Jan. 30, 1962 H. L. LAMBERT ETAL 3,018,870

PROPORTIONAL SPACING MECHANISM

Filed Aug. 18, 1959 5 Sheets-Sheet 1

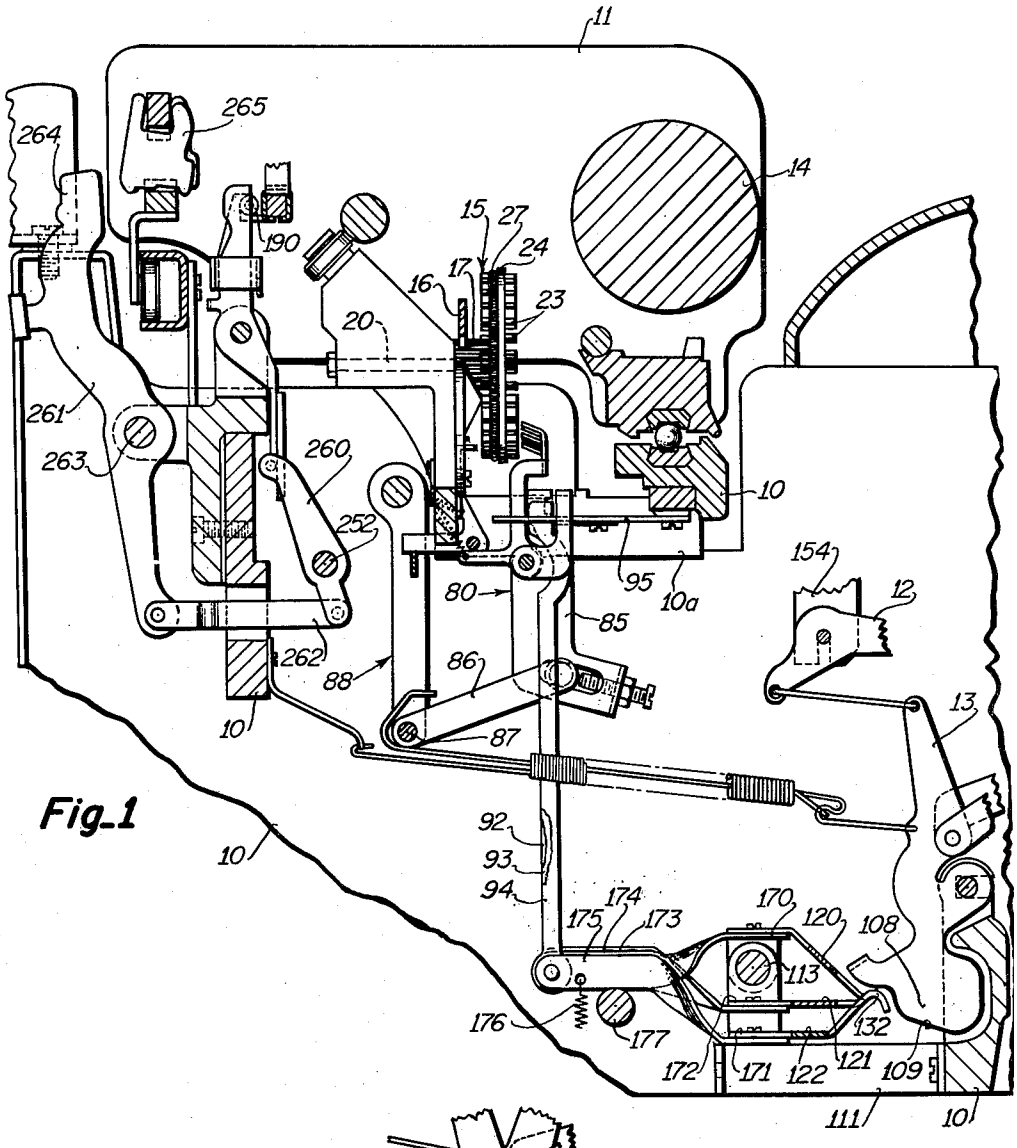

Fig_1

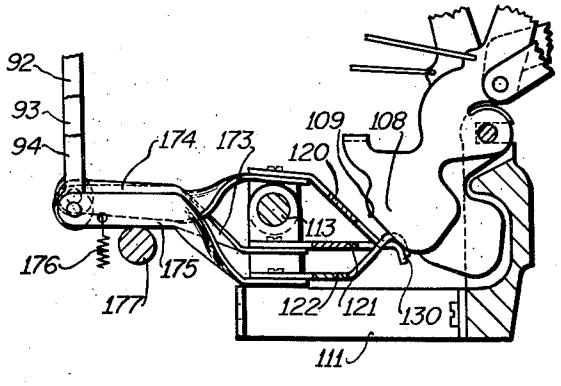

Fig_9

INVENTORS
HARRY L. LAMBERT
PAUL F. PAGE

BY Thomas L. Ross

ATTORNEY

Jan. 30, 1962 H. L. LAMBERT ETAL 3,018,870

PROPORTIONAL SPACING MECHANISM

Filed Aug. 18, 1959 5 Sheets-Sheet 2

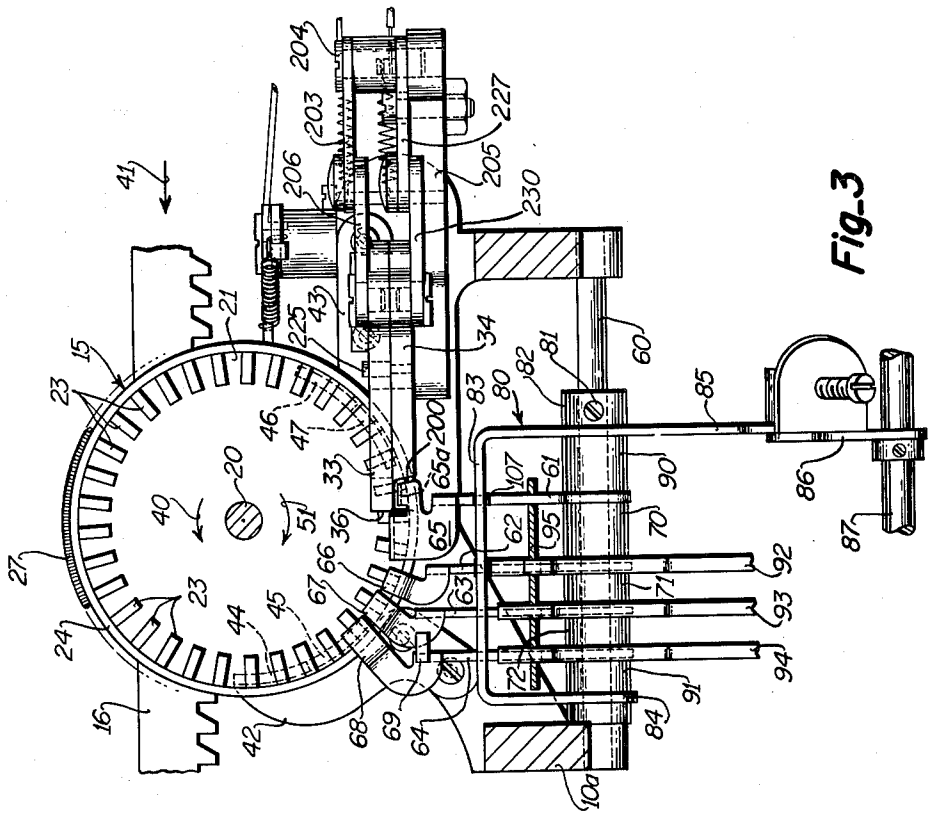

Fig. 3

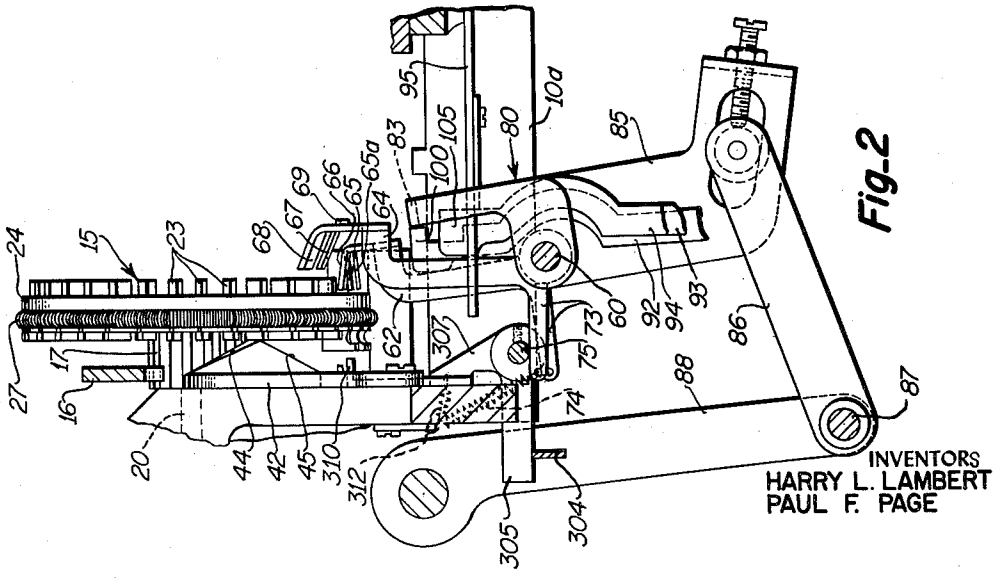

Fig. 2

INVENTORS
HARRY L. LAMBERT
PAUL F. PAGE

Jan. 30, 1962 H. L. LAMBERT ETAL 3,018,870

PROPORTIONAL SPACING MECHANISM

Filed Aug. 18, 1959 5 Sheets-Sheet 3

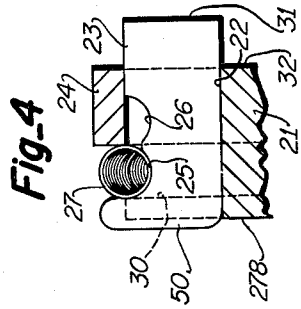

Fig.4

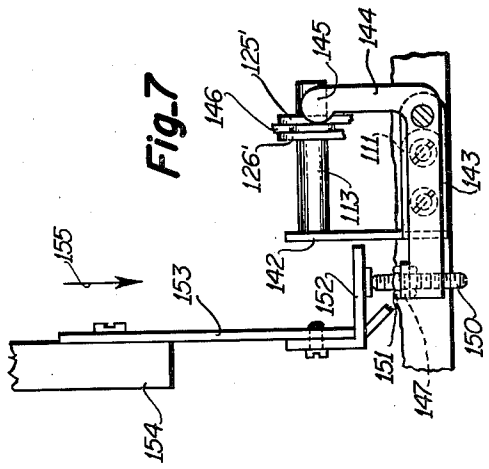

Fig.7

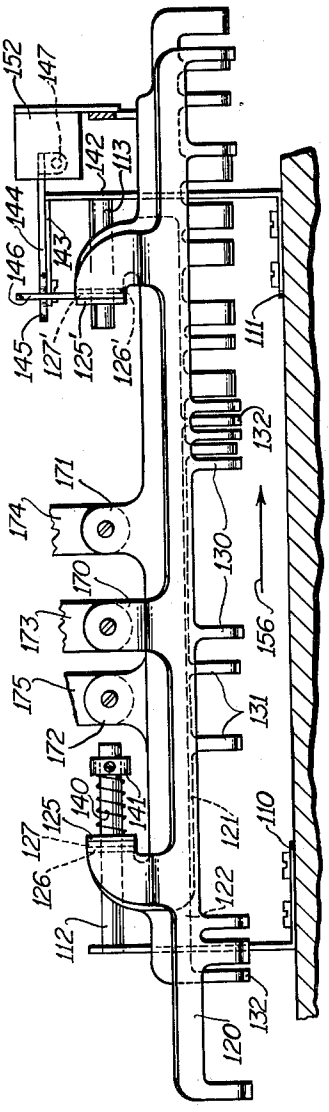

Fig.5

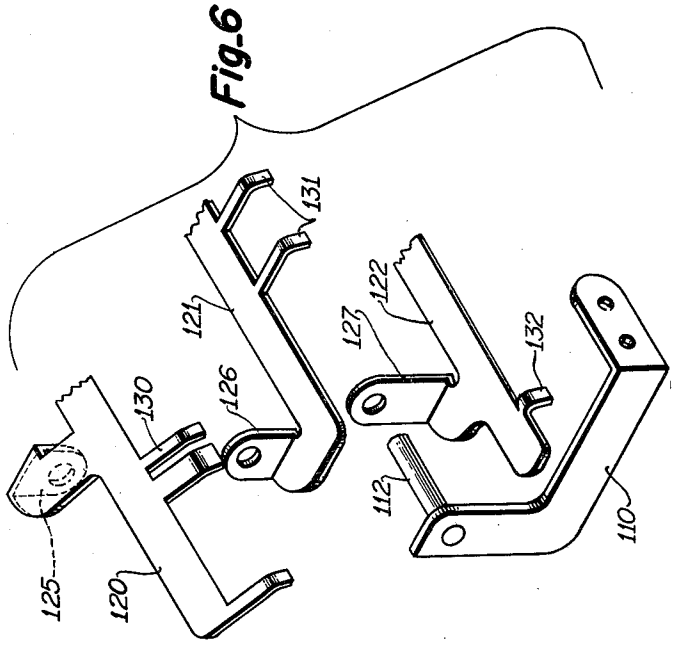

Fig.6

INVENTORS
HARRY L. LAMBERT
PAUL F. PAGE

Jan. 30, 1962 H. L. LAMBERT ETAL 3,018,870

PROPORTIONAL SPACING MECHANISM

Filed Aug. 18, 1959 5 Sheets-Sheet 4

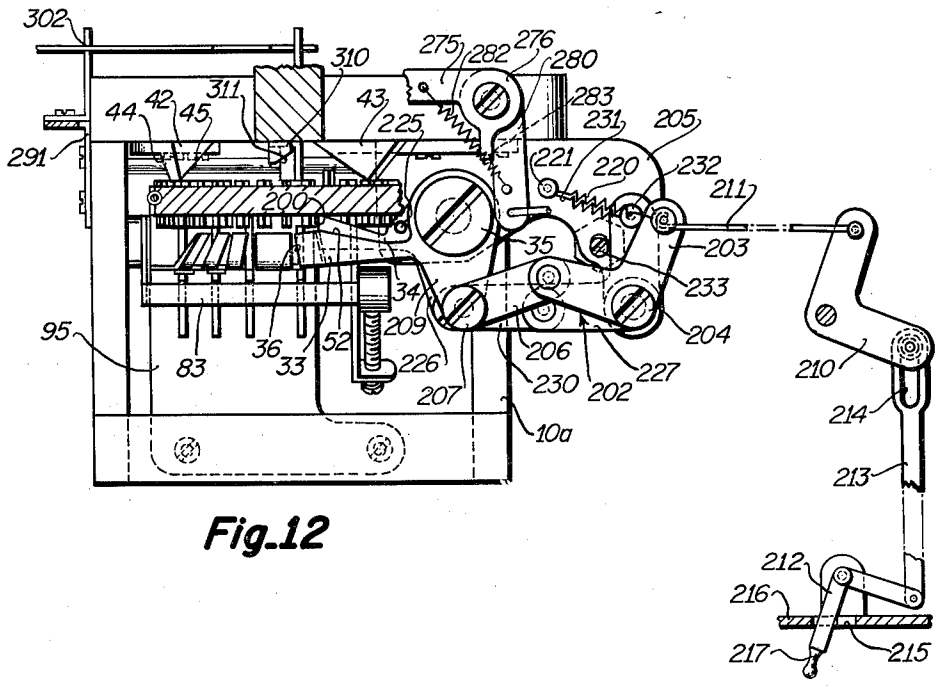

Fig_12

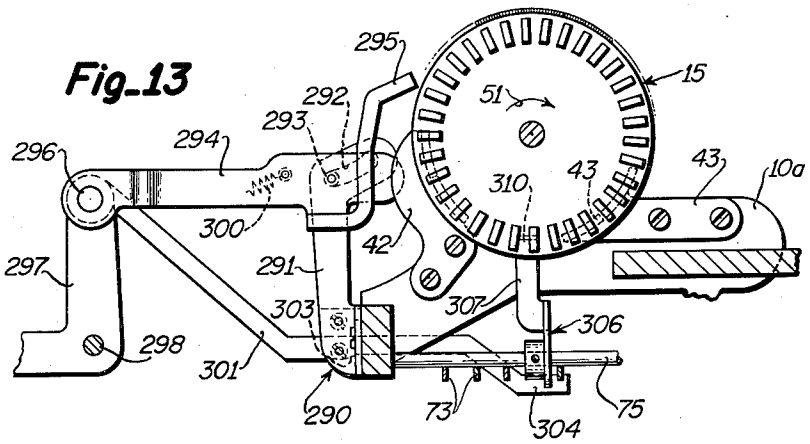

Fig_13

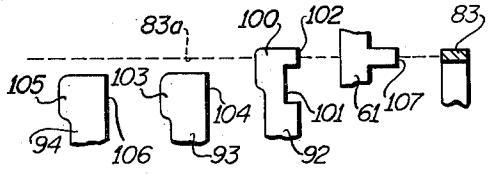

Fig_8

INVENTORS
HARRY L. LAMBERT
PAUL F. PAGE

Jan. 30, 1962 H. L. LAMBERT ETAL 3,018,870

PROPORTIONAL SPACING MECHANISM

Filed Aug. 18, 1959 5 Sheets-Sheet 5

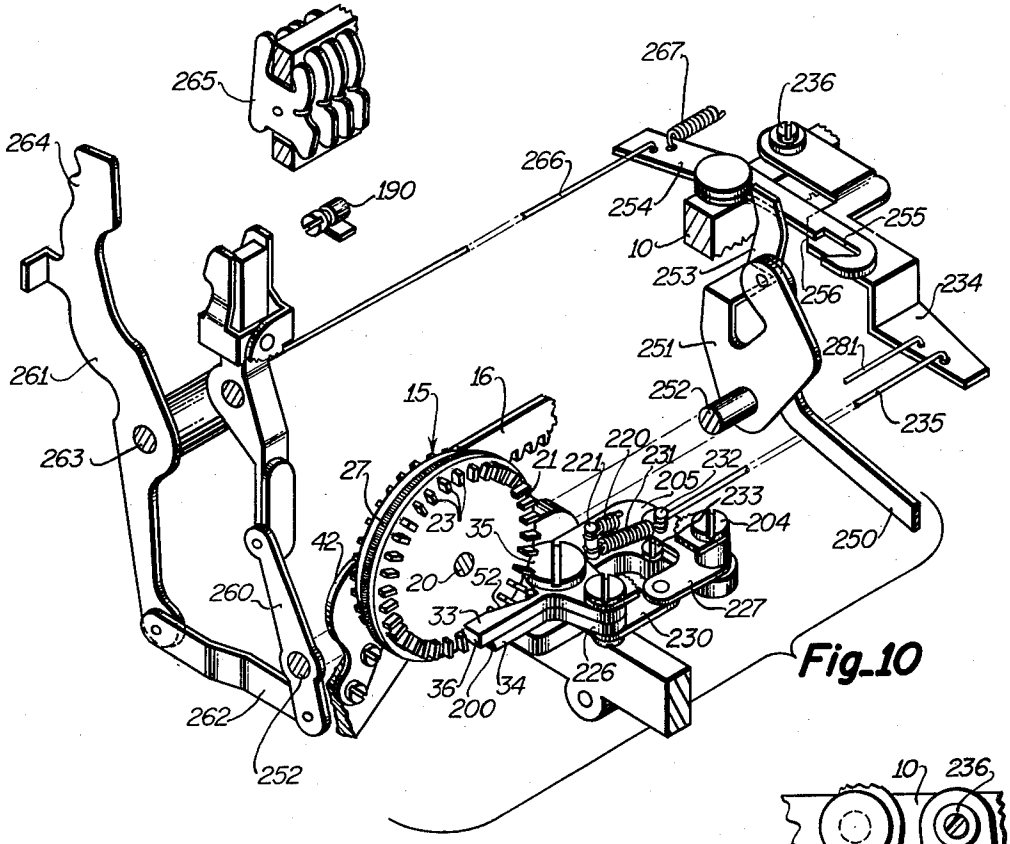

Fig_10

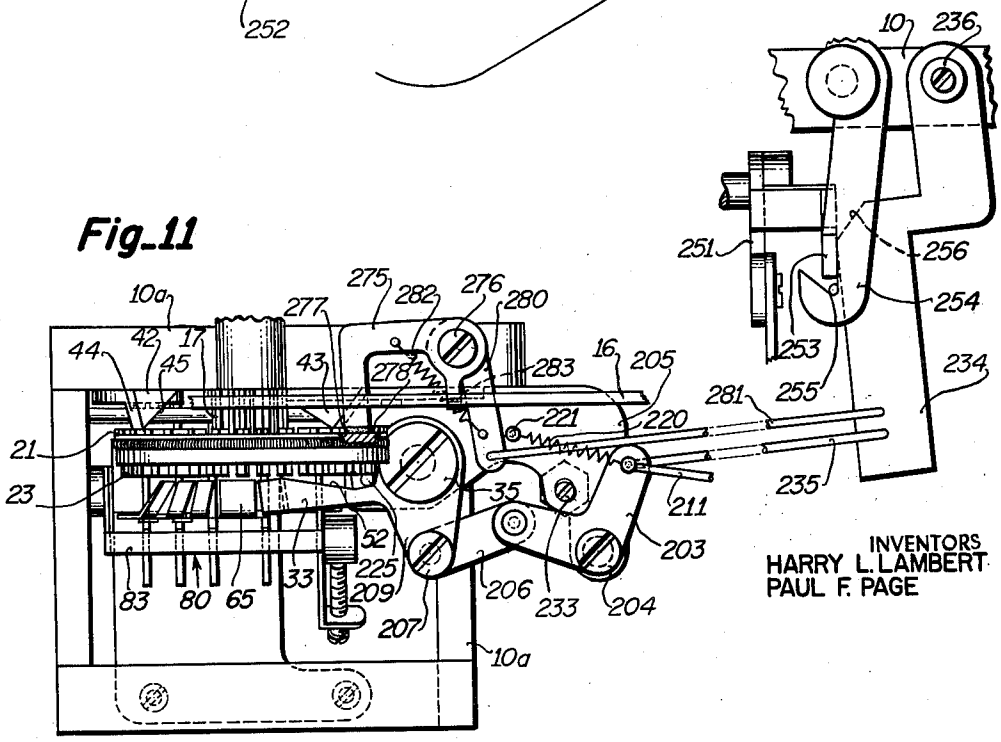

Fig_11

INVENTORS
HARRY L. LAMBERT
PAUL F. PAGE

United States Patent Office 3,018,870 Patented Jan. 30, 1962

3,018,870

PROPORTIONAL SPACING MECHANISM

Harry L. Lambert, West Hartford, and Paul F. Page, Newington, Conn., assignors to Royal McBee Corporation, Port Chester, N.Y., a corporation of New York

Filed Aug. 18, 1959, Ser. No. 834,597
21 Claims. (Cl. 197—84)

This invention relates to an improved device for controlling the intermittent carriage feed motion of a typewriter or a like machine, and more particularly relates to an improved variable spacing mechanism for a typewriter carriage, and more specifically relates to a novel proportional escapement device for controlling the extent of incremental letter feed motion of a typewriter carriage in accordance with the widths of the successive characters to be typed.

It is well recognized that the appearance of print work obtainable with typewriters and like machines is greatly enhanced by providing some sort of means for controlling the extent of successve letter feed movements of the typewriter carriage in accordance with the respective widths of the letters typed. The many prior attempts to provide apparatus for so proportioning the incremental displacements of the typewriter carriage have not been entirely satisfactory either because they have been unreliable and/or too complex, or because they have been unable to efficiently cooperate with the other carriage control mechanism so as to properly effect one or more of the desired carriage functions, such as back space, tabulation and/or banking operations. Furthermore those few available devices for permitting the proportional spacing movement of a typewriter carriage are expensive and in operation tend to reduce the maximum permissible typing speed. The latter defect becomes significant when such prior art devices are used in electric typewriters the manually operated keys of which may be readily actuated at high speeds.

One object of the instant invention is to provide a proportional spacing mechanism for typewriters or like business machines which is reliably efficient and relatively inexpensive.

Another object of the instant invention is to provide an improved proportional spacing mechanism for typewriters or the like having a relatively simple construction that inherently accommodates any rebound movements of the typewriter carriage which may occur at the termination of a tabulating or carriage return operation.

Another object of the invention is to provide an improved escapement mechanism for a typewriter carriage whereby a plurality of stop members are each initially moved to a set position so as to be cooperable with a normally stationary stop and are subsequently selectively moved to unset positions so as to permit variable incremental letter feed movements of the typewriter carriage.

Another object of the invention is to provide an improved proportional spacing mechanism for typewriters whereby a plurality of settable stop members are movably mounted on a rotatable disc or carrier and are each successively displaced from unset to set positions during the progressive rotation of said disc produced by movement of the carriage in a letter feeding direction.

Another object of the invention is to provide a novel proportional escapement mechanism for typewriters wherein a predetermined number of stop members, each of which is initially positioned in set or carriage arresting position, are normally displaced to unset positions so as to permit the typewriter carriage to partake of successive normal incremental letter feed movements.

Another object of the invention is to provide a novel proportional spacing mechanism for typewriters having a pluraltiy of movable stop members each of which is

initially moved to a set position whereby several of the set stop members may be moved to unset positions by selectively operating a plurality of associated fingers during each typing operation of the machine.

A further object of the invention is to provide a novel proportional escapement mechanism whereby a plurality of set stop members mounted on a rotatable carrier cooperate with a normally stationary stop which is movable to an inoperative position during a tabulating movement of the typewriter carriage, and which is restored to its operative position with the arresting of the carriage tabulating movement.

A further object of the invention is to provide a novel proportional spacing mechanism for typewriters whereby a plurality of initially set stop members mounted on a rotatable carrier or disc cooperate with a normally stationary stop, said fixed stop being movable from a normal operative position to an inoperative position during a tabulating movement of the typewriter carriage and in being restored to its operative position in response to the arresting of said carriage moves at least one of said stop members to an unset position.

Another object of the invention is to provide a novel proportional spacing mechanism for typewriters whereby a plurality of settable stop members, which are mounted on a rotatable carrier so as to cooperate with a normally stationary stop member, are successively moved to unset positions in response to disc rotation produced by a return movement of the typewriter carriage.

A still further object of the invention is to provide a novel proportional spacing mechanism for typewriters whereby a plurality of normally set stop members, which are mounted on a rotatable disc and which selectively cooperate with a normally stationary stop member, are sequentially moved to unset and set positions respectively in response to a return movement of the typewriter carriage.

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 central longitudinal view taken in partial section and shows the pertinent portions of the instant typewriter.

FIGURE 2 is a side elevational view taken in partial section and shows the construction of the principal parts of the typewriter escapement mechanism.

FIGURE 3 is a front elevational view taken in partial section and shows the apparatus illustrated in FIGURE 2.

FIGURE 4 is a fragmentary diametral view in partial section of the escapement carrier or disc and illustrates the set positions of the stop members on said disc.

FIGURE 5 is a plan view in partial section and shows the construction of the power operated permutation bails that control the operation of the escapement mechanism.

FIGURE 6 is an exploded perspective view showing an end portion of each of the three permutation bails illustrated in FIGURE 5.

FIGURE 7 is a rear elevational view showing the interconnection between the case shift linkage and the permutation bails.

FIGURE 8 is a diagrammatic sketch illustrating the normal disposition of the upper ends of the escapement controlling interposers and the escapement operating bail.

FIGURE 9 is an active side elevational view of a portion of the apparatus shown in FIGURE 1.

FIGURE 10 is a fragmentary perspective view illustrating the structural and functional cooperation between

the instant carriage tabulating and escapement mechanisms.

FIGURE 11 is a plan view illustrating the active positions of the pertinent parts of the escapement mechanism during a carriage tabulating movement.

FIGURE 12 is a plan view taken in partial section and shows the type expanding linkage associated with the instant escapement mechanism.

FIGURE 13 is a front elevational view showing the back space linkage associated with the instant escapement mechanism.

The instant escapement mechanism is shown and will be described as embodied in an electric typewriter of the type presently being produced and sold by the Royal McBee Corporation, however it will be understood that this mechanism may be used in conjunction with other types of manual and electric typewriters and similar business machines having corresponding controls for their respectively associated intermittently movable carriages.

Referring to FIGURE 1 the pertinent parts of an electric typewriter are shown. It will be understood that unless otherwise stated the various conventional parts or elements are suitably supported in the usual manner on the machine frame. The main frame **10** slidably mounts the record supporting carriage **11** for movement in letter feed and carriage return directions under the action of the usual carriage drive means. The machine is provided with the normal complement of type bars and respectively associated sub-levers, such as shown at **12** and **13** respectively, which are selectively actuated by a power roll under the control of the typewriter keys. As the type bars are successively operated to type characters on the record sheet supported by the cylindrical platen **14**, the carriage is permitted to intermittently move in a letter feed direction under the control of the proportional escapement mechanism **15**. This mechanism is operable to variably limit the extent of each successive letter spacing movement of carriage **11** in accordance with the width of the particular letter typed thereby greatly improving the appearance of the typed material as compared to that produced by typewriters affording uniform letter feed carriage movements.

The carriage **11** is provided with a swingably mounted rack **16** which is normally in engagement with a pinion **17** fixed on a shaft **20** that is rotatably mounted in the usual manner on the machine frame **10**. The proportional escapement mechanism **15** controls the rotation of the pinion **17** and hence through rack **16** determines the intermittent linear stepping movements of said carriage **11** produced by the usual carriage spring drive means. Referring to FIGURES 1–4, the escapement mechanism **15** comprises a disc or carrier **21** which is rotatably fixed to the shaft **20** and which has a plurality of equally circumferentially spaced and radially extending slots, such as at **22** of FIGURE 4, in which are respectively disposed stop members **23**. The stop members **23** are radially retained in said slots by means of a hoop **24** which is shrunk fit on and about the periphery of said carrier **21**; stop members **23** being free for longitudinal sliding movement in said slots in a direction substantially parallel to the common axis of shaft **20** and carrier **21**. The radially outer edge of each stop member **23** is provided with a pair of detent notches **25**, **26** which are adapted to cooperate with a toroidal coil spring **27** that is seated in a correspondingly contoured groove **30** formed about the periphery of said carrier **21**. As will be evident the spring **27** in cooperation with notches **25**, **26** will yieldably retain each stop member **23** in either a set or operative position, as illustrated in FIGURE 4, or in an unset or inoperative position wherein the forward end **31** of each stop member is substantially flush with the forward face **32** of the disc or carrier **21**. Referring particularly to FIGURES 3 and 12, the various stop members **23** are cooperable with either one of a pair of similar normally stationary stops **33**, **34** which are pivotally mounted by means of stud **35** on the usual escapement sub-frame **10***a* which comprises a portion of the main frame **10**. The stops **33**, **34** normally extend generally parallel to the lower forward face **32**, FIGURE 4, of said carrier **21** so that their free ends lie in the circular path of travel of the forward ends of those stop members **23** which are in their respective set positions illustrated in FIGURE 4. The abutment surface or shoulder **36** at the free end of stop **33** is operative to control normal carriage letter feed operations and attention will first be directed to its functional nature in the escapement mechanism; the purposes and functions of stop **34** being described in a subsequent part of this disclosure.

As will be evident, when any stop member **23** which is in its set or operative position approaches and engages the abutment shoulder **36** of stop **33**, such will arrest further counter clockwise rotation **40**, FIGURE 3, of the carrier **21** and thus prevent the typewriter carriage from further movement in a letter feed direction **41**. Any stop member **23** which is in its said unset or inoperative position as it approaches the outer end or abutment surface **36** of the normally stationary stop **33** will not be intercepted by said stop but will arcuately bypass the latter thereby permitting the carriage spring drive means to move the carriage **11** in said letter feed direction **41** until a subsequent stop member **23**, which is in the set position, encounters stop **33** thereby again arresting the letter feeding motion of the carriage.

Fixedly mounted on the said sub-frame **10***a* is a pair of cams **42** and **43**, FIGURES 3 and 13, which are respectively disposed adjacent to the lower portion of the rear face of the disc **21**. Cam **42** is provided with a forwardly extending wedge shaped portion having tapered camming edges **44** and **45**, FIGURE 2, while cam **43** is provided with a forwardly extending wedge shaped portion having tapered camming edges **46** and **47**, FIGURE 3. These camming edges are positioned so as to lie in the path of travel of the rearward ends, such as **50**, FIGURE 4, of those stop members **23** which are in their respective unset or inoperative positions. When the disc or carrier **21** is rotating in a letter feed or counter clockwise direction **49**, FIGURE 3, both of the camming surfaces **44** and **47** will be capable of successively displacing unset stop members **23** to their respective set positions; on the other hand when said disc is rotating in a carriage return or clockwise direction **51**, FIGURE 3, both of the camming surfaces **45** and **46** will be capable of successively displacing unset stop members **23** to their respective set positions.

As is best illustrated in FIGURE 12, the rearward edge of stop **33** is undercut so as to form an angularly disposed undercut camming surface **52** which lies in the path of travel of the forward ends **31**, FIGURE 4, 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 **52** in a carriage return or clockwise direction **51** as seen in FIGURE 3.

It will be seen that during normal typing operations all of the successive stop members **23** will be sequentially positioned in their respective set positions prior to approaching the immediate vicinity of the end **36** of stop **33** so that various ones of these set stops may thereafter selectively engage the said stop **33** during letter spacing operations. Normally one of the set stop members **23** is in operative engagement with the said stop end **36** thereby preventing letter feeding movements of said carriage, the next succeeding stop members to the left, as seen in FIGURE 3, of said one stop member also being in their respective set positions. When a letter spacing operation is to be effected said one set stop member together with one, two, three or four of said next succeeding set stop members **23** will be displaced to their unset positions, by means to be described, so that the typewriter carriage may move through a distance

corresponding to the predetermined number of said set stops so displaced, this distance also corresponding to even multiples of the incremental circumferential pitch of the successive stop members **23**. As the disc or carrier **21** rotates in said counter clockwise direction **40**, FIGURE 3, during the letter spacing operation the stop members which were just displaced to unset positions will by-pass stop **33** and the next following stop member **23** which is in the set position will swing into operative engagement with said end **36** of stop **33** thereby completing said letter spacing operation. It will be noted that the number of stop members **23** moved to set positions by the camming surface **47** during this letter spacing operation will be the same as the said predetermined number of stop members moved to unset positions to permit said letter spacing operation.

The means for simultaneously displacing a predetermined number of said set stop members to unset positions will be described with particular reference to FIGURES 2 and 3. A shaft **60** is rotatably mounted on the sub-frame **10***a* and pivotally supports four radially extending arms **61**, **62**, **63** and **64**. The upper end of arm **61** is bent off so as to form a stop member engaging finger **65** which is of sufficient width, as seen in FIGURE 3, to be capable of engaging the forward ends of three stop members and displacing the same to their respective unset positions. As seen in FIGURE 3 the finger portion **65***a* is operatively associated with the stop member **23** that is located immediately to the right of the normally positioned stop end **36** while the remaining portion of finger **65** is operatively associated with the two stop members **23** which are located immediately to the left of said stop end **36**. The upper ends of the arms **62**, **63** and **64** are bent off so as to form similar fingers **66**, **67** and **68** which are respectively adapted to engage and displace the forward ends of the third, fourth and fifth set stop members to the left, as seen in FIGURE 3, of the said end **36** of stop **33**. Finger **68** is provided with a laterally bent off carry over lug **69** that overlies the forward face of the adjacent finger **67**. Spacer bushings **70**, **71** and **72** are provided on said shaft **60** between the respective arms **61–64** so as to maintain the latter in predetermined laterally spaced relation with respect to each other and to their respectively associated stop members **23**. Each of the arms **61–64** is provided with a rearwardly extending radial arm **73**, FIGURE 2, the free end of which is connected to a tension spring **74** that is suitably anchored on the machine frame **10***a*. Springs **74** yieldably bias arms **61–64** to their respective normal clockwise positions, as seen in FIGURE 2, determined by engagement of the upper edges of said radial arms **73** and the lower edge of a shaft **75**, FIGURES 3 and 13, that is rotatably mounted in the sub-frame **10***a*, the stop member engaging fingers **65–68** then being spaced a short distance in front of the forward ends **31** of the six respectively associated stop members **23**.

Selective actuation of the arms **61–64** in a counter clockwise direction, FIGURE 2, for selectively displacing the associated stop members **23** to their unset positions is obtained by means comprising an actuator bail **80** which is rotatably secured to said shaft **60** by means of a suitable set screw **81**, FIGURE 3, that is threaded through a bail hub portion **82**. Bail **80** comprises a main body **83**, a short depending leg **84** and an elongated depending leg **85**. The lower end of depending leg **85** is articulately and adjustably connected to a link **86** which is pivotally secured to the shaft **87** fixed to the free end of the power operated universal bail arm **88** normally associated with the usual escapement mechanism of the typewriter. In that the purpose, construction and operation of bail arm **88** is well known further structural discussion thereof here is unnecessary. It will be understood that when any one of the type bars of the machine is actuated the free end of the said universal bail will be displaced through counter clockwise and clockwise oscillatory strokes thereby correspondingly actuating the bail **83**. The bail body **80** is maintained in proper axially spaced relation with respect to the said arms **61–64** by means of the spacer bushings **90** and **91** mounted on shaft **60**. Mounted for vertical sliding movement between the respective arms **62–64** and the bail body **83** is a set of three vertically movable and selectively operable interposers **92**, **93** and **94**, FIGURE 3, that are maintained in substantially coplanar relation with respect to the arms **61–64** respectively by means of a slotted comb **95** which is secured to the sub-frame **10***a* by any suitable means. The shapes and normal vertical positional relation of the upper ends of said interposers are illustrated in the diagrammatic sketch of FIGURE 8. The upper end **100** of interposer **92** is coplanar with and adapted to engage the forward edge of the stop member setting arm **62**, and is formed with a notch **101** and an abutment surface **102** which is normally positioned at the same level as the bail body **83**. Said surface **102** is adapted to be engaged and displaced by said bail body **83** and such action will correspond to a three incremental unit escapement of the typewriter carriage as will be described in a subsequent part of the specification. The upper end **103** of interposer **93** is coplanar with and adapted to engage the forward edge of the arm **63** and has an upper forwardly facing abutment surface **104** that is normally positioned below the level of the bail body **83**. Said surface **104** is adapted, when elevated, to be engaged and displaced by the bail body **83** and such action will correspond to a four incremental unit escapement of the carriage **11**. The upper end **105** of interposer **94** is coplanar with and adapted to engage the forward edge of the stop member setting arm **64** and has an upper forwardly facing abutment surface **106** which is normally positioned below the level of the bail body **83**. Said surface **106** is adapted, when elevated, to be engaged and displaced by the bail body **83** and such action will correspond to a five incremental unit escapement of the carriage as will be described. The arm **61** is provided with a forwardly extending projection **107**, FIGURES 3 and 8, which is always located immediately to the rear of the bail body **83** and is adapted to be engaged and displaced by the bail body **83** during each operative typing stroke of the typewriter, such action corresponding to a two unit escapement of the carriage. The three interposers **92–94** are selectively vertically operated in accordance with the desired length of escapement travel of the typewriter carriage that is to accompany each of the successively typed characters.

The various type bars of the machine control and operate means for so selectively actuating said interposers; such means being next described in connection with FIGURES 1, and 8–10. As shown in FIGURE 1 each sub-lever, such as **13**, is provided with a depending projection **108** having a lower camming edge or surface **109**. Mounted on the machine frame immediately to the rear of the sub-levers is a pair of laterally spaced brackets **110** and **111**, FIGURE 5, the rearward ends of said brackets having coaxially disposed bail supporting stud shafts **112** and **113**, respectively, fixed thereto which extend inwardly towards the longitudinal center plane of the machine. Pivotally mounted on said stud shafts are three permutation bails **120**, **121** and **122**; said bails being provided with pairs of nesting bent off ears, such as illustrated at **125—125¹**, **126—126¹** and **127—127¹** of FIGURES 5 and 6 which are suitably apertured to pivotally engage the associated one of said stud shafts **112**, **113**.

The bail **120** is provided with several laterally spaced and forwardly extending fingers **130**, FIGURES 5 and 6, the outer ends of which lie in the respective paths of travel of those sub-lever projections, such as **108**, that are respectively associated with the characters having four incremental units of width, such as the letters "E," "w" and "U." The bail **121** is provided with several similar forwardly extending fingers **131** which are laterally inter-

spersed with the various fingers **130**. The outer ends of fingers **131** lie in the respective paths of travel of those sublever projections that are respectively associated with the characters having two incremental units of width such as the letters "I," "f" and "l." The bail **122** has forwardly extending fingers **132** which are laterally interspersed with the various other bail fingers. The outer ends of said fingers **132** lie in the respective paths of travel of the sub-lever projections respectively associated with those characters having five incremental units of width such as the characters "W," "M," "m" and "%." As will be noted some of the fingers **130**, **131** are wider than the others, a single wide finger being provided in each case here instead of having two separate but narrower and immediately adjacent fingers where necessary. The bails **120–122** are normally axially biased to the left, as seen in FIGURE 5, by means of a compression spring **140** which is disposed between the collar **141** fixed to the stud shaft **112** and the adjacent face of the bent off ear **125** at the left side of said permutation bail **120**. The right side bracket **111**, as seen in FIGURE 5, in addition to being formed with the upstanding stud shaft supporting portion **142** is provided with a lateral bent off portion **143**, FIGURES 5 and 7, on which is pivotally mounted a bell crank **144**. The upper end **145** of one leg of bell crank **144** is disposed immediately adjacent the inner face of a rearward extension **146** of said bent off ear **127¹** of bail **121**. The outer end of the other bell crank leg is provided with a bent off portion **147** which is adjustably threadedly engaged by an abutment screw **150** having an operatively associated lock nut **151**. The upper end of said abutment screw is disposed beneath the lower face of a bracket **152** that is fixed to the side of the usual power operated case shift link **153** which vertically displaces the typewriter segment **154**. The construction and operation of link **153** is conventional in nature and needs no further explanation here. In that the action of said spring **140** is to yieldably urge the upper end of said screw **150** into engagement with the said lower face of the bracket **152**, it will be evident that the axial position of the three nested bails **120–122** will be determined by the position of the segment **154** and the engagement of set screw **150** with the bracket **152**. As will be evident when the segment is in its normal elevated position for permitting typing of lower case characters the bails **120–122** will be moved to and yieldably retained in a left hand position, as seen in FIGURE 5, under the action of spring **140**. In this condition of the bails the various sub-lever projections such as **108**, associated with the two, four and five unit width characters will be operative to engage one set of the said bail fingers **130**, **131** and **132** respectively. Here there will be no bail fingers aligned with the type bar projections associated with the three unit width characters such as "b," "h" and "5." When the case shift mechanism is operated and the segment is lowered, as illustrated by arrow **155**, FIGURE 7, to a position for permitting the typing of upper case characters, the bell crank **144** will be rotated in a counter clockwise direction, FIGURE 7, thereby shifting said bails to a right hand position as indicated by arrow **156**, FIGURE 5. In this condition of the bails the various sub-lever projections, such as **108**, associated with the 2, 4 and 5 unit width characters will again be operative to engage another set of the said bail fingers **130**, **131** and **132** respectively. As before there will be no bail fingers aligned with the type bar projections associated with the upper case three unit width characters such as "J," "S" and "#."

As best illustrated in FIGURES 1 and 5 the three bails **120**, **121**, and **122** are respectively provided with centrally located and rearwardly extending projections **170**, **171** and **172** to which are respectively fixedly secured the rearwardly extending arms **173**, **174** and **175**. The rearward ends of the bail arms **173**, **174** and **175** are respectively articulately connected to the lower ends of the said interposers **92**, **93** and **94**. Each of the bails **120–122** is biased in a counter clockwise direction by means of a spring **176** which is suitably anchored to the machine frame. The normal position of the bails **120–122**, as shown in FIGURE 1, is determined by engagement of the lower edges of said arms **173–175** with the cross shaft **177** mounted in the frame of the machine.

In the operation of the above described apparatus the typewriter segment **154** will normally be in its upper or FIGURE 1 position so as to permit the typing of lower case characters. It will be recalled that the typewriter carriage **11** is normally restrained from moving in a letter feed direction **41**, FIGURE 3, by that stop member **23** which is in its set position and which is in engagement with the end **36** of the normally stationary stop **33**. Here, in that there are no bail fingers **130–132** which are aligned with and adjacent to the various camming edges such as **109** of the sub-lever projections associated with the three unit width characters, when any one of said three unit characters is typed none of the bails **120–122** will be rotated and hence none of the interposers **92–94** will be vertically displaced from the respective normal positions illustrated in FIGURE 8. Thus when the universal escapement bail **88** swings in a counter clockwise direction, as seen in FIGURE 1, through the forward stroke of its cyclic oscillatory motion, link **86** will cause bail **85** to rock in a counter clockwise direction so that the bail body **83** engages both the said forward surface **102**, FIGURE 8, of interposer **92** and the laterally adjacent shoulder **107** on the said arm **61**. The resultant pivotal movement of the stop member engaging fingers **65** and **66**, FIGURES 2 and 3, will serve to displace to unset positions those three set stop members **23** which are disposed immediately to the left, FIGURE 3, of the abutment surface **36** of said normally stationary stop **33**. When this occurs the carriage is free to move in said letter feed direction **41**, FIGURE 3, and the carrier or disc **21** will be thereby rotated in a counter clockwise direction **40** until the next set stop **23** swings into engagement with the said stationary stop **33**. As will be apparent the extent of this rotational movement of carrier **21** will be three times the peripheral pitch distance between the adjacent stop members **23** and hence the extent of resultant movement of the typewriter carriage **11** will correspond to the three incremental units of width of the lower case character just typed. As soon as the said three stop members have been displaced to unset positions by said fingers **65** and **66**, the universal escapement bail arm **88** and bail **80** will immediately commence their clockwise strokes, FIGURE 2, so as to permit the associated springs **74** to swing the said fingers **65**, **66** out of the operative path of travel of the leftwardly adjacent stop members **23** and back to their respective normal positions. At the completion of the return stroke of the actuated type bar the various parts will be restored to their normal FIGURE 1 positions.

When a lower case character having two incremental units of width is typed the camming edge, such as **109**, of the associated sub-lever projection will engage one of the fingers **131** so as to rock the bail **121** in a clockwise direction, FIGURE 1, thereby elevating the interposer **92** to an extent sufficient to place the surface **102** thereof above the operative path of travel **83***a*, FIGURE 8 of the bail body **83**. As a result the bail body **83** which swings in the counter clockwise direction, as seen in FIGURE 2, during the forward printing stroke of the type bar will engage only the said shoulder **107** formed on the arm **61** thereby causing the stop member engaging finger **65** to displace two set stop members **23** to their respective unset positions; these two stops being first, that stop member which is in engagement with the stop **33** and secondly, that stop member immediately to the left thereof as seen in FIGURE 3. This action will free the carriage for movement in the letter feeding direction **41** through a distance corresponding to the two incremental unit width of the character just typed; the associated

permutation bail, interposer, sub-lever, etc., cooperatively completing their operative strokes in a manner similar to that described above for the typing of three incremental unit width characters. When a lower case character having a four incremental unit width is typed the camming edge, such as **109**, of the associated sub-lever projection will engage one of the fingers **130** as actively shown in FIGURE 9, so as to rock the bail **120** and thereby elevate interposer **93**. As a result the interposers **92** and **93**, and the arm **61** will be rocked by the said motion **83***a* of bail body **83** so that the stop member engaging fingers **65**, **66** and **67** will collectively displace four stop members **23** to unset positions. This will free the carriage for movement in a letter feed direction to an extent corresponding to the four incremental unit width of the character just typed. When a lower case character having five incremental units of width is typed the camming edge, such as **109**, of the associated sub-lever projection will engage one of the fingers **132** so as to rock bail **122** which will elevate the interposer **94** to an extent sufficient to place the surface **106** in the operative path of travel **83***a* of the bail body **83**. Thus the motion of the bail body **83** will displace the arm **61**, the interposer **92**, and interposer **94**, so that the stop member setting fingers **65**, **66**, **67** and **68** collectively displace five of the stop members to unset positions, said finger **67** being operative through said carry over lug **69**. It will be understood that in each of the above described operations the universal bail **88** will move through the arcuate return portion of its cyclic oscillatory motion immediately after the various fingers **65**, **66**, **67** and/or **68** have displaced the desired number of stop members **23** to unset positions so that fingers are thereby immediately withdrawn from the path of movement of the following set stop members **23** and will not interfere with the ensuing movement of the latter.

When the case shift mechanism of the typewriter is operated to permit typing of upper case characters the bails **120–122** will be shifted to their right hand positions, FIGURE 5, so that again none of the bail fingers **130–132** are positioned to cooperate with the sub-lever projections respectively associated with the characters having three incremental units of width. The operations of the bail **80** and the respective interposers **92–94** for the typing of 2, 3, 4 and 5 unit width upper case characters respectively correspond to that just described for the typing of 2, 3, 4 and 5 unit width lower case characters. When the segment is elevated by operation of the case shift mechanism so as to again permit typing of lower case characters, the bails **120–122** will be restored to their normal left hand axial positions, FIGURE 5, under the action of spring **140**.

As the varaible width characters are successively typed the typewriter carriage **11** letter feeds to the left as seen in FIGURE 3 until arrested by the right hand margin stop **190**, FIGURE 10, of the machine, whereafter 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. In that the rack **16** remains in engagement with the pinion **17** during carriage return movements the carrier or disc **21** will be rotated in a clockwise direction **51**, FIGURE 3. During this action any stop members **23** which are not in their set positions will be successively moved to such positions by the camming edge **46**, FIGURES 3 and 11, of cam **43**. Immediately thereafter these set stop members are successively displaced to their respective unset positions as they wipe past the said tapered undercut camming surface **52**, FIGURE 12, of said stop **33**. These unset stops are then successively displaced to their respective set positions by means of the said tapered camming edge **45**, FIGURE 2, of cam **42**. This action continues until the end of the return travel whereupon the usual carriage spring drive means will return the carriage a short distance in a letter feed direction until the last stop member **23** just moved to the set position by said camming edge **45** of cam **42** swings in a counterclockwise direction, FIGURE 3, into operative engagement with the end or abutment shoulder **36** of said stop **33** 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 **36** 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. This inherent characteristic of operation of the instant apparatus is very beneficial in that it avoids the necessity of having to provide additional or special means for overcoming the well known problem of carriage rebound that normally occurs at the end of most carriage return strokes.

Means are provided in the instant escapement mechanism for expanding the characters that are typed, i.e. each letter feeding movement is permitted to be longer than usual so that the spaces between the successively typed characters are greater than normal. Referring to FIGURES 3, 10, 11 and 12 it will be seen that the second normally stationary stop **34** previously referred to is provided with an abutment surface or end **200** which is normally operatively disposed in the path of travel of the set stop members **23** but which is offset to the right, FIGURE 3, from said stop end **36** a distance approximately corresponding to the circumferential pitch of said stop members **23**. As will be evident when the stop **33** is swung outwardly, counter clockwise as seen in FIGURES 10 and 11, the end **200** of stop **34** will become operative to arrest the letter feeding movements of the carriage **11**. When several stop members **23** are to be moved to unset positions to permit a letter feeding movement of the carriage, the stop member setting arm **61**, FIGURE 3, and its associated fingers **65** and **65***a* will always displace those three set stop members which are immediately to the left, FIGURE 3, of the abutment surface or end **200** of the said second normally stationary stop **34**. Here the lengths of the carriage displacements corresponding to the normal typing of characters having 2, 3, 4 and 5 incremental units of width will now be 3, 4, 5 and 6 incremental units respectively. Thus the distance between the successively typed characters will be increased by an amount corresponding to the operative horizontal offset distance between the stop ends **36** and **200**. The extent of such offset distance is slightly less than the circular pitch of the successive stop members **23**.

The means for swinging the normally stationary stop **33** away from the carrier **21** to permit expanded typing comprises an upper toggle linkage **202**, FIGURE 12, said linkage comprising a bell crank **203** which is pivotally mounted by means of stud **204** to a bracket **205** secured by any suitable means to the escapement frame **10***a*. The outer end of one arm of bell crank **203** is articulately connected to one end of a link **206** that is pivotally connected by a stud **207** to the outer end of the radially disposed arm **209** formed on said stop **33**. The outer end of the other arm of the bell crank **203** is articulately connected to one arm of a bell crank **210** by a link **211** while the other arm of bell crank **210** is articulately connected to a bell crank **212** by means of a link **213** having an elongated slot **214** formed therein. The forwardly extending arm of bell crank **213** projects through a suitable stepped slot **215** formed in the front panel **216** of the typewriter and, as will be apparent, by manually adjustably positioning bell crank handle **217** the normally stationary stop **33** may be swung from and to the operative position shown in FIGURE 10 to and from the inoperative position shown in FIGURE 12. A spring **220**, operatively secured between the bell crank **203** and a stud **221** fixed to said bracket **205**, rotatably biases bell crank **203** so as to urge and lock the stop **33** towards and in its oper-

ative FIGURE 10 position. As long as stop 33 is so locked in its operative position the above described normal typing operations may be carried out. On the other hand when stop 33 is retained in its inoperative position by the shifting of the manually operable bell crank 212 the typed material will be expanded. When said bell crank 212 is restored to its normal position, FIGURE 10, spring 220 will restore stop 33 and the associated linkage to normal positions for subsequent normal typing operations.

The instant escapement mechanism 15 is adapted to cooperate with the carriage tabulating linkages of the typewriter. When a tabulating carriage movement is to take place both of the normally stationary stops 33 and 34, FIGURE 3, are swung away from the carrier or disc 21, as illustrated in FIGURE 11, so as to permit the carriage rack 16, which remains in engagement with the pinion 17 during said tabulating movement, to rotate the carrier 21 in a counter clockwise direction 40, FIGURE 3. As is best seen in FIGURES 11 and 12, the lower stop 34 is provided with an upstanding stud 225 which is disposed immediately to the rear of the said tapered undercut surface 52 of the upper stop 33. The forwardly extending projection 226, FIGURES 10 and 12, of stop 34 is articulately connected to a bell crank 227 by means of a link 230; bell crank 227 being rotatably mounted on said stud 204, FIGURES 3 and 12. Bell crank 227 is rotatably biased in a counter clockwise direction, FIGURE 12, by means of a spring 231 which is operatively secured between the bell crank stud 232 and the said stud 221 fixed to said bracket 205, thereby normally maintaining the stop 34 in its clockwise operative position shown in FIGURE 12. The operative position of the stop 34 and hence also, through said stud 225, the operative position of stop 33 is determined by the engagement of the rearwardly extending leg of bell crank 227 with the abutment screw 233 fixed to said bracket 205, FIGURE 12. When in this operative position the toggle connection between bell crank 203 and stop 33 and the toggle connection between bell crank 227 and stop 34 are in their locked conditions. Bell crank 227 is articulately connected to a lever 234 by means of a link 235. It will be apparent from FIGURE 11 that when lever 234 is pivoted in a counter clockwise direction about its pivot stud 236 the stop 34 will swing away from the carrier 21 against the action of spring 231 thereby, through said upstanding stud 225, correspondingly swinging the stop 33 against the action of the spring 220, as illustrated in FIGURE 11. Under these conditions neither of the stops 33, 34 will be effective to impede the swinging movement of any of the set stop members 23 and hence the carrier 21 will be free to rotate thereby permitting the carriage 11 to partake of a tabulating movement until stopped by the action of the usual tabulation arresting means whereupon the stops 33 and 34 will be urged by springs 220, 231 toward their respective operative positions shown in FIGURE 10 so as to resume letter feed control of the carriage as will be more fully described below.

The essential elements of the conventional tabulating arresting means for the instant carriage 11 are fragmentarily shown in FIGURE 10 and will be briefly described to an extent sufficient to indicate the nature of the structural and functional cooperation between such and the escapement mechanism 15. To initiate a tabulating movement of the carriage the power operated link 250 is moved forwardly thereby rocking the crank plate 251 and its supporting shaft 252. During this action the upwardly extending arm 253 of said plate moves along the left edge, FIGURE 10, of the clockwise spring biased pivoted lever 254; the walls defining the lever notch 255 finally swinging into detenting engagement with said arm 253 as shown in FIGURE 11. During this travel the arm 253 will engage the angularly disposed camming edge 256 of said lever 234 and swing the latter in a counter clockwise direction to thereby swing the stop 34, and the stop 33 if the latter has not already been swung to its inoperative position for expanded typing, away from carrier 21 so that the carriage 11 is free to commence a tabulating movement. When the plate 251 and shaft 252 are so rocked the arm 260 secured to the central part of the shaft will be arcuately displaced so as to swing lever 261 in a clockwise direction through link 262. The lever 261 is fixed to the shaft 263 which is pivotally and axially movably mounted on the machine frame 10. The clockwise movement of lever 261 serves to swing the upper blade portion 264 of the lever into the path of travel of any of those tab stops 265 which have been moved to a "set" position. During the tabulating movement of the carriage the various stop members 23 of the escapement mechanism will be moved to and remain in their respective set positions as they swing counter clockwise, FIGURE 10, past the now inoperatively positioned stops 33, 34. This tabulating movement will continue until one of the tab stops 265 which has been previously moved to said "set" position engages the upper blade portion 264 of lever 261. This will cause an axial movement of lever 261 and such will, through the interconnecting link 266, serve to pivot lever 254 in a counter clockwise direction, FIGURE 10, against the action of spring 267. This rotative displacement of lever 254 will release the plate 251 and the arm 253 for rearward pivotal movement from the detented position of FIGURE 11 to the normal position of FIGURE 10. As the arm thus rides back past the camming edge 256 of lever 234, the latter will thereby be permitted to swing in a clockwise direction, FIGURE 11, under the action of spring 231 thus allowing the bell crank 227 to swing into engagement with said stop positioning screw 233, FIGURE 10, so as to again operatively position said stops 33, 34 with respect to the carrier 21 and stop members 23. It will be noted that during the terminal portion of this clockwise restoring movement, FIGURE 10, of the stop 33 the latter will engage one or more of the set stop members 23 of the now arrested carrier 21 and will displace said stop members to unset positions so that the stop end 36 will again be operatively positioned in the path of travel of the next following set stop member.

When the plate 251 and shaft 252 are pivotally restored to their normal positions as above described the upper blade portion 264 of said lever 261 will swing rearwardly to its inoperative position, FIGURE 10, out of the path of travel of the various set tab stops 265. Thus the arrested position of the carriage determined by the operation of the tabulation arresting mechanism will be maintained by engagement with stop end 36 of that set stop member 23 which is next to the last stop member displaced to unset position by the restoration of said stop 33 to its operative position. The relative timed sequence of movement of lever 261 and the stops 33, 34 is such that the former moves into and out of the said path of travel of the tab stops just before and after the stops 33, 34 move out of and into the said path of travel of said stop members 23, respectively, whereby control of the carriage movement in a letter feed direction alternately changes from and to the escapement mechanism 15 and the above described tabulation control linkage. As will be apparent only the stop 34 will be pivotally displaced and operatively associated and disassociated with the stop members 23 during tabulating operations when the escapement mechanism is conditioned for expanded typing as above described. It will be noted that in the instant arrangement there is no connecting linkage which, as in the usual case, acts to lift the carriage rack 16 out of engagement with the pinion 17 when a tabulating movement is initiated.

The inherent nature of operation of the instant escapement mechanism overcomes the long standing problem involving carriage tabulating rebound caused by the im-

pact of the set tab stop with the tab stop arresting blade. It will be seen from FIGURE 10 that when stop 33 is restored to its operative position after completion of a tabulating movement of the carriage, if there is any carriage rebound there will be an accompanying clockwise rotation of carrier 21. This however will not prevent the stop member 23, which was just previously in operative engagement with the stop end 36, from again engaging said stop end after said rebound in that during the relatively small clockwise "rebound" rotation of carrier 21 any stop members 23 which move past the undercut cam surface 52 and the stop end 36 will be displaced to unset positions and will not subsequently prevent said operative set stop member from re-engaging stop end 36 after completion of the carriage rebound movement. In this way the tabulated positions of the typewriter carriage will always correspond to the respective predetermined columnar positions determined by the respective tab stops which are in "set" posiitons.

A tab brake is provided with the instant apparatus so that the typewriter carriage may be yieldably restrained from acquiring excessive speeds during tabulating movements. Referring to FIGURE 11 there is shown a brake arm 275 which is pivotally mounted on the escapement sub frame 10*a* by means of a stud 276. Secured to the free end of brake arm 275 is a friction pad 277 which is made of leather or other suitable material and which is adapted to be pressed against the rearward face 278, FIGURE 4, of the rotatable disc or carrier 21. Also rotatably mounted on stud 276 is a lever 280 which is articulately connected to tab lever 234 by means of a link 281 and which is yieldably connected to said brake arm 275 by means of a tension spring 282. The clockwise limit of rotation of lever 280 with respect to brake arm 275 is determined by engagement of the left edge, FIGURE 11, of lever 280 with a depending bent off ear 283 formed on arm 275. The parts are constructed and arranged so that during normal typing operations the link 281 maintains lever 280 and brake arm 275 in a clockwise position wherein the friction pad 277 is out of operative contact with the carrier 21. When a tabulating movement of the carriage is initiated, as above described, the counter clockwise rotation of lever 234 will cause lever 280 to partake of a counter clockwise stroke which is greater than that needed to swing the friction pad into contact with said rearward face of carrier 21. Under these conditions the spring 282 will yieldably hold said pad in braking engagement with the carrier and hence the typewriter carriage 11 will be prevented from acquiring speeds above a predetermined value depending on the adjustable operative tension in spring 282. At the termination of the carriage tabulating movement the clockwise movement of tab lever 234 will, through lever 280 and bent off ear 283, positively swing said brake arm 275 to its normal inoperative position thereby leaving the carrier 21 unimpeded for subsequent typing operations.

Referring to FIGURE 13 there is shown a back spacing apparatus for incrementally displacing the typewriter carriage in a carriage return direction. In that the rack 16 and pinion 17, FIGURE 1, are engaged during this operation the back space linkage is here directly operative on the carrier 21 of the escapement mechanism 15. Secured to the escapement frame 10*a* is a bracket 290 which has an upwardly extending arm 291 that is formed with an arcuate slot 292. Mounted for sliding movement in said slot is a pin 293 which is fixedly secured to a link 294 that is provided with a bent off upwardly extending stop member engaging finger 295. The left end, FIGURE 13, of link 294 is articulately connected by means of a stud 296 to a bell crank 297 which is pivotally mounted on the shaft 298. The ball crank 297 is presently used in the back spacing mechanism of the typewriter and hence its well known construction and operation need not be further particularized here. Suffice it to say that when a backspace operation is to be made the bell crank 297 will be power actuated through clockwise and counter clockwise oscillatory strokes. A suitably anchored spring 300 maintains the link 294 in a normal left hand position determined by engagement of stud 293 with the end of slot 292 as shown in FIGURE 13. Also articulately connected to bell crank 297 by means of a stud 296 is a stop member setting link 301 which extends through a suitable slot 302, FIGURE 12, formed in the rearward portion of said bracket 291. The right end portion, FIGURE 13, of link 301 is provided with an angularly disposed camming surface 303 and an integral tip 304 which normally underlies the rearwardly extending arm 305, FIGURE 2, of a bell crank 306 that is rotatably secured to said shaft 75. The upper end of the bell crank arm 307 is provided wtih a forwardly extending bent off ear 310, FIGURES 2, 12 and 13, which has an angularly disposed camming edge 311 that is located adjacent the lower rearward portion of the carrier 21. A suitably anchored spring 312, FIGURE 2, normally maintains the bell crank 306 in a counter clockwise position determined by engagement of the lower edge of said bell crank arm 305 with the tip 304 of link 301 as illustrated in FIGURE 2. In this position of the bell crank the camming edge 311 of the bell crank ear 310 lies out of the operative path of travel of the adjacent stop members 23 and hence is inoperative during normal typing operations.

When a back spacing operation is to be effected the power actuated clockwise stroke of bell crank 297 will cause the end of finger 295 of link 294 to move along an arcuate path determined by the contour of said slot 292, and to engage the forward end portion of an adjacent set stop member 23 and displace the latter through an arcuate distance which is slightly greater than the circumferential pitch of said stop members 23. The resultant clockwise rotation 51, FIGURE 13, of the carrier 21 and pinion 17 causes the typewriter rack 16 and carriage 11 to be displaced through a distance corresponding to a little more than one incremental unit in a carriage return direction. During this action, the clockwise motion of bell crank 297 will, through link 301, cause the angular camming edge 311, FIGURE 12, of bell crank ear 310 to be swung into the operative path of travel of the rearward end 50, FIGURE 4, of the adjacent unset stop member 23. In that said adjacent stop member 23 will then be moving in a clockwise direction by the action of the back spacing link 294, as just described, the rearward end 50 of said stop will wipe past said camming edge in swinging by the end 36 of said stationary stop 33 and will be thereby displaced from an unset position to a set position. As a result after the completion of the said back spacing movement of the carrier 21, the said stop member 23 which was just moved to set position by cam edge 311 may then swing back a short distance into operative engagement with the end 36 of stop 33 and thereby maintain the carriage in a position which is one increment unit to the right, as viewed from the front of the machine, from that position which it occupied just previous to the back spacing operation. After completion of the clockwise motion of bell crank 297, the springs 312 and 300 will respectively urge the bell crank 306 and link 294 towards their normal positions shown in FIGURES 12 and 13 preparatory for subsequent typing operations or another carriage back spacing operation.

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 machine of the class described having a frame;

a carriage movably mounted on said frame; a mechanism for driving said carriage in at least one direction; and means for controlling the feed movement of said carriage in said one direction under the action of said drive mechanism: said means comprising a carrier movably mounted on said frame and operatively connected to said carriage; a plurality of stop members movably mounted on said carrier; a stop mounted on said frame; said stop members each being movable to a set position so as to be cooperable with said stop thereby preventing movement of said carriage in said one direction, and to an unset position so as to by-pass said stop thereby permitting a movement of said carriage in said one direction; means for moving each successive stop member to a set position as said stop members respectively approach said stop; and selectively operable means for sequentially displacing said set stop members to unset positions so as to successively permit said carriage to intermittently partake of predetermined feed movements in said one direction under the action of the carriage driving mechanism.

2. Apparatus as defined by claim 1, additionally comprising a letter spacing expanding device including a second normally stationary stop mounted on said frame and adapted to cooperate with stop members that are in set positions; said second stationary stop being formed with a stop member contacting surface that is offset with respect to the normal operative position of the corresponding contact surface on the first mentioned stop, and means for moving the first mentioned stop and said second stop out of the path of travel of the set stop members.

3. In a typewriter having a frame; a transversely movable carriage mounted on said frame; and drive means for moving said carriage in a letter feed direction: a proportional spacing mechanism comprising a carrier movably mounted on said frame and operatively geared to said carriage; a plurality of stop members movably mounted on said carrier; a stop mounted on said frame; each of said stop members being movable to either a set position so as to be engageable with said stop and thereby prevent movement of said carriage, or to an unset position so as to by-pass said stop and thereby permit movement of said carriage; means for moving said stop members to set positions; and a plurality of selectively operable fingers for successively displacing different numbers of the set stop members to unset positions for permitting said carriage to successively move through variable distances under the action of said drive means.

4. In a typewriter having a frame; a carriage movably mounted on said frame; drive means for said carriage; a plurality of type bars movably mounted in said frame and each adapted to partake of a printing stroke; and means for controlling the movement of said carriage; the last mentioned means comprising a plurality of stop members; movable means on said frame for supporting said stop members; means operatively connecting said movable means to said carriage; a stop mounted on said frame; said stop members each being movable to a set position so as to be engageable with said stop thereby preventing movement of said carriage, and to an unset position so as to by-pass said stop thereby permitting movement of said carriage; means for moving each stop member to a set position; and means normally operative for displacing a predetermined plurality of the set stop members to unset positions so as to permit said drive means to move said carriage through a distance the extent of which is determined by the number of said set stop members which are displaced to unset positions.

5. In a machine of the class described having a frame; a carriage movably mounted on said frame; a mechanism for driving said carriage in at least one direction; and means for controlling the feed movement of said carriage in said one direction under the action of said drive mechanism: said means comprising a carrier movably mounted on said frame and operatively connected to said carriage; a plurality of stop members movably mounted on said carrier; a normally stationary stop mounted on said frame; said stop members each being movable to a set position so as to be cooperable with said normally stationary stop and thereby prevent movement of said carriage in said one direction, and to an unset position so as to by-pass said normally stationary stop and thereby permit a movement of said carriage in said one direction; means moving each stop member to a set position as said members respectively approach said stop; and a plurality of selectively operable fingers for normally displacing a predetermined plurality of the set stop members to unset positions so as to permit said carriage to intermittently partake of predetermined feed movements in said one direction under the action of the carriage driving mechanism.

6. In a machine of the class described having a frame; a carriage movably mounted on said frame; a mechanism for driving said carriage in at least one direction; and means for controlling the feed movement of said carriage in said one direction under the action of said drive mechanism: said last named means comprising a carrier movably mounted on said frame and operatively connected to said carriage; a plurality of equally spaced stop members movably mounted on said carrier; a normally stationary stop mounted upon said frame; said stop members being successively movable to a set position to engage the stop side of said stationary stop and thereby prevent movement of said carriage in said one direction, and movable to an unset position so as to by-pass said normally stationary stop to thereby permit a movement of said carriage in said one direction; means moving each stop member to a set position adjacent the stopping side of said normally stationary stop; and means for displacing the set stop members to unset positions adjacent the stopping side of said stop to permit said carriage to intermittently partake of predetermined feed movements in said one direction under the action of said carriage driving mechanism.

7. In a machine of the class described; a frame; a carriage movably mounted on said frame; a mechanism for driving said carriage in at least one direction; and means for controlling the feed movement of said carriage in said one direction under the action of said driving mechanism: said means comprising a disc rotatably mounted on said frame and operatively connected to said carriage; a plurality of stop members movably mounted on said disc; a normally stationary stop mounted on said frame; said stop members each being movable to a set position so as to be cooperable with said normally stationary stop and therby prevent movement of said carriage in said one direction, and to an unset position so as to by-pass said normally stationary stop and thereby permit a movement of said carriage in said one direction; means displacing each successive stop member to a set position in response to the respective bodily movements of said members as the latter approach said stop; and means for displacing the initially set stop members to unset positions so as to permit the carriage driving mechanism to intermittently move said carriage in said one direction.

8. In a typewriter having a frame; a carriage movably mounted on said frame; drive means for moving said carriage in a letter feed direction; a plurality of type bars movably mounted on said frame and each adapted to partake of a printing stroke; and means for controlling the movement of said carriage: the last mentioned means comprising a plurality of stop members; movable means on said frame for supporting said stop members; means operatively gearing said movable means to said carriage; a stop mounted on said frame; said stop members each being movable to a set position so as to be engageable with said stop thereby preventing movement of said carriage, and to an unset position so as to by-pass said stop thereby permitting movement of said carriage; means displacing each successive stop member to a set position as said stop members respectively progressively approach

said stop; and a plurality of selectively operable means responsive to the operation of some of said type bars for normally displacing a predetermined plurality of the set stop members to unset positions so as to permit said drive means to move said carriage through a distance the extent of which is determined by the number of said set stop members which are normally displaced to unset positions.

9. In a typewriter having a frame; a carriage movably mounted on said frame; means for driving said carriage in a letter feed direction; and a plurality of type bars pivotally mounted in said frame and each adapted to partake of a printing stroke: the improvement comprising a disc rotatably mounted in said frame; means for operatively gearing said disc to said carriage; a plurality of spaced stop members movably mounted on said frame adjacent said disc; said stop members each being movable to a set position so as to be engageable with said stop thereby preventing letter feeding movement of said carriage, and to an unset position so as to by-pass said stop member thereby permitting a letter feeding movement of said carriage under the action of said driving means; cam means mounted on said frame; said cam means being constructed and arranged to progressively move each successive stop member to a set position as said stop members respectively approach said stop; and a plurality of individually operable fingers movably mounted on said frame and selectively actuated in response to the operation of each of said type bars for selectively displacing several of the set stop members to unset positions so as to permit said carriage to incrementally move in a letter feed direction by an amount determined by the number of said set stop members moved to said unset positions.

10. In a typewriter having a frame; a carriage movably mounted on said frame; and drive means for moving said carriage in a letter feed direction: the improvement comprising a disc rotatably mounted on said frame; means operatively gearing said disc to said carriage so that a linear displacement of said carriage in a letter feeding direction is accompanied by a rotary motion of said disc; a plurality of stop members movably mounted in a circular array around the periphery of said disc; said stop members being longitudinally movable in directions substantially parallel to the axis of rotation of said disc; a stop mounted on said frame adjacent the periphery of said disc; said stop members each being movable to a set position so as to be engageable with said stop and thereby prevent letter feeding movement of said carriage, and to an unset position so as to by-pass said stop and thereby permit letter feeding movement of said carriage under the action of said drive means; a cam mounted on said frame adjacent the periphery of said disc; said cam being constructed and arranged so as to successively displace said stop members to their respective set positions in response to the rotation of said disc produced by movement of said carriage in said letter feed direction; a plurality of fingers movably mounted on said frame and being operatively disposed adjacent the periphery of said disc in a region between said cam and said stop; said fingers being selectively operable to sequentially displace different numbers of the initially set stop members to unset positions so as to permit said carriage to intermittently move in a letter feed direction through variable distances depending on the respective numbers of stop members respectively moved to unset positions; and cam means for successively displacing stop members which are inset positions to unset positions during rotation of said disc produced by a return movement of said carriage.

11. The combination with a typewriter having a movable carriage of an escapement mechanism for permitting uniform and variable movement of said carriage comprising a carrier, said carriage and said carrier being operatively connected whereby said carrier is urged in one direction, a series of stop members mounted on said carrier for movement from a first to a second position, stop means cooperable with one of said series of stop members in said first position for holding said carrier against movement, means for moving said one stop member and a number of successive stop members in said series to said second position, said one stop member and number of successive stop members corresponding to a desired incremental movement of said carriage, and means for restoring the equivalent number of members moved to said second position to said first position during said incremental movement.

12. Apparatus as recited in claim 11 further comprising carriage tabulating mechanism, means responsive to operation of said tabulating mechanism for moving said stop means from a normal operative position to an inoperative position out of the path of said stop members to permit tabulating advance of said carriage, and means operative upon arrest of said tabulating advance of the carriage for restoring said stop means to normal operative position.

13. Apparatus as recited in claim 12 additionally comprising a plurality of settable tab stops, and means responsive to operation of said tabulating mechanism for cooperating with said settable stops for arresting said tabulating advance, said settable tab stop spacing corresponding to the spacing between a predetermined number of said stop members and being always in phase with predetermined ones of said stop members.

14. In a business machine having a carriage, type bars, key levers, and means controlled by said key levers for operating said type bars, said type bars each bearing a type character of varying width, a proportional escapement mechanism for releasing said carriage after printing a letter and for stopping said carriage after the latter has travelled a distance corresponding to the width of the letter printed, said mechanism comprising a disc, means operatively connecting said disc with said carriage, stop members mounted on said disc for movement to a first and a second position, stop means adapted to cooperate with stop members in said first position for stopping carriage movement, a plurality of selectively operable fingers for normally moving a predetermined number of said set stop members to said second position whereby said carriage is permitted to move a predetermined number of incremental units of distance, means for restoring stop members in said second position to said first position during letter feed movement of said carriage, a mechanism for initiating a carriage tabulating movement, means responsive to the operation of said tabulating mechanism for swinging said stop means from a normal operative position to an inoperative position, means to arrest the tabulating movement of said carriage, and means responsive to the operation of the last mentioned means for swinging said stop means back to its normal operative position and locking the same in said operative position.

15. In a typewriter; a frame; a carriage movably mounted on said frame; drive means for moving said carriage in a letter feeding direction; a plurality of settable stop members; means mounted on said frame for movably supporting said stop members; means for operatively gearing the last mentioned means to said carriage; a stop mounted on said frame, said stop being movable to a normal operative position and to an inoperative position; each of said stop members being movable to a set position so as to be engageable with said operatively positioned stop thereby preventing a letter feeding movement of said carriage, and to an unset position so as to by-pass said operatively positioned stop thereby permitting a letter feeding movement of said carriage; means for successively displacing said stop members to set positions as said stop members respectively approach said stop; means for displacing said initially set stop members to unset positions to thereby permit letter feeding movement of said car-

riage under the action of said drive means; means for moving said stop to an inoperative position out of the path of movement of the stop members which have been displaced to set positions so as to initiate a tabulating movement of said carriage; means for arresting the tabulating movement of said carriage; and means responsive to the operation of the carriage arresting means for restoring said stop to its normal operative position.

16. In a typewriter; a frame; a carriage movably mounted on said frame; drive means for moving said carriage in a letter feeding direction; a plurality of settable stop members; means mounted on said frame for movably supporting said stop members; means for operatively gearing the last mentioned means to said carriage; a stop mounted on said frame, said stop being movable to a normal operative position and to an inoperative position; each of said stop members being movable to a set position so as to be engageable with said operatively positioned stop thereby preventing letter feeding movement of said carriage, and to an unset position so as to by-pass said operatively positioned stop thereby permitting letter feeding movement of said carriage; means successively displacing said stop members to set positions in response to the approach of the latter towards said stop; means for selectively displacing said initially set stop members to unset positions to thereby permit letter feeding movement of said carriage under the action of said drive means; means for moving said stop to an inoperative position out of the operative path of movement of the stop members which have been displaced to set positions so as to initiate a tabulating movement of said carriage; means for arresting the tabulating movement of said carriage; means for retaining said stop in its inoperative position during said carriage tabulating movement; and means responsive to the termination of said carriage tabulating movement for disabling said carriage arresting means and for returning said stop to its normal operative position thereby restoring control of carriage movements to said stop members and said stop, the returning of said stop to its normal operative position being effective to move at least one of the set stop members to an unset position.

17. Apparatus as defined by claim 15, additionally comprising a movable tabulating braking means adapted to be moved from an inoperative to an operative position so as to frictionally engage the stop member supporting means, and means for moving said braking means to an operative position when said stop is moved to an inoperative position and for moving said braking means to an inoperative position when said stop is moved to an operative position.

18. Apparatus as defined by claim 1, additionally comprising an expanding means comprising a second normally stationary stop mounted on said frame; said second stop having an abutment surface which normally lies in the operative path of travel of said set stop member and which is offset, circumferentially of said carrier, with respect to the stop member engaging surface of the first mentioned stop so as to be operable to control the letter feed movement of said carriage when said first mentioned stop is moved to its inoperative position.

19. Apparatus as defined by claim 1, additionally comprising cam means for successively displacing the set stop members to unset positions during rotation of said carrier produced by a return movement of said carriage.

20. Apparatus as defined by claim 10, additionally comprising a second cam means for successively displacing stop members which are in unset positions to set positions during rotation of said disc produced by said return movement of said carriage.

21. Apparatus as defined by claim 1, additionally comprising a carriage back spacing mechanism having a power operated member adapted to engage one of the stop members on said carrier and rotatably displace the latter a short distance in a carriage return direction, and means responsive to this displacement for moving at least one other of said stop members from unset to set position so that this stop member may subsequently swing into carriage restraining engagement with said stop.

References Cited in the file of this patent

UNITED STATES PATENTS

1,054,875	Smith	Mar. 4, 1913
1,286,186	Miller	Nov. 26, 1918
2,303,878	Helmond	Dec. 1, 1942
2,439,470	Jackson	Apr. 13, 1948
2,518,166	Miller	Aug. 18, 1950
2,794,530	Liebmann	June 4, 1957

FOREIGN PATENTS

529,261	Italy	June 21, 1955