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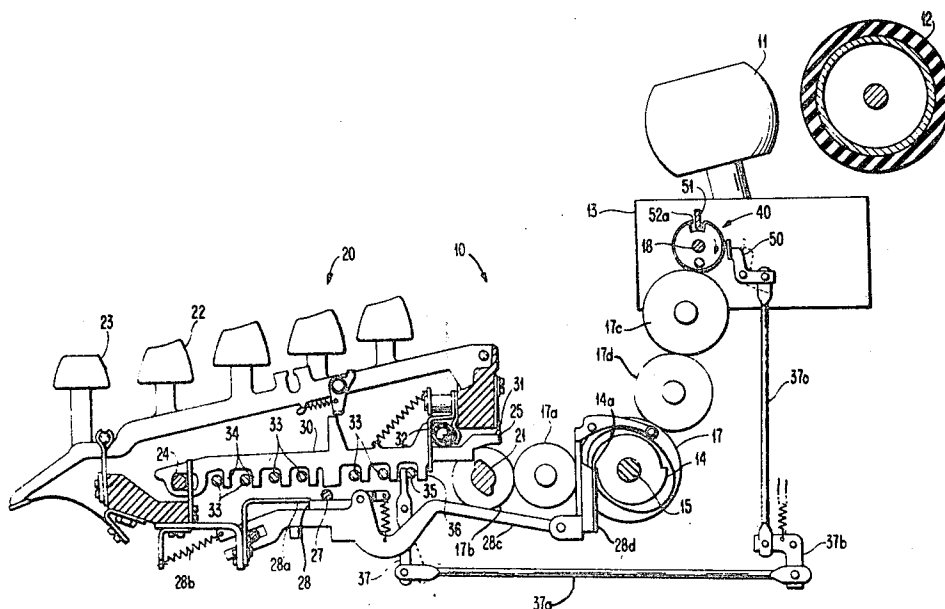
[56] **References Cited**
UNITED STATES PATENTS
 2,281,775 5/1942 Long et al. 178/29
 2,879,876 3/1959 Palmer et al. 197/16
 2,919,002 12/1959 Palmer 197/16

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[54] **CYCLICALLY OPERABLE TYPEWRITER**
7 Claims, 4 Drawing Figs.

[52] **U.S. Cl.**..... **197/16,**
197/55, 178/28
 [51] **Int. Cl.**..... **B41j 23/08**
 [50] **Field of Search**..... **197/16, 55;**
178/28

ABSTRACT: A typewriter constructed to operate in sequential cycles in performing both print and functional operations is provided with a normally engaged clutch operable to interrupt a print operation after its initiation whenever nonprinting functions are selected. Mechanism is provided for restoring the partially actuated print mechanism to a preset home position prior to initiation of a subsequent typewriter cycle.



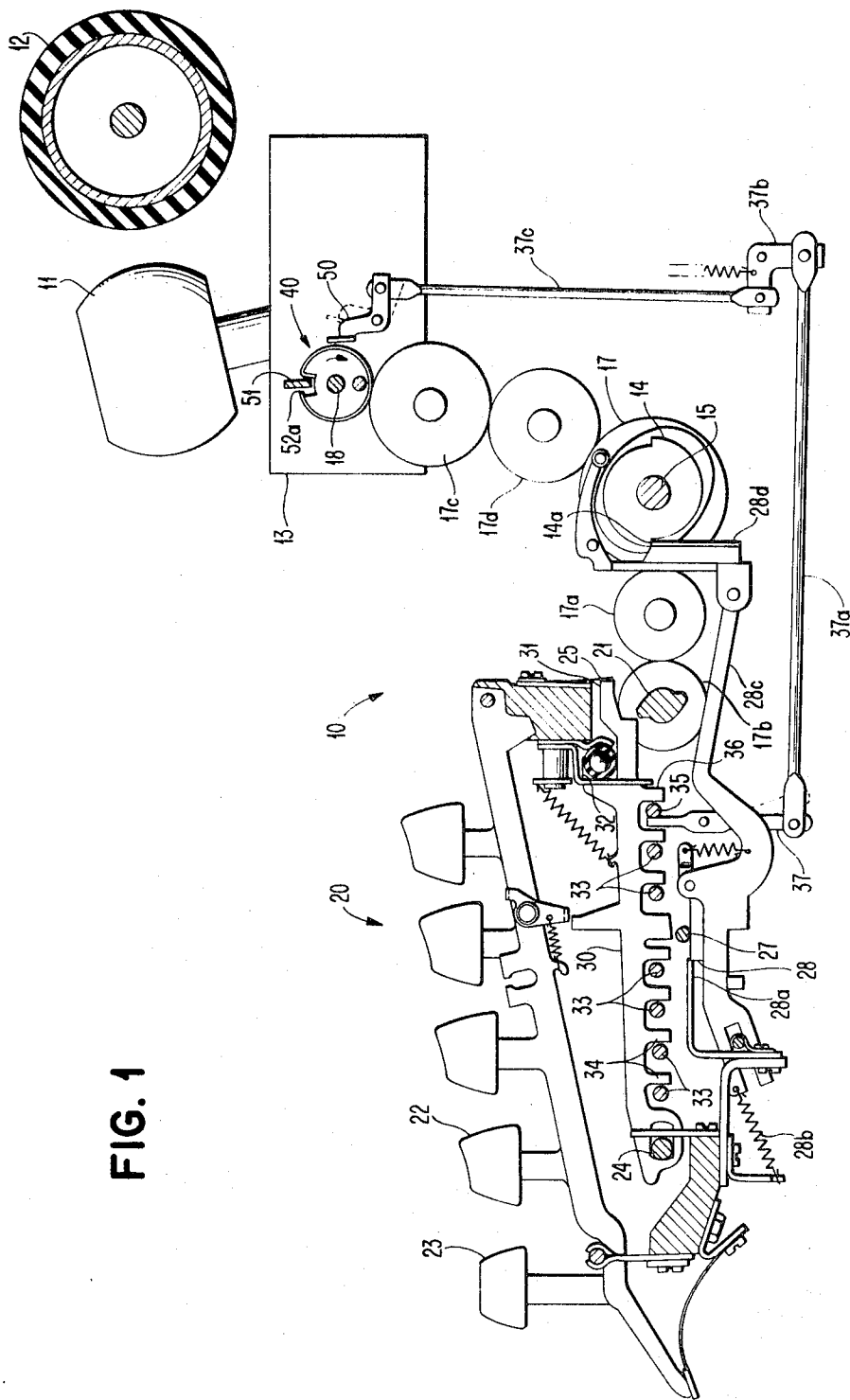


FIG. 1

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FIG. 2

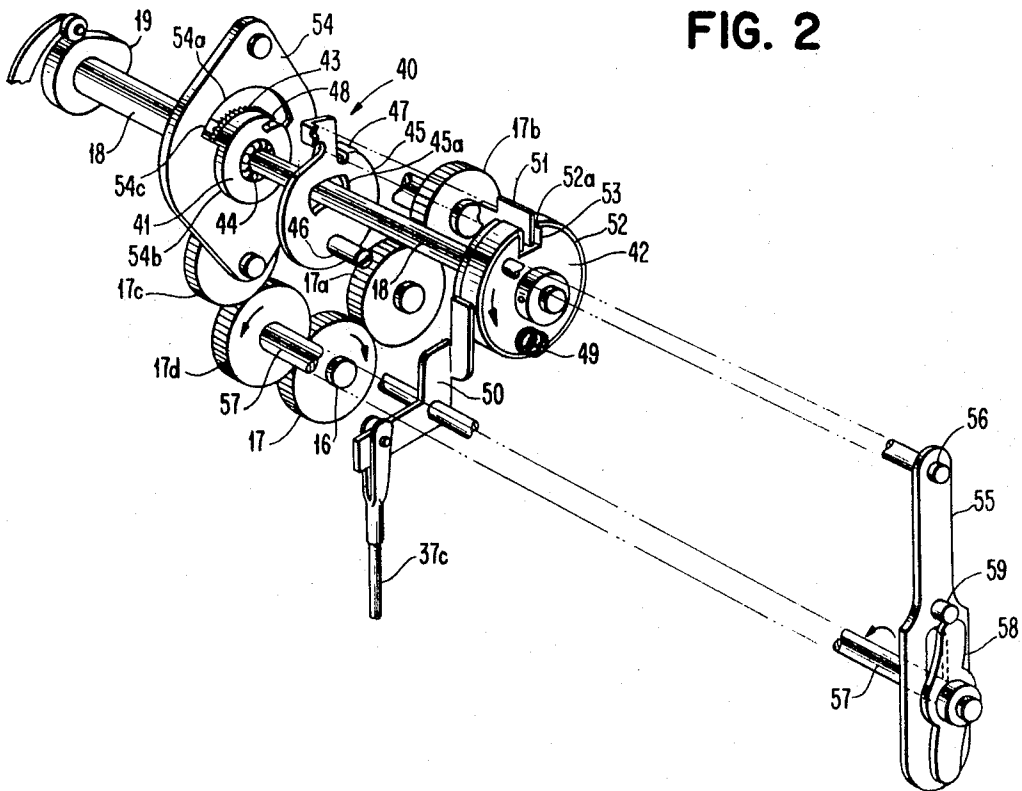


FIG. 3

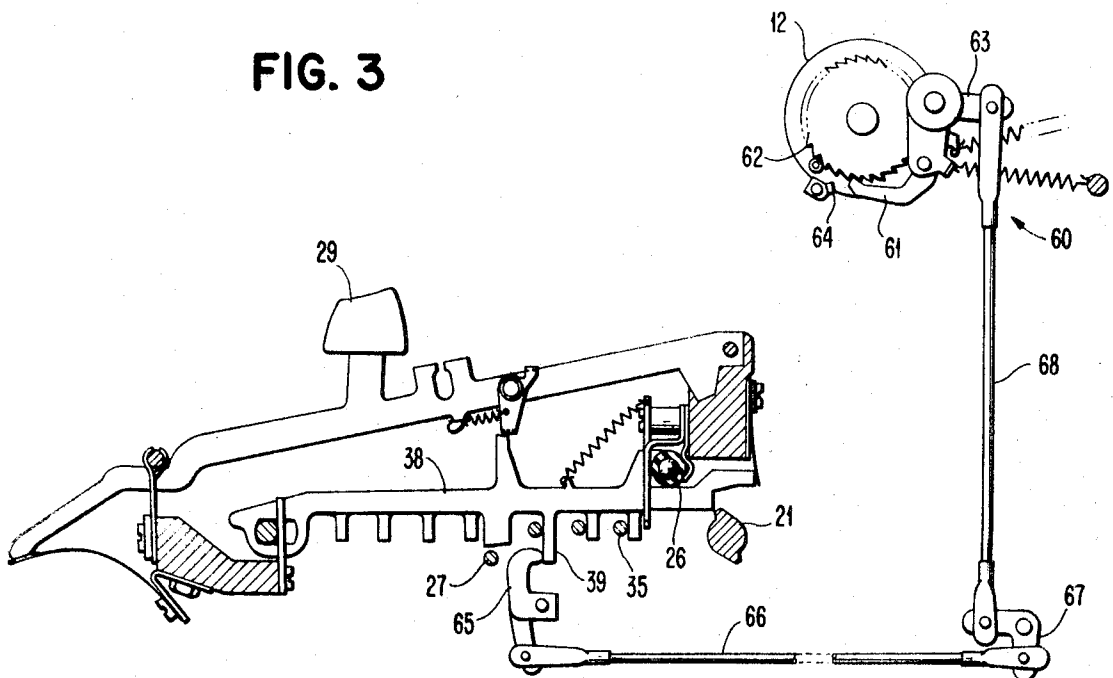
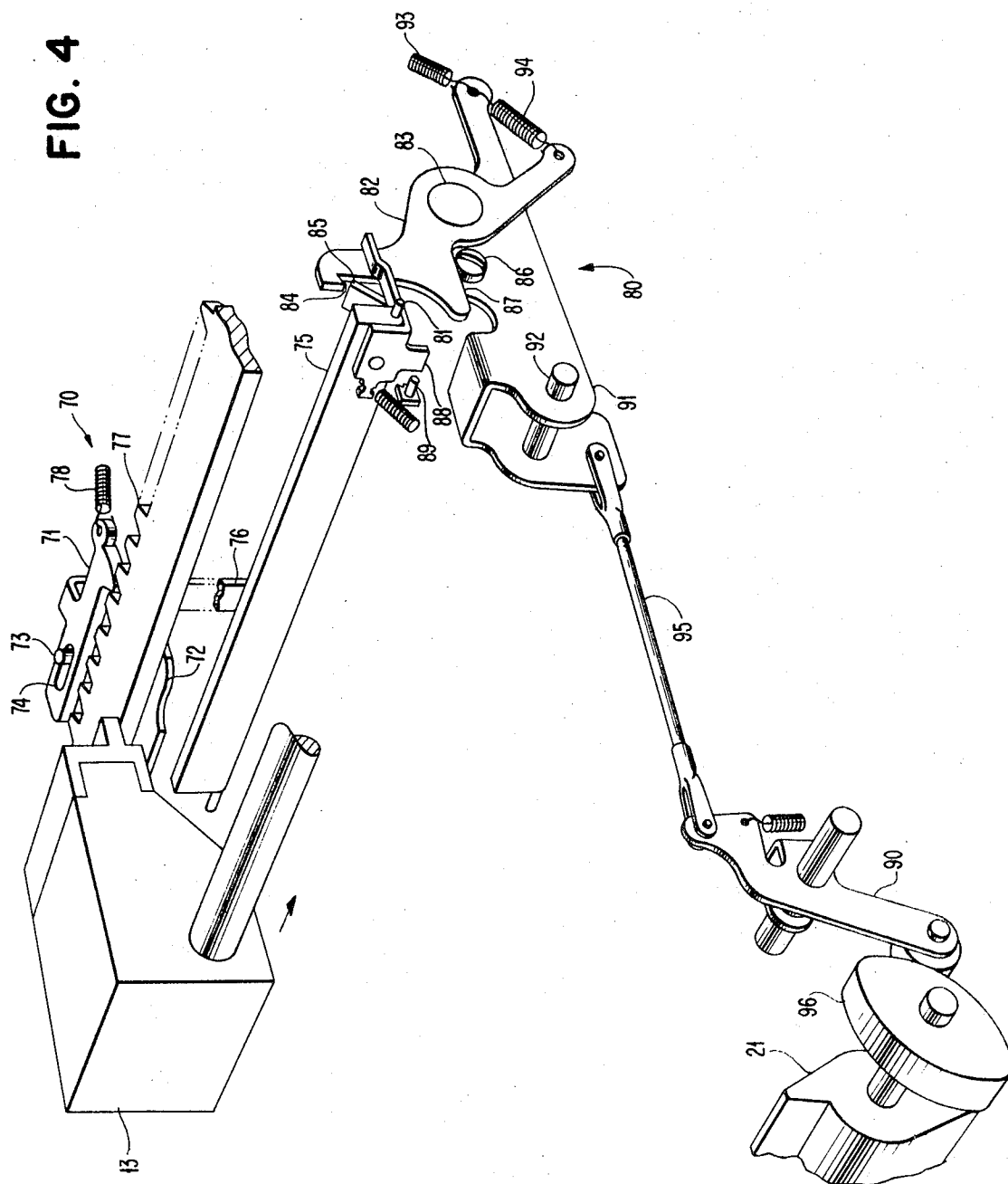


FIG. 4



CYCLICALLY OPERABLE TYPEWRITER

DISCLOSURE OF THE INVENTION

Much effort has been expended toward improving the ability of typewriters to accommodate the arrhythmic and unpredictable manipulation of the typewriter keyboard while insuring accurate printing with a minimum of interference with the operator's natural style. While typing machines of known construction must perform their various writing functions in ordered sequence and at rates determined by the mechanical capabilities of the machine, operators manipulate the typewriters in a sequential manner, but at rates that are convenient and comfortable for them. Character sequences and character function combinations are often selected by operators at rates that exceed the capabilities of the machine.

Various interlocks have been devised and are currently employed in sophisticated typewriters to eliminate typing errors caused by too rapid flurry keyboarding. U.S. Pat. No. 3,086,635 discloses a keyboard construction for interlocking a large plurality of keys by means of a sequence discriminating ball interlock, a keystroke storage device, and a sequence cycle timing device which cooperate to generate properly timed output control information from random rate keystrokes.

U.S. Pat. No. 2,879,876 discloses a typewriter having a power driven keyboard for controlling both printing operations and ancillary operations such as space, shift, and carrier return in a sequential cyclical manner. The powered keyboard operates on a keyboard cycle to generate sequential information. The sequential information then is directed to either a separately cycled printing mechanism or to separately cycled operational mechanisms.

It has been found difficult to maintain a proper phase relationship between independently cycled keyboard and output mechanisms without an elaborate control interface therebetween. The difficulty of in-phase maintenance is accentuated with rapid typing and with operation of power recycled repeat operations. A principal reason for this in-phase maintenance difficulty lies in the sequential nature of the keyboard and output cycles. The keyboard cycle must reach an information output stage before the determination is made of whether a print or a functional cycle will be required. If the selected output cycle is not complete simultaneously with the keyboard cycle or at least by the time the keyboard cycle has reached a subsequent information output stage, information will be lost or garbled by the overlap of adjacent output cycles.

Our invention takes advantage of a fully interlocked powered keyboard for character and functional operations without the out-of-phase exposure inherent in the independent keyboard and output cyclic mechanisms. In our invention, the output mechanism, for example a print drive shaft, begins its cyclic operation simultaneously with the powered keyboard. When the keyboard reaches its information output state, a decision is made as to whether a print operation or an ancillary nonprint operation is required. If a print operation has been selected, the print shaft continues through a cycle which terminates simultaneously with the keyboard cycle. On the other hand, if an ancillary function had been selected, the print shaft cycle is interrupted and the print shaft is restored to a home position. In either event, the print shaft is always in phase with the keyboard cycle at the beginning of any keyboard operation.

In a preferred embodiment of our invention, we employ a normally engaged dog clutch for interrupting the print shaft operation when required. A displaceable abutment is employed to selectively engage a control surface at a point in the machine cycle where a print or no-print decision is required. Engagement of the control surface with the abutment disengages the dog clutch to terminate motion of the print shaft. A cam driven restore arm, operating in time with the keyboard cycle, restores the print shaft and dog clutch to their home positions.

As an added feature, our invention prevents typing errors caused by the inadvertent initiation of a keyboard cycle wherein adequate information as to the function to be performed is not properly defined. The control abutment is normally positioned to terminate the point shaft operation and only properly defined keyboard information will displace the abutment. Accordingly, a printing operation initiated by such an inadvertent keyboard cycle will be automatically terminated to avoid typing errors.

These and other objects, features and advantages of our invention will be more completely understood from the following description of a specific illustrative embodiment of our invention wherein reference is made to the accompanying drawings of which:

FIG. 1 is a cross-sectional side view of a typewriter constructed in accordance with our invention and illustrating the primary components thereof;

FIG. 2 is an exploded perspective view of a normally engaged dog clutch employed in a preferred embodiment of our invention;

FIG. 3 is a fragmentary perspective view of one ancillary mechanism of the typewriter shown in FIG. 1; and

FIG. 4 is a side cross-sectional view of the typewriter shown in FIG. 1, illustrating a further ancillary mechanism thereof.

Referring now more specifically to FIG. 1, there is shown an office machine such as a typewriter 10 of the type disclosed in U.S. Pat. No. 2,919,002 having a type element or impact printing member 11 cooperable with a paper holding platen 12. Type element 11 is supported by a carrier 13 that is displaceable along the platen 12 for writing lines of characters. The typewriter 10 includes a power operated keyboard or input operating mechanism 20 constructed generally like that disclosed in U.S. Pat. No. 3,086,635 for controlling the typewriter operations. A normally disengaged selectively engageable 180° cycle clutch 14 selectively connects continuously rotating power shaft 15 with a keyboard power member or filter shaft 21 through primary drive shaft 16 (see FIG. 2) and intermediate gears 17, 17a and 17b. Primary drive shaft 16 is also connected to a secondary print operation drive shaft 18 through intermediate gears 17c, 17d and 17, and a normally engaged selectively effective power transmission or clutch 40 shown in detail in FIG. 2.

During normal operation of the typewriter, depression of a typical keyboard key, such as a print key 22 or spacebar key 23, pivotally displaces an associated interposer 30 clockwise about its pivot rod 24 from a normal unselected position as shown to a selected position where leaf spring latch 25 moves leftwardly over the top edge 31 of the interposer 30 to retain it in its depressed position. Also, tab 32 of the interposer 30 enters a displacement interlock 26 to prevent depression of any other key of the keyboard 20 and a laterally extending cycle clutch bail or universal member 27 is depressed. A cycle clutch latch 28 is thus released from keeper 28a to allow spring 28b to move transfer link 28c leftwardly thereby pulling cycle clutch latch 28d from control shoulder 14a of the cycle clutch 14 to initiate a typewriter cycle. Engagement of the cycle clutch 14 commences rotation of keyboard filter shaft 21 and of print power shaft 18 through gearing described above.

Filter shaft 21 rotates counterclockwise to perform a keyboard operation by displacing the depressed interposer 30 leftwardly out of the interlock 26 from under the latch 25 and through an operating stroke. The thus displaced interposer 30 moves selected ones of a plurality of encoding bails 33 as determined by its specific configuration of downward projections 34. The bails 33 control a selector mechanism not shown herein but fully described in aforesaid U.S. Pat. No. 2,919,002 for positioning the type element 11 to normally select a character corresponding to the depressed key. Leftward movement of an interposer 30 corresponding to any print character also will displace a print cycle select bail 35 by tab 36 to move a print transmission control abutment 50 to its broken line position as shown in FIG. 1, through transfer link

37, push rod 37a, frame pivoted bellcrank 37b, and push rod 37c. As will later be described in greater detail, control abutment 50, when in its broken line position, permits a complete 360° rotation of print shaft 18. A cam or print output operating mechanism 19 (see FIG. 2) is driven by shaft 18 to move the type element 11 through an impact stroke for performing a print operation. On the other hand, if bail 35 is not displaced by a tab 36, as may occur when a nonprint keyboard cycle such as word space is selected by an interposer 30 that is configured relative to bail 35 by the absence of a tab 36, or as may occur by inadvertent engagement of clutch 14 without proper storage of an interposer 30, then abutment 50 will not be displaced to its broken line position and will be effective to interrupt rotation of print shaft 18, thereby preventing print impact between the type element 11 and the platen 12.

SELECTIVELY EFFECTIVE POWER TRANSMISSION (SEE FIG. 2)

Normally engaged clutch 40 includes a transmission clutch drive disc 41 and a pawl support disc 42 which are supported by the shaft 18 for rotation about a common axis. Disc 41 is securely attached to a gear 43 that engages gear 17c and is rotatably mounted by bearing 44 for independent rotation relative to shaft 18. A pawl plate 45 is pivotally mounted to the support disc 42 by a pin 46 and is carried on the shaft 18 by a guide slot or enlarged opening 45a. Pawl plate 45 includes a bent over tab, tooth or pawl 47 that is engageable with a slot or pawl receiving drive surface 48 concentric with the pivot axis defined by pin 46. A coil spring 49, connected between the support disc 42 and pivot pin 46 normally urges pawl 47 into engagement with the slot 48 whereby shaft 18 will invariably be driven through at least a partial rotation upon rotation of shaft 16.

Pawl plate 45 also includes an operating arm or control surface 51 (see also FIG. 1) that is engageable with the abutment 50 when it is positioned in its full line position, during rotation of print shaft 18. Engagement of surface 51 with abutment 50 causes the pawl plate 45 to pivot clockwise relative to shaft 18 and lift the pawl 47 from the slot 48 to sever the driving connection between gear 43 and the shaft 18. A circum-scribing leaf spring 52 surrounds the drive disc 42 and resiliently presents an end 52a to the control surface 51. Upon striking the abutment 50, control surface 51 is driven relatively clockwise, in FIG. 2, as permitted by a slot 53, against the free spring end 52a which absorbs the abrupt shock by which shaft 18 is arrested.

It is desirable that pawl 47 be definitely engaged or disengaged during the latter part of a typewriter cycle of operation since partial engagements could cause a typing malfunction. To this end, a fail safe control plate 54 is provided as a backup control for the pawl 47. Control plate 54 surrounds drive disc 41 and includes a first radially relieved arc portion 54a which permits the pawl 47 to be lifted from the slot 48 of drive disc 41 during the early portions of the typewriter cycle of operation. Control disc 54 comprises a further arc 54b that closely encompasses the drive disc 48 to prevent outward movement of the pawl 47 from the slot 48 during latter portions of the typewriter cycle. A ledge 54c connects the arcs 54a and 54b at a location that is spaced relative to the abutment 50 and the pawl 47 such that control surface 51 will reach abutment 50 just prior to the point in an operating cycle that pawl 47 passes the ledge 54c. It will be seen that a partial engagement of pawl 47 with slot 48 during the early portion of a cycle will cause pawl 47 to encounter ledge 54c to thereby pivot pawl plate 45 and completely disengage the clutch 40. If pawl 47 remains engaged as it passes ledge 54c, the close fitting arc 54b of the control plate 54 will retain the pawl engaged throughout the remainder of the cycle.

PRINT SHAFT RESTORE

Following disengagement of clutch 40, it is desirable to restore the print shaft 18 to its starting or home position prior

to initiation of a subsequent cycle. A crank arm or pitman 55 is provided for this purpose. Pitman 55 is pivotally connected to drive disc 42 by stud 56 and is longitudinally slidably guided on an idler shaft 57 for reciprocating movement. A print shaft restore cam 58 rotates with idler shaft 57 during each cycle of operation and is capable of reciprocating pitman 55 by engagement with a follower stud 59 thereon. Normally, the timing of rotation of cam 58 and drive disc 42 is such that follower 59 does not encounter the cam 58. In the event rotation of drive disc 42 is interrupted, cam 58 encounters follower stud 59 and lifts pitman 55 to drive disc 42 counterclockwise to its home position.

ANCILLARY FUNCTIONS

In addition to printing characters, typewriters are required to perform a number of ancillary functions such as word space, line feed, line return, tabulation and backspace. Keys such as spacebar key 23 and line feed key 29 (see FIG. 3) for selecting these functions can be incorporated into the keyboard 20 of my typewriter in a manner substantially identical with the print character keys.

FIG. 3 shows a typewriter line feed mechanism 60 as an example of an ancillary function mechanism. The line feed mechanism 60 employs a feed pawl 61 that is engageable with a ratchet 62 connected with the platen 12. Pawl 61 is pivoted to a pawl carrier bellcrank 63. Clockwise pivoting of bellcrank 63 brings pawl 61 into engagement with the ratchet 62 to drive it clockwise until the pawl 61 encounters a fixed stop 64.

The index or line feed keylever 29 is constructed similar to key 22 shown in FIG. 1 and operates an index control interposer 38 that is similar to interposer 30 FIG. 1 with two primary exceptions. Interposer 38 has no projection adjacent print select control bail 35. Also, interposer 38 includes an elongated projection 39 that engages a transfer link 65 upon reciprocation, to drive the pawl carrier 63 through push rods 66, bellcrank 67 and push rod 68.

In operation, depression of key 29 moves interposer 38 to its latched position to depress cycle clutch control bail 27 and initiate a cycle of typewriter operation. Interposer 38 also activates the displacement interlock 26 to prevent subsequent immediate key depression. Rotation of filter shaft 21 drives interposer 38 leftwardly to move index pawl 61 through its operating stroke thereby performing the line feed operation. Inasmuch as bail 35 is not displaced leftwardly due to the configuration of interposer 38, stop 50 (see FIGS. 1 and 2) which is responsive to the position of bail 35, remains in its full line position to interrupt the rotation of print shaft 18 as described above and prevents an undesired print operation.

WORD SPACE

As shown in FIG. 4, the ancillary function of lateral incremental spacing of the type element carrier 13 is performed under the control of an escapement mechanism 70. A pawl 71 is pivotally carried by a plate 72 on the carrier 13 by a stud 73 that rides in a pawl slot 74. A torque bar 75 extends laterally across the width of the typewriter and engages a downwardly extending tab 76 of the escapement pawl 71. Carrier 13 is normally urged to the right by a clock spring (not shown) which motion is resisted by the pawl 71. A trigger device 80 is operated by a cam follower 90 to pivot the torque bar 75 about its axis 81 to lift the pawl 71 from the teeth of an escapement rack 77. When lifted, the pawl 71 is moved rightwardly to the limit of slot 74 by a pawl bias spring 78. Trigger 80 abruptly releases torque bar 75 permitting it to restore and permitting reentry of pawl 71 into the teeth of rack 77. Carrier 13 thus comes to rest in a position controlled by the next adjacent tooth of the rack 77.

More specifically, trigger 80 employs a carrier bellcrank 91 that is pivoted to the typewriter frame about a stud 92 and is normally urged in a counterclockwise direction by a spring 93. A trigger pawl 82 is pivoted about a stud axis 83 to the bellcrank 91 and includes a tooth 84 for engaging a cooperating

tooth 85 connected to the torque bar 75. A knockoff screw 86 engages a cam surface 87 of pawl 82 to lift tooth 84 from tooth 85 overcoming a spring 94 after torque bar 75 has pivoted through a predetermined angle as determined by projection 88 encountering frame mounted stud 89. Bellcrank 91 is connected to cam follower mounted stud 89. Bellcrank 91 is connected to cam follower 90 by a tie rod 95. Cam follower 90 engages an escapement control cam 96 that rotates with the filter shaft 21 during each typewriter operating cycle since normally, it is desired that each print operation be accompanied by a letter space movement of the carrier 13.

Interword spacing is achieved in my invention by providing the keyboard spacebar 23 with an interposer (not shown) similar to interposer 30, but lacking the projection 36. As described above, the absence of projection 36 on the interposer is responded to by abutment 50 remaining in its full line position during the cycle thereby terminating rotation of the print shaft 18. Accordingly, rotation of filter shaft 21 and cam 96 will produce a letter feed operation of escapement pawl 71 but type element 11 will not strike platen 12.

It will be recognized from the foregoing description that the spacebar operation as well as functional operations such as line feed will be fully interlocked in regard to character keys since all keys are provided with interposers that activate the displacement interlock 26. Similarly, the various key strokes for characters and for functions will be stored by the respective interposer latches 25 to rigidly sequence the generation of information from the keyboard even though keystrokes are randomly received. Having thus described and illustrated both the broad and more specific concepts of our invention, we hereby define the subject matter sought to be patented by the following claims:

We claim:

1. A machine for performing sequentially effective interrelated functions comprising a continuously rotating power shaft; a primary drive shaft; a normally disengaged, selectively engageable, fixed increment clutch for selectively connecting said power shaft to said primary drive shaft; first operating mechanism operatively connected with said primary drive shaft for selectively performing a plurality of first operations of the machine upon rotation of said primary drive shaft; a secondary drive shaft; and a second operating mechanism connected with said secondary drive shaft for performing a further operation of said machine upon rotation of said secondary drive shaft through a fixed angle; wherein in the improvement comprises:

a selectively effective power transmission serially interposed between said primary and secondary drive shafts providing a normally effective drive interconnection therebetween whereby said secondary drive shaft is invariably rotated by said primary drive shaft through a portion of said angle, said transmission being controllable to render said interconnection ineffective, and means responsive to performance of one of said first operations for controlling said power transmission to render said interconnection ineffective.

2. A typewriter having a continuously rotating power shaft; a primary drive shaft; a normally disengaged, selectively engageable, fixed increment clutch for connecting said power shaft to said primary drive shaft; a keyboard including a first plurality of depressable type keys for selecting print operations of said typewriter and at least one depressable function key for selecting an ancillary typewriter function; a secondary drive shaft; and an impact member connected with said secondary drive shaft for printing upon rotation of said secondary drive shaft through a fixed angle; wherein the improvement comprises:

a universal member displaceable upon depression of any of said keys for activating said clutch,

a selectively effective power transmission serially interposed between said primary and secondary drive shafts for providing a normally effective drive interconnection therebetween whereby said secondary drive shaft is in-

variably rotated by said primary drive shaft through a portion of said angle, said transmission being controllable to render said interconnection ineffective, and means responsive to depression of said function key for controlling said power transmission to render said interconnection ineffective.

3. The typewriter as defined in claim 2 wherein said keyboard includes a plurality of interposers, each of said interposers being individually operatively associated with a different one of said keys for displacement thereby from an unselected to a selected position, latch means for retaining each interposer in its selected position when displaced thereto, a displacement interlock cooperable with all of said interposers for preventing more than of said interposers from being in its selected position at any given time, a power member operatively connected to said clutch for driving any interposer from its selected position, from retension by said latch means, and through an operating stroke; wherein said universal member is displaced to activate said clutch in response to any of said interposers being displaced to its selected position; and wherein said function key depression responsive means comprises the further improvement of:

a control member having a first operating position for controlling said power transmission to render said interconnection ineffective and a second operating position, a bail movably positioned adjacent said interposers and operatively connected with said control member, and said interposers and said bail being mutually configured for differential intercooperation whereby said control member is positioned in said second position by said bail whenever an interposer associated with a type key is driven through its operating stroke and said control member is positioned by said bail in its first position whenever the interposer associated with said function key is driven through its operating stroke.

4. A typewriter as defined in claim 3 wherein the improvement further comprises means biasing said control member to said first operating position.

5. Apparatus as defined in any of claims 1, 2, 3, or 4 wherein said selectively effective power transmission comprises:

a first transmission clutch element connected for rotation by said primary drive shaft, a second transmission clutch element connected with said secondary drive shaft and rotatable about an axis common with said first transmission clutch element, a pawl,

means pivotally supporting said pawl on said second transmission clutch element for motion about a second axis, said first transmission clutch element having a drive surface thereon for receiving said pawl, said drive surface being substantially concentric with said second axis when engaged by said pawl, and

an operating arm connected to said pawl for moving said pawl about said second axis to a position of nonengagement with said drive surface.

6. Apparatus as defined in any of claims 1, 2, 3, or 4, wherein said selective power transmission controlling means is effective only after said secondary drive shaft has been displaced from a home position and wherein the improvement further comprises:

a crank arm operatively connected to said secondary drive shaft, and means driven by said primary drive shaft for restoring said secondary drive shaft to its home position through said crank arm.

7. Apparatus as defined in claim 5, wherein said selective power transmission controlling means is effective only after said secondary drive shaft has been displaced from a home position and wherein the improvement further comprises:

a crank arm operatively connected to said secondary drive shaft, and means driven by said primary drive shaft for restoring said secondary drive shaft to its home position through said crank arm.