribbon 118. Such adjuncts are well known in the Teletype art and need not be particularized here. It will be apparent that several additional sets of type, similar to that illustrated at 34, may be provided on the printing head 33 and additional means employed to further shift the carriage and the hammer supporting bracket 110 to a corresponding degree. Thus the instant device may be readily adapted to selectively print a large number of different characters.

The circuit diagram for the control means of the instant apparatus is shown in Fig. 5. The six solenoids 70a, 70b, etc. for operating the stop control permutation discs are respectively connected to the output lines 119 of any suitable type of electrical signal encoder 120 which, for example, may be similar to that shown and described in patent application Serial No. 714,895 filed February 2, 1958, for "Encoders." A plurality of switch controlled input lines, such as that illustrated at 121 and 122, are connected between a power line 123 and the

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encoder 120. The switches 124 and 125 are respectively connected in lines 121, 122 and are adapted to be suitably operated from the keyboard of the instant machine in a manner well understood in the art. The solenoids 70a, 70b, etc. are each connected to ground through line 127, normally open relay contacts 130 and 131 and lines 132, 133. The "common" output line 134 of the encoder 120 is connected to ground through normally closed relay contacts 135, 136, line 137, solenoid 78 and lines 140, 133. The clutch or detent solenoid 105 is normally connected to a condenser 141 through line 142, normally closed relay contacts 143, 144 and line 145. When solenoid 105 is operated the condenser 141 is adapted to be charged from power line 123 through resistance 146, line 147, normally open relay contacts 150, 144 and line 145. The solenoid 78 operates the movable switch contacts 130 and 144 as well as operating the stop control disc 73 as described in connection with Figs. 1-4.

A time delay circuit is provided for operating relay 151 so as to open the contacts 135, 136 controlling the operation of solenoids 78 and 105. This time delay circuit includes a line 152 which is connected from the common encoder output line 134 to ground both through line 153, normally closed contacts 154, 155, line 156, condenser 163, resistor 157 and line 133; and through line 160, relay solenoid 161, line 162, resistor 157 and line 133. When an electrical signal is received from the common encoder output 134, the solenoid 161 will not be energized until sufficient time has elapsed to charge condenser 163 in line 156. Subsequently, when the solenoid has been energized, condenser 163 will be discharged to ground through normally open contacts 155, 164 and lines 165, 133.

The normal position of the cam 96 is such as to permit charging of condenser 166 in line 167 from power line 123 through resistor 169, line 170, normally closed contact arms 100, 102 and lines 167, 133. When cam 96 is rotated from its normal counterclockwise position shown, through one cyclic revolution, as indicated by arrow 173, Fig. 7, the grooved portion 97 thereof will permit the movable arm 100 to contact the switch arm 103 during the latter portion of the cycle thereby energizing printing hammer solenoid 109 through lines 123, 170, 176 and 133.

The hammer shift solenoid 115 is connected between power line 123 and ground through case shift switch 177 and lines 178, 179 and 133.

During the operation of the instant printing device, the record sheet is properly positioned between the paper feed rolls 117, Fig. 2, of the carriage so that the cooperating hammer 108 and type 34 will progressively print characters on the desired areas of said record sheet. Referring to both the circuit diagram of Fig. 5 and the timing diagram of Fig. 6 when the switch 124, corresponding to a character to be printed, is closed at time  $t_0$  by the manual or power operation of the associated key linkages of the instant printing device, current will flow through lines 134, 137 and 140 thereby energizing solenoid 78 at time  $t_1$  and closing contacts 130, 131 so that current at time  $t_2$  flows through encoder 120 and a coded combination of solenoids 70a, 70b, etc. to ground through lines 127 and 132. This action of the solenoid 78 will cause the stops 90 to move to their respective radially outer or inoperative positions, Fig. 1 thereby permitting the energized solenoids 70a, 70b, etc. to rotatably index the associated code discs 60-65. The closure of contacts 144 and 150 will permit charging of condenser 141 through lines 147, 145. After the solenoid 78 has remained energized for a predetermined period of time,  $t_1$  to  $t_3$ , the condenser 163 connected in parallel with the time delay relay 151 will have become charged thereby allowing relay solenoid 161 to draw current through lines 152, 160, 162. Energization of relay solenoid 161 will first connect contacts 155, 164

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thereby discharging condenser 163 to ground through lines 156, 165 and 133; and secondly, will break contacts 135, 136 thereby interrupting the circuit to solenoid 78 at time  $t_3$ . Deenergization of solenoid 78 will permit the stops 90 to move radially inward and engage the notched peripheries of the indexed discs 60-65 so that the selected stop 90a, Fig. 3, corresponding to the character to be printed, is positioned in the circular path of movement of the type wheel stop 35.

When solenoid 78 is deenergized contacts 143, 144 will be restored to their normally closed position shown in Fig. 5 and will connect the charged condenser 141 to the solenoid 105 thus momentarily energizing the latter, from time  $t_4$  to  $t_5$ , so as to momentarily withdraw the armature 106 thereof, Fig. 1, out of detenting engagement with the lug 107 on gear 13. The gear train 12 is thus freed at time  $t_4$  to drive the main drive shaft 11 at a varying speed, as shown by curve 180, Fig. 6, which in turn correspondingly yieldably rotates the printing head 33 until the stop 35 engages the selected and operatively positioned stop 90a, at a time such as  $t_6$  during the cyclic movement of shaft 11, thereby positioning the desired type 34a, Fig. 3, opposite the printing hammer 108. During this rotational indexing movement of the printing head 33 the main drive shaft 11, being connected to the output end of gear train 12, will complete one full revolution after having had a predetermined angular acceleration and deceleration from and to a zero velocity at the beginning  $t_4$  and the end  $t_7$  of said revolution, as indicated by said curve 180. The zero velocity of shaft 11 between times  $t_7$  and  $t_{10}$  results from the above noted operative nature of the gear train; the detent armature 106, Fig. 1, serving merely to prevent or permit a repetition of this rotational cyclic movement of drive shaft 11. The shaft 16, Fig. 1, constituting the input to gear train 12, will, when yieldably driven by shaft 18, rotate through one revolution at a substantially constant angular speed as indicated by line 181, Fig. 6. Near the end of its cyclic revolution, and after the completion of the cyclic revolution of shaft 11 at time  $t_7$ , the cam 96 secured to shaft 16 will permit the movable arm 100 of switch 98, Fig. 5, to contact the fixed switch arm 103 thereby allowing the charged condenser 166 to discharge to ground through lines 167 and 176. This action will momentarily energize solenoid 109 between times  $t_8$  and  $t_9$  so as to impart a printing stroke to the hammer 108. Near the end of the rotational movement of shaft 16 the cam 96 will again cause the movable switch arm 100 to contact arm 102 thereby recharging condenser through lines 170, 167 preparatory for a subsequent cyclic operation of the apparatus. At the completion of the rotational movement of shaft 16 at time  $t_{10}$  the lug 107 on gear 13, Fig. 1, will detentingly engage the armature 106 of the solenoid 105 which was previously momentarily energized to permit initiation of the just completed cycle. All of the various parts and circuits will then have been restored to their respective normal positions illustrated in Figs. 1, 2 and 5 preparatory for the next cycle of operation of the device.

It will be apparent that when it is desired to vertically shift the record sheet and the hammer supporting bracket 110, Fig. 2, so as to select from a different set of type on the printing wheel 33, the switch 177, Fig. 5, will be initially closed by the actuation of the usual case shift key thereby energizing the solenoid 115 and appropriately shifting the record sheet relative to the printing head 33.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration only and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

The invention claimed is:

1. In a printing device; a printing head having a plu-

ality of type formed on the periphery thereof, a printing hammer movably mounted for cooperation with said type, a plurality of stops selectively positionable to arrest the movement of said head, a main drive shaft, means intermittently rotating said shaft so that the latter has a predetermined cyclic acceleration and deceleration, one revolution detent control means for controlling the initiation and termination of the successive single revolutions of said shaft rotating means, and means for yieldably coupling said shaft to said printing head.

2. In a printing device; a rotatably mounted printing head having a plurality of type formed on the periphery thereof, a printing hammer movably mounted for cooperation with said type, a main drive shaft, means for yieldably coupling said printing head to said shaft, means for rotating said shaft through one revolution such that there is a predetermined angular acceleration and deceleration of said shaft during said one revolution whereby said printing head yieldably follows the motion of said shaft and is capable of partaking of a corresponding angular motion therewith, and a plurality of selectively positionable stops for variably limiting the extent of said corresponding angular motion of said head.

3. Apparatus as defined by claim 2, additionally comprising means operated after the completion of said angular motion of said head for actuating said hammer.

4. In a printing device, a printing head having a plurality of type formed on the periphery thereof, a printing hammer movably mounted for cooperation with said type, cyclically operated means for yieldably driving said printing head, a plurality of stops selectively positionable to arrest the movement of said head, means normally operable to prevent operation of said cyclically operated means, means responsive to the selective positioning of one of said stops for disabling the last mentioned means thereby permitting the actuation of said cyclically operated means, and means operated at the completion of each cyclic operation of said drive means for actuating said hammer.

5. In a rotary type printing device; a rotatable cylindrical printing head having a plurality of type formed in the periphery thereof, a single stop secured to said head, a printing hammer movably mounted for cooperation with said type, means for actuating said hammer, a plurality of stops selectively movable into and out of the path of movement of said single stop, permutation means operable to select which of said movable stops is moved into said path, means for selectively indexing said permutation means, means for moving the selected stop into and out of said path, a main drive shaft, means for yieldably coupling said shaft to said printing head, means for intermittently rotating said drive shaft through successive angles of fixed and equal mag-

nitudes, a first control means operable to control the initiation and termination of each intermittent driving movement of said drive shaft, and a second control means responsive to the operation of said stop moving means for operating said first control means.

6. Apparatus as defined by claim 5; additionally comprising control means responsive to the operation of the means for intermittently rotating said drive shaft for operating said hammer actuating means after completion of each intermittent rotation of said drive shaft.

7. Apparatus as defined by claim 6 additionally comprising means for yieldably driving said shaft rotating means.

8. Apparatus as defined by claim 6; additionally comprising means for disabling said stop moving means after a predetermined period of operation of the latter.

9. In a wheel printing device; a rotatable printing head having a plurality of type formed on the periphery thereof, a stop secured to said head, a plurality of movable stops adapted to selectively cooperate with the stop formed on said head, means for moving said stops, a plurality of permutation discs for respectively controlling the extent of movement of said stops, a plurality of solenoids respectively actuating said discs, a key controlled encoder for selectively electrically controlling the operation of said solenoids, a main drive shaft, means for yieldably coupling said shaft to said printing head, means for intermittently rotating said shaft, means for controlling the initiation and termination of the rotational movements of said drive shaft, means responsive to said stop moving means for operating the last mentioned means, and means operated by said encoder for disabling said stop moving means after a predetermined period of operation of the latter.

10. Apparatus as defined by claim 9 wherein said shaft rotating means includes a gear train which imparts a predetermined rotational acceleration and deceleration to said shaft during each of the intermittent rotational movements of the latter.

11. Apparatus as defined by claim 9; additionally comprising means for yieldably driving said shaft rotating means.

12. Apparatus as defined by claim 11; additionally comprising a printing hammer movably mounted for cooperation with said type, means for actuating said hammer, and means responsive to the operation of said shaft rotating means for operating said hammer actuating means after the completion of each intermittent rotation of said drive shaft.

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