This invention relates to a novel escapement mechanism for business machines and more particularly relates to a full drop escapement device for controlling the intermittent letter feeding movements of a typewriter carriage or the like.

During each typing operation of a typewriter having a conventional type partial drop escapement, the carriage is first released and then restrained to thereby partially complete a desired letter feeding movement, and is subsequently released and restrained to thereby complete the remainder of said letter feeding movement. It will be readily appreciated that when using a partial drop escapement considerably more time is required for each carriage letter feed movement than when using a full drop escapement that permits the carriage to execute a letter feeding movement in one full uninterrupted step instead of two successive smaller steps. The time factor is of particular importance in that such normally limits the maximum printing speed obtainable without "crowding" of the typed characters.

One object of the instant invention is to provide a full drop typewriter escapement which is simple and inexpensive in construction and efficiently reliable in operation.

Another object of the invention is to provide a full drop escapement device having only one movable dog or finger.

Another object of the invention is to provide an improved full drop escapement mechanism whereby a movable dog having two degrees of freedom cooperates with a plurality of teeth or stop members that are movably mounted on a rotatable carrier.

Another object of the invention is to provide a novel full drop escapement mechanism for typewriters whereby a single dog or finger movably mounted so as to have two degrees of freedom cooperates with a plurality of stop members which are movably mounted on a rotatable disc, one of said degrees of freedom being in the longitudinal plane of the adjacent stop member and the other degree of freedom being in the plane of the arcuate movement of the operative portions of said stop members.

Another object of the invention is to provide a novel typewriter escapement mechanism whereby a plurality of stop members mounted on a movable carrier are each successively displaced from an inoperative to an operative position in response to the movement of said carrier and are each successively moved to an inoperative position by the operation of a dog or finger.

A further object of the invention is to provide a novel full drop escapement device for typewriters whereby a plurality of equally spaced stop members movably mounted on a rotatable disc are each successively displaced from an upset to a set position in response to the rotation of said disc and are each successively displaced from a set to an unset position by the operation of a dog or finger which is movably mounted on the machine frame so as to have two degrees of freedom.

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 front elevational view taken in partial section and shows the general construction of the instant escapement mechanism.

Figure 2 is an active-side elevation view of the apparatus shown in Figure 1.

Figure 3 is a fragmentary sectional view taken along section line 3—3 of Figure 1.

Figure 4 is a fragmentary sectional view taken along section line 4—4 of Figure 1.

The carriage of the typewriter is provided with a swingingly mounted rack 8 which is normally in engagement with a pinion 6 fixed on a shaft 7 that is rotatably mounted in the usual manner on the machine frame 10. The escapement mechanism 11 controls the rotation of the pinion 6 and hence through rack 8 determines the intermittent letter feed movements of said carriage which are effected by the usual carriage spring drive means.

The escapement mechanism 11 comprises a wheel or carrier 12 which is rotatably fixed on the shaft 7 and which has a plurality of equally and circumferentially spaced radially extending slots, such as at 13 of Figure 3, in which are respectively disposed teeth or stop members 14. The stop members 14 are radially retained in said slots by means of a hoop 15 which is shrunk fit on and about the periphery of said carrier 12; teeth 14 being free for longitudinal sliding movement in said slots in a direction substantially parallel to the common axis of shaft 7 and carrier 12. The radially outer edge of each stop member 14 is provided with a pair of detent notches 16, 17 which are adapted to cooperate with a toroidal coil spring 20 that is seated in a correspondingly contoured groove 21 formed about the periphery of said wheel 12.

As will be evident the spring 20 in cooperation with notches 16, 17 will yieldably retain each stop member 14 in either a set or operative position, as illustrated in Figure 3, or in an unset or inoperative position wherein the forward end 22, Figure 3, of each stop member is substantially flush with the forward face 23 of the disc or carrier 12. Referring to Figures 1 and 2, the various stop members 14 are cooperable with a stop 24 which is fixedly mounted on said frame 10 by means of screws 25. The stop 24 normally extends generally parallel to the lower portion of the forward face 23 of said carrier 12 so that its free end lies in the circular path of travel of the forward ends of those stop members 14 which are in their respective set positions illustrated in Figure 3. The left end, Figure 1, of stop 24 is undercut as at 26 so as to provide an abutment shoulder or end surface 27.

As will be evident when any stop member 14 which is in its set or carriage retaining position approaches and engages the abutment shoulder 27 of stop 24, it will arrest further counterclockwise rotation, Figure 1, of the carriage 12 and thus prevent the typewriter carriage from further movement in a letter feed direction 31. Any stop member 14 which is in its said unset or carriage releasing position as it approaches the outer end or abutment surface 27 of the stop 24 will not be prevented said stop but will arcuately by-pass the latter thereby permitting the carriage to move in said letter feed direction 31 until a subsequent stop member 14 which is in the set position encounters stop 24 thereby again arresting the letter feeding motion of the carriage.

Fixedly mounted on frame 10 is a pair of similar cams 32 and 33, Figures 1 and 2, which are respectively disposed adjacent to lower portion of the rear face of the carrier 12. Cam 32 is provided with a forwardly extending wedge shaped portion having tapered camming edges.
3 and 35 while cam 33 is provided with a forwardly extending wedge shaped portion having tapered camming edges 36 and 37. Each of these camming edges is positioned so as to lie in the path of travel of the rearward ends, such as 40, Figure 3, of those stop members 14 which are in their respective unset of inoperative positions. When the wheel carrier 12 is rotating in the counter clockwise direction 30, both of the camming sur- faces 34 and 36 will be capable of successively displacing unstop set members 14 to their respective set positions; on the other hand when said disc is rotating in a clockwise direction, Figure 1, both of the camming surfaces 34 and 35 will be capable of successively displacing unstop set members 14 to their respective set positions. As is shown in Figure 4, the rearward edge of stop 24 is undercut so as to form an angularly disposed camming surface 41 which lies in the path of travel of the said forward ends 22 of those stop members which are in their set positions whereby these stop members will be displaced to their respective unset positions when moving past said cam surface 41 in a carriage return or clockwise direction as seen in Figure 1.

It will be seen that during normal typing operations all of the successive stop members 14 will be sequentially positioned in their respective set positions prior to approaching the immediate vicinity of the end surface 27 of stop 24 so that each of these stop stops may thereafter sequentially engage the said stop 24 during letter spacing operations. Normally one of the set stop members 14 is in operative engagement with the said stop end 27 thereby preventing letter feeding movements of said carriage, the next succeeding stop member to the left, as seen in Figure 1, of said one stop member also being in their respective set positions. When a letter spacing operation is to be effected said one stop member will be displaced to its inoperative position, by means to be described, so that the typewriter carriage may move through a distance corresponding to the incremental circumferential pitch of the successive stop members 14. As the disc or carrier 12 rotates in said counterclockwise direction 30, Figure 1, during the letter spacing operation the stop member which was just displaced to unstop position will by-pass stop 24 and the next following stop member 14 which is in the set position will swing into operative engagement with said end 27 of stop 24 thereby completing said letter spacing operation. It will be noted that as soon as the said one stop member has bypassed the stop 24 it will be immediately reset to an operative position by the camming surface 36.

As the various characters are successively typed the typewriter carriage will move in a letter feed direction 31 until arrested by the usual right hand margin stop of the machine, thereafter it is necessary to displace the carriage through a return stroke the extent of which is determined by the position of the usual left hand margin stop. The rack 5 preferably remains in engagement with the pinion 6 during carriage return movements and the carrier or disc 12 will thus be rotated in a clockwise direction, Figure 1. During this action any stop members 14 which are not in their respective set positions will be successively moved to such positions by the camming edge 37 of cam 33. Immediately thereafter these set stop members are successively displaced to their respective unset positions as they wipe past the said tapered undercut camming surface 41, Figure 4, of said stop 24. These unset stops are then successively displaced to their respective set positions by means of the said tapered camming edge 35, Figure 1, of cam 32. This action continues until the rearward edge of the return travel drive means will return the carriage a short distance in a letter feed direction until the last stop member 14 just moved to the set position by said camming edge 35 of cam 32 swings in a counterclockwise direction 30, Figure 1, into operative engagement with the end or abutment shoulder 27 of said stop 24 preparatory for typing a new line of print. It will be noted that the arcuate distance between said last set stop member and said stop end 27 is always the same, hence for any given setting of the left hand margin stop the carriage, after completing a return movement, will always come to rest in the same predetermined columnar position thereby insuring an even left hand margin for the typed material.

The means for displacing the stop member 14 which is in operative engagement with the stop shoulder 27 to its unset or carriage releasing position comprises a dog or finger 45 which is pivotally mounted on a ball 46 that is fixed to a shaft 47 rotatably mounted in said frame 10. The pivot axes of dog 45 and ball 46 are disposed in horizontal planes and are skewed at an angle of substantially 90 degrees thereby giving dog 45 two degrees of freedom of movement. The dog 45 is biased in a counterclockwise direction, Figure 1, by means of a spring 50 to a normal position determined by engagement of the lower end 51 of said dog with the inner face of the depending bail arm 52. The upper end of dog 45 is bent off at 53 so as to lie immediately adjacent to the outer end 22 of the operative stop member 14. The lower end of the depending bail arm 52 is adjustably articulated connected to a link 54 that is pivotally connected to the accurately oscillating shaft 55 of the usual universal escapement bail 56 of the typewriter. It will be understood that bail shaft 55 is laterally accurately displaced through forward and reverse strokes as at 57, Figure 2, during each typing operation.

In the operation of the instant apparatus the typewriter carriage is normally prevented from partaking of travel in a letter feed direction by means of that stop member 14 which is in operative engagement with the stop shoulder 27. When a typing stroke is to be effected the escapement bail arm 56 is initially displaced to thereby swing the ball 46 in a counterclockwise direction, Fig. 2, so that the bent off end 53 of dog 45 displaces the operative stop member 14 to unset or carriage releasing position as shown in Figure 2. This will free the typewriter carriage and its associated rack 5 for movement in a letter feed direction 31, Figure 1, until the next stop member 14 swings into engagement with the stop 24 thereby arresting the letter feed movement of the carriage. Here during the latter part of the counterclockwise rotation of carrier 12 the said next set stop member 14 will laterally engage the left edge, Figure 1, of the bent off end 53 of dog 45. In that the dog 45 is yield- ably mounted on ball 46, the former will not impede the letter feed rotation 30 of carrier 12 but will be rota- tably displaced in a clockwise direction, Figure 1, by the letter feed swinging movement of said next stop member so that the bent off edge 45 moves into the under- cut 26 of stop 24, as illustrated in Figure 2. Shortly after this action the universal bail shaft 55 is swung through its return arcuate stroke and thereby swings the ball 46 and dog 45 in a clockewise direction, Figure 2, so that said dog moves out from said stop undercut 26. As bail 46 is thus being restored to its normal position the spring 50 will restore dog 45 to normal position on the bail as illustrated in Figure 1 preparatory for initiating the next escapement operation. As will be evident each letter feed escapement operation once started is completed without interruption and hence the instant apparatus constitutes a reliable and inexpensive full drop escapement mechanism.

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 forms without departing from its spirit or the scope of the appended claims.
The invention claimed is:

1. In a typewriter, a frame, a carriage movably mounted on said frame, and a full drop escapement device mounted on said frame and adapted to control the incremental feed movement of said carriage; said escapement device comprising a stop secured to said frame, said stop having an abutment shoulder formed thereon, an escapement wheel rotatably mounted on said frame, a plurality of teeth movably mounted about the periphery of said wheel for successive cooperation with said abutment shoulder, said teeth being adapted to be moved to carriage retaining positions wherein said abutment shoulder lies in the arcuate path of travel of the ends of said teeth and to carriage releasing positions wherein the said ends of said teeth by-pass said abutment shoulder and thereby permit movement of said wheel and carriage, a ball member mounted on said frame for movement in a first plane, and a dog movably mounted on said ball member for movement in a second plane, said ball member and dog being constructed and arranged so that said dog displaces one of said teeth from said carriage retaining position to said carriage releasing position in response to the movement of said member in said first plane to thereby release said carriage for movement and so that the next one of said teeth displaces said dog in said second plane and past the operative plane of said abutment shoulder in response to the said carriage movement until said next one of said teeth engages said abutment shoulder and thereby arrests said carriage movement, the said abutment shoulder being the only element in the escapement device which can arrest the escapement movement of said wheel once said escapement movement is initiated.

2. Apparatus as defined by claim 1; additionally comprising means on said frame for successively moving each of said teeth from a carriage releasing to a carriage retaining position in response to the movement of said wheel.

3. Apparatus as defined by claim 2 wherein said dog is pivotally mounted on said ball member and is spring biased to a normal operative position thereon, and wherein said ball member is pivotally mounted on said frame.

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