Dec. 5, 1961 A. W. SCRIBNER 3,011,616

TYPE BAR IMPACT CONTROL

Filed Sept. 30, 1960 2 Sheets-Sheet 1

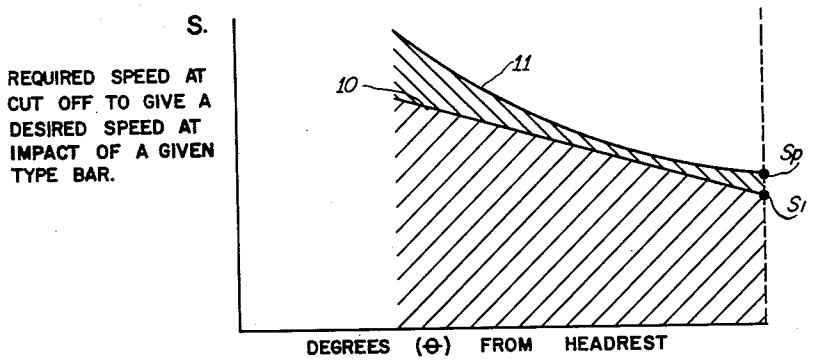


Fig_1

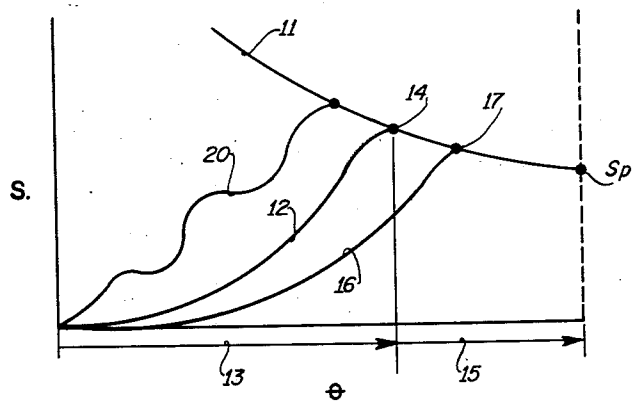


Fig_2

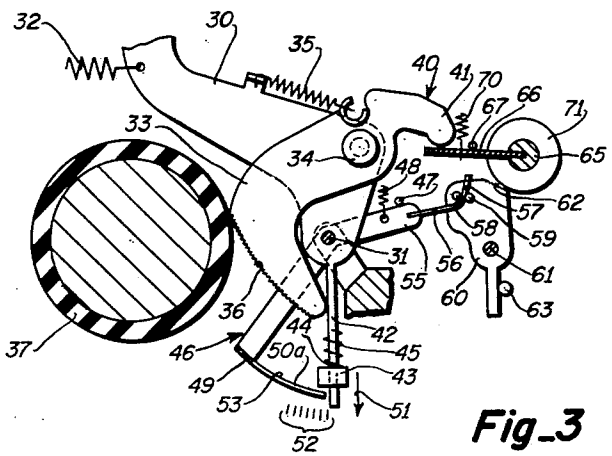


Fig_3

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TYPE BAR IMPACT CONTROL

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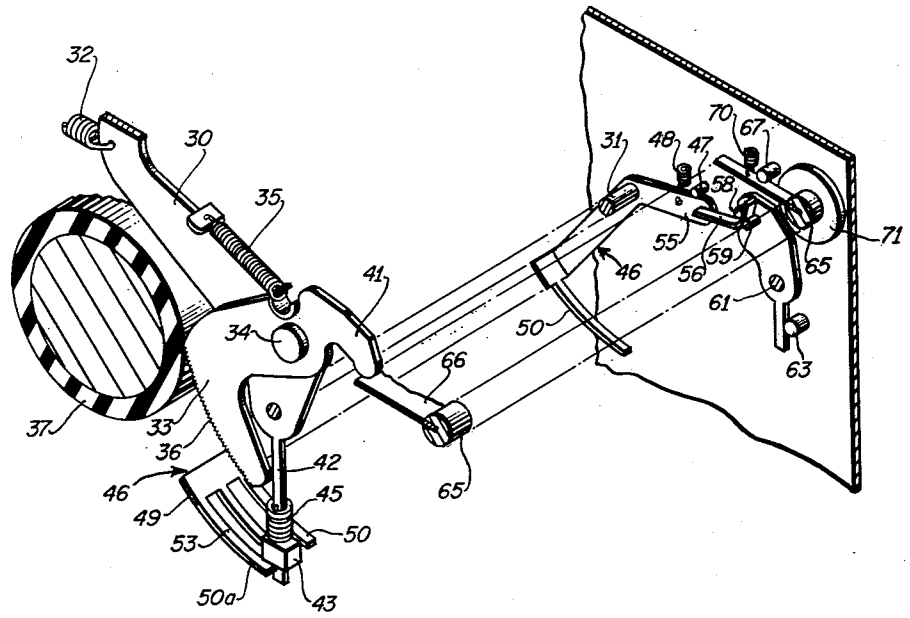


Fig_4

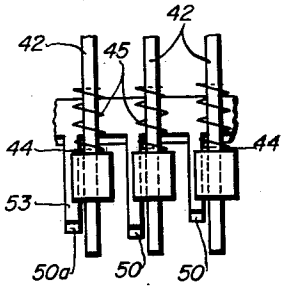


Fig_5

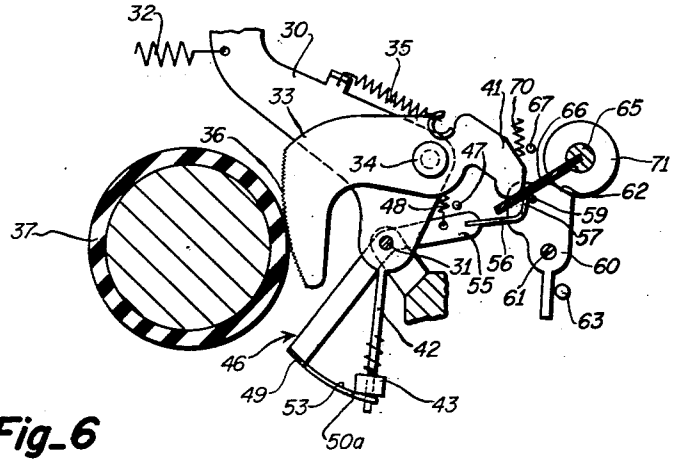


Fig_6

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3,011,616

TYPE BAR IMPACT CONTROL

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Filed Sept. 30, 1960, Ser. No. 59,773
11 Claims. (Cl. 197—17)

This invention relates to a novel type action and more specifically relates to a novel method and arrangement for controlling the printing impact of a type bar of an electric typewriter.

In order to obtain good print work from a typewriter it is essential that any given type bar in the machine always strike the platen with a predetermined and substantially uniform impact during repeated typing operations. If the successive typing impacts of any given bar vary then the typed characters appearing on the record sheet will be correspondingly light and dark in shade intensity.

In the usual electric typewriter action a type bar which is to effect a printing operation is displaced through approximately 90 degrees in moving from the head rest to the platen. The first portion of this displacement comprises a power stroke during which the type bar is accelerated as a result of being effectively coupled to a power roll or a similar driving means. At some point in the latter part of the type bar displacement a power cut off is effected, i.e. the type bar is effectively uncoupled from the power roll and the bar together with the immediately related parts of the action are thereafter allowed to move in substantially free flight until printing impact occurs. During free flight the type bar is decelerated due primarily to the action of the type bar return spring or springs, and to a lesser degree by the frictional drag acting on the various moving parts of the type action. Under these general dynamic conditions when power cut off is effected relatively early in the type bar displacement the time period allocated for type bar acceleration is decreased, while the period permitted for type bar deceleration is increased. Conversely when power cut off is effected relatively late in the type bar displacement the length of the power stroke and hence the type bar acceleration period is increased while the free flight stroke and hence the deceleration period is decreased. As will be apparent not only is the point of power cut off important in the determination of the final printing speed possessed by the type bar as it strikes the platen but the intensity of the print work produced by a given type bar will normally be very sensitive to any deviation of the actual power cut off point from the predetermined desired cut off point for that particular type bar.

In the operation of conventional type actions it has been assumed that the type bar acceleration characteristics during repeated power strokes of a given bar are substantially uniform and hence that the respective speeds of the bar at its various respective angular positions during these repeated power strokes are also substantially uniform. Based on this assumption the power cut off for each type bar is located at a predetermined point along the displacement path of the type action. Here for example, adjustable power cut-off set screws are sometimes used to effect a disengagement of a roll cam from a power roll after the type bar has been power driven to a predetermined angular position. The difficulty encountered in this type of arrangement is that the acceleration characteristics of a given type bar during repeated typing operations are not always uniform to the degree required to avoid the above noted light-dark printing problem. Here, when the type bar reaches any predetermined angular position in its power stroke its

speed may be above or below that anticipated by reason of the effects of certain operational variables such as the point where the roll cam and power roll are effectively coupled, backlash between the type action parts, slippage in the drive connections, variations in power roll speeds, etc. As a result if the power cut off occurs at a normally fixed position and if the speed of the type bar when it reaches this position varies depending on the effects of said variables it will be apparent that the typing impact and print intensity produced by successive actuation of a given type bar will also vary thus giving poor print work.

The present invention is concerned with controlling the power cut-off to a type bar by taking into consideration not just the arrival of the type bar to a predetermined angular position, but the combined effects of both type bar position and speed in such a way that the above mentioned type bar drive variables which at present are at least partially determinative of the accelerational characteristics of the type action, are no longer operative to variably effect the intensity of the printing impact of the type bar.

One object of the invention is to provide a novel type bar speed control arrangement for typewriters wherein means are provided for sensing when, during any given typing cycle, the type bar has reached any one of a predetermined set of critical combined conditions of speed and position.

Another object of the invention is to provide a novel type bar speed control arrangement for typewriters whereby for each typing cycle or operation the typing impact is controlled by sensing the speed of the type bar during its power stroke and effecting a power cut off thereto during said cycle in accordance with the speed measurements made.

Another object of the invention is to provide a novel type action wherein a power cut off to the type bar is effected whenever the speed and position of the bar matches any one of many different predetermined desired free flight conditions of speed and position for that particular type bar.

Another object of the invention is to provide a novel type action whereby the speed of the type bar is sensed during the power stroke and whereby power cut off is effected when the type bar reaches a predetermined desired speed at a predetermined desired angular position.

Another object of the invention is to provide a novel method and apparatus for controlling the speed of a type bar whereby the driving of the type bar is terminated when a predetermined desired set of dynamic conditions have been reached which will give the desired free flight typing impact after the predetermined type bar decelerating forces have been overcome.

Another object of the invention is to provide a novel method of controlling type bar printing impact whereby the decelerating effects on any given type bar of the type bar return spring and other factors such as frictional drag are measured so that the type bar free flight speeds required at positions of varying distances from the platen to respectively produce an acceptable typing impact may be determined, and whereby the power to the type bar is cut off when the type bar reaches one of the several predetermined desired free flight conditions of speed and position.

Another object of the invention is to provide a type action having a centrifugally sensitive fly weight for sensing the speed of the type bar and controlling the driving action for the latter so that it will possess a predetermined desired speed at printing impact.

Still another object of the invention is to provide a novel type bar speed control apparatus wherein a centrifugally sensitive fly weight senses the speed of the type

action during a power stroke, said fly weight being engageable at various points along one predetermined surface of an element which when displaced serves to cause disengagement of the type action from its drive means.

A further object of the invention is to provide a novel power cut off for an electric typewriter whereby a type action may be automatically uncoupled from an associated power roll at different points during successive power strokes of the type bar while substantially uniform intensity to the printing work is still retained.

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:

FIGURES 1 and 2 are graphs illustrating the operational concept of the instant invention.

FIGURE 3 is a side elevational view illustrating the construction and arrangement of the instant type bar speed control apparatus.

FIGURE 4 is an exploded perspective view of some of the apparatus shown in FIGURE 3.

FIGURE 5 is a fragmentary front elevational view illustrating the lower end construction of the various sub levers of the typewriter.

FIGURE 6 is an active view of the parts shown in FIGURE 3.

After the power cut-off of a driven type bar has been effected the free flight of the bar is opposed and slowed down principally by the action of the type bar return spring or springs, and to a much lesser degree by the frictional drag of the various parts of the moving type action. If a particular impact speed of the type bar is desired then the type bar must be initially driven to a higher maximum speed so that after cut-off the predetermined effects of the above mentioned spring and frictional decelerating forces will cause the type bar to slow down to said particular desired terminal or impact speed.

Referring to FIGURE 1 the line **10** represents the free flight speeds (S) of the type bar at various positions which are required to overcome the decelerating action of the type bar return spring in order that the type bar have a desired terminal speed of S_1. Superimposed with respect to line **10** is a curve **11** which illustrates the added deceleration effects of the average frictional drag of the various parts of the moving type action over and above the effects noted by line **10**. In that the actual values represented by line **10** may be quite accurately determined for any given bar and its return spring, and in that a fairly accurate average value may be determined for the much smaller frictional decelerating effects, the combined deceleration effects represented by curve **11** may be determined and plotted for any given type bar with a workable degree of accuracy, and this dynamic operation of the type bar will inherently be substantially uniform for each successive typing operation of the bar; curve **11** indicating the free flight type bar speeds at various angular positions required to give the said type bar its final desired printing speed S_p at the time of impact.

The curve **11** is again illustrated in FIGURE 2 together with an exemplary curve **12** which illustrates the speed changes of the type bar as the latter is accelerated by the power roll during a power stroke. If the power stroke **13** is here continued until the curve **12** intersects the curve **11** as at **14** and a power cut off is effected at that time, then the type bar will continue to move through a free flight stroke **15** in accordance with the predetermined and predictable conditions noted by the remainder of curve **11** so that a predetermined typing speed S_p will result at printing impact. If the next power stroke of the same type bar follows the different dynamic conditions exemplified by curve **16** then cut-off should be effected at the intersection point **17** so that the type bar may again follow the inherent predictable dynamic conditions noted by curve **11** to effect a printing impact having the same intensity as in the previous typing operation of the bar. As will be apparent no matter what the acceleration characteristics of the type bar are during its power stroke, e.g. that noted by curves **12**, **16** or **20**, as soon as the conditions of both speed and position of the type bar match any point on the substantially fixed curve **11** a power cut off should be effected so that the free flight of the bar will be allowed to follow the substantially fixed inherent operational characteristics of motion as represented by the remainder of curve **11**. In this way the printing impact of the type bar will always be substantially the same and hence the printed characters will be uniform in shade or intensity.

Apparatus is provided for sensing the critical conditions of both speed and position of each type bar during each of its power strokes. Referring to FIGURE 3 there is shown a conventional type "rubber roll" action comprising a sublever **30** which is pivotally mounted on the cross shaft **31** and which is biased to a normal counter clockwise position by a type bar return spring **32**. A roll cam **33** is pivotally mounted on the sublever by means of a stud **34** and is rotatably biased to a normal counter clockwise position by means of a spring **35**. The roughened eccentric peripheral surface **36** of the roll cam is adapted to be swung into operative engagement with the periphery of a continuously driven rubber coated power roll **37** by means of a suitable key action acting on the roll cam tail **41** as diagrammatically illustrated at **40** in FIGURE 3. As the roll cam surface **36** progressively engages the power roll periphery the sublever **30** is driven through a clockwise power stroke so as to correspondingly swing the related type bar towards the platen. The construction and operation of this type of drive unit is well known in the art and further explanation thereof need not be made here. Suffice it to say here that at some point in the clockwise power stroke of sublever **30** the roll cam **33** is caused to be disengaged from the power roll **37** to effect a power cut-off to the type bar so that the latter may continue its motion in free flight to the printing point of the typewriter.

The above described type action which is exemplary of the various other type actions in the machine is augmented as follows. The sublever **30** is provided with a depending projection **42**, FIGURES 3, 4 and 5, on which is slidably mounted a small apertured centrifugally sensitive fly weight **43**. The weight **43** is normally biased into engagement with the bent off sublever pin **44**, FIGURE 5, by means of a spring **45** that is anchored to the upper portion of the sublever projection **42**. Pivotally mounted on said sublever supporting cross shaft **31** is a bail **46** which is biased into normal engagement with the frame stud **47** by means of a very light spring **48**. The body portion **49** of the bail defines a comb having a plurality of forwardly extending teeth **50**, FIGURE 4, which are respectively associated with the various type actions of the machine. The comb tooth **50*a*** associated with the said sublever **30** extends laterally adjacent the sublever projection **42** and slightly below the lower side edge of the normally positioned fly weight **43** as is best illustrated in FIGURES 4 and 5. As will be apparent when the sublever **30** is power operated as above described the fly weight **43** will, due to centrifugal force, move radially outwardly **51**, FIGURE 3, along the sublever projection **42** and against the action of spring **45** as the sublever swings in a clockwise direction through various angular positions illustrated at **52** of FIGURE 3 and will engage the upper edge **53** of the comb tooth **50*a***. For a given mass of the fly weight **43** and a given spring constant for spring **45** the radial positions of fly weight **43** along the sublever projection **42** will be determinable or predictable for the various different pivotal speeds of the sublever **30** on the cross shaft **31**. In view of this the

said upper edge **53** of comb **50***a* is contoured and positioned so that the radial distances between said edge and the axis of the sublever pivot shaft **31** for the respective successive rotary positions **52** of the pivoting sublever **30** correspond to the conditions noted by the said curve **11** of FIGURE 2, i.e. for any given position and speed of the driven sublever **30**, corresponding to a given point on the curve **11**, the fly weight will be just making contact with the comb tooth edge **53**. Under these conditions it will be apparent that when the fly weight **43** engages any point along the upper surface **53** of the comb tooth the dynamic conditions of both speed and position as represented by some point on curve **11** have been attained by the type bar and if a power cut off can be effected immediately the type bar can complete its printing stroke in free flight in the inherently uniform manner designated by the remainder of said curve **11**.

Means are provided for automatically causing disengagement of the roll cam **33** from the power roll **37** in response to the engagement of fly weight **43** with the bail tooth edge **53**. The right hand end, FIGURE 4, of bail **46** is formed with a forwardly extending arm **55** to which is connected a flexible cantilevered leaf spring **56**. The forward bent off end **57** of this leaf spring extends upwardly between two studs **58** and **59** provided on a locking cam **60**. The cam **60** is pivotally mounted on the machine side frames by means of a stud shaft **61** and is formed with a roughened and slightly eccentric peripheral surface **62**. In the normal position of bail **46** the bent off end **57** of the leaf spring lightly engages the cam stud **58** so as to bias the locking cam **60** into normal engagement with a frame stud **63**. A cross shaft **65** is pivotally mounted in the machine side frames and has fixed thereto an elongated rearwardly extending power cut off bail **66** which is normally disposed a short distance below the various roll cam tails such as **41**. The bail **66** is biased into normal engagement with a frame stud **67** by means of a spring **70**. Also fixed on cross shaft **65** is a rubber coated locking disc or roll **71** having a lower portion of its periphery disposed immediately above the surface **62** of the locking cam **60**.

The above described apparatus defines a means for permitting a power cut off point to be selected at a time after the power stroke of the type bar has started, and for automatically uncoupling the type action from the power roll at varying points during the respective successive power strokes of the type bar so as to give uniform impression for that particular type bar.

The normal condition of the parts described is shown in FIGURES 3–5. In operation when the roll cam **33** becomes engaged with the power roll **37** the roll cam tail **41** will spring downwardly during the ensuing power stroke and will immediately engage and correspondingly displace the bail **66**. As the bail **66** thus follows the downward movement of the roll cam tail **41** the locking disc or roll **71** will partake of a rotary motion. As the sublever **30** is being driven in a clockwise direction the fly weight **43** will tend to move radially outward against the action of spring **45** due to the centrifugal forces set up. The arcuately moving fly weight **43** will thus ultimately engage and slightly pivotally displace the bail **46** which will cause the bail arm **55** and leaf spring **56** to move through a very short downward stroke. Immediately at the beginning of this stroke the locking cam **60** will be swung into operative engagement with the periphery of the now rotating locking disc **71** thereby arresting the rotary motion of disc **71** as well as the downward movement of bail **66** and the roll cam **33** as illustrated in FIGURE 6. This action causes the disengagement of the roll cam from the power roll and hence effects a power cut off to the type bar being driven. The following free flight movement of the parts is accommodated by the slight flexing of leaf spring **56** while the roll cam **33** is immediately restored to its normal position relative to the sublever **30** by the action of the spring **35** and the bail **66** is restored to its normal position by spring **70**. At typing impact the sublever **30** will stop moving momentarily and the fly weight **43** will tend to move upwardly under the action of its spring **45** thus freeing bail **46** for movement to its normal position by the action of spring **48**. Bail **46** is thus free to accommodate a subsequent typing operation which may or may not be chronologically overlapped with the previous typing operation. After typing a character on the record sheet the type bar together with the remaining parts of the action will be restored to their normal positions shown in FIGURE 3. During the successive typing operations the length of the power stroke will vary depending on the acceleration characteristics of the type bar motion. It will be noted from FIGURE 2 that when the power stroke is relatively long the maximum required speed is less than when the power stroke is relatively short.

It will be apparent from the above discussion that a power cut off to the actuated type bar will occur only when the dynamic conditions represented by a point on the curve **11**, FIGURE 2, have been attained. These conditions may occur relatively early or late in a power stroke and hence there is no fixed angular position of the type bar when cut off is affected during each successive operation of the bar; rather cut off occurs only when both the speed and position of the type bar has reached any one of many different predetermined combination of values. Under these conditions the successive typing impacts of said bar will always be substantially the same and hence it is immaterial to the print work whether the type bar acceleration was slow or fast, whether the power roll and roll cam engagement was early or late, whether there was slippage in the driving action, etc. Here the unpredictable effects of all the variables which go into the driving of the type bar will no longer affect the printing impact because the operational datum used for determining the substantially uniform successive impacts of a given type bar is based on the inherently uniform decelerating conditions acting on the type bar rather than on the relatively unpredictable accelerating conditions acting thereon.

As will be understood the various other type actions of the typewriter are constructed and will operate in a manner similar to that for the action just described, the various upper edges, corresponding to **53**, of the respective comb teeth **50** being respectively contoured and positioned so as to give the desired impact for the respectively associated type bars.

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. A method of controlling the printing impact of a given type bar; comprising the steps of determining at positions located at different distances from the typewriter printing point the various free flight speeds required of the type bar to give a desired printing impact against the action of the decelerating forces experienced by the type bar during said free flight, driving said type bar from a normal rest position towards said printing point, sensing the speeds of said type bar as it is being driven, and terminating the driving of said type bar when the dynamic conditions of speed and position of the driven bar match any one of the said determined free flight conditions of speed and position of the type bar whereby the predetermined and predictable free flight conditions of said type bar essentially determine the uniformity of intensity of the respective successive printing impacts rather than the relatively unpredictable conditions of the respective power driven strokes thereof.

2. In a printing machine having at least one movably

mounted printing element, drive means for actuating said printing element, means for effectively coupling said printing element to said drive means, and means for effectively uncoupling said printing element from said drive means; the improvement comprising means for sensing the speed of said printing element during the time that said printing element is effectively coupled to said drive means, and means responsive to the operation of said speed sensing means for causing operation of said means for effectively uncoupling said printing element from said drive means before a printing action occurs.

3. In a typewriter; a type bar adapted to be moved from a rest position to a printing position, a power drive means, means for effectively coupling said type bar to said power drive means, means for effectively uncoupling said type bar from said power drive means at a selected one of many different positions of said type bar during its printing stroke, and means operative during a given printing stroke of said type bar for determining a desired one of said positions and for causing operation of said uncoupling means when said type bar is at said determined position prior to the completion of said given printing stroke.

4. In a typewriter; a type bar adapted to be moved from a rest position to a printing position, a power drive means, means for effectively coupling said type bar to said drive means, means capable of effectively uncoupling said type bar from said power drive means at any one of several desired times during any given power stroke of the type bar, means for determining when said uncoupling means should be operated, and means responsive to the operation of said last mentioned means for operating said uncoupling means during the respective typing strokes.

5. In a typewriter; a type bar adapted to be moved from a rest position to a printing position, a power drive means, means for effectively coupling said type bar to said power drive means, means for effectively uncoupling said type bar from said power roll at any point during a power stroke of the type bar, and means for automatically operating said uncoupling means at various points during the respective successive power strokes of said type bar.

6. In a typewriter; a type bar adapted to be moved from a rest position to a printing position, a power drive means, means for effectively coupling said type bar to said power drive means, means for effectively uncoupling said type bar from said power drive means, and means conditionable in response to a power stroke of the type bar for controlling the operation of said uncoupling means so as to terminate said power stroke.

7. In a typewriter having at least one type bar, a drive means, means for effectively coupling said type bar to said drive means, and means for effectively uncoupling said type bar from said drive means; the improvement comprising means for sensing the arrival of said type bar at any one of a plurality of predetermined sets of dynamic conditions of both speed and position, and means operated by said sensing means for operating said means

for effectively uncoupling said type bar from said drive means.

8. In a typewriter having a type bar, a power drive means, and means for effectively coupling said type bar to said power drive means, the free flight speeds of said type bar required at positions located different distances from the typewriter printing point to give a predetermined printing impact against the action of the measured inherent type bar decelerating forces being measured and known; the improvement comprising means for effectively disengaging said type bar from said power drive means, means for sensing when the dynamic condition of the driven type bar matches any one of the said known speed-position conditions for free flight of said type bar, and means responsive to the operation of said sensing means for operating said means for effectively uncoupling said type bar from said power roll whereby said type bar printing impact will always be substantially uniform.

9. In a type action having at least one type bar, a drive means, and means for effectively coupling said type bar to said drive means; the improvement comprising means for effectively uncoupling said type bar from said drive means, a fly weight connected for movement in timed relation with said type bar and yieldably supported on the type action so as to be centrifugally sensitive to the speed of movement of said type bar, and means controlled by the movement of said fly weight for operating said means for effectively uncoupling said type bar from said drive means.

10. In a typeaction having a power roll, a type bar, means for effectively coupling said type bar to said power roll, and means decelerating said trpe bar during free flight of the latter, the free flight speeds of said type bar required at positions located different distances from the printing point to give a predetermined intensity of printing impact against the action of said decelerating means being known; the improvement comprising means for effectively uncoupling said type bar from said power roll, means for sensing the arrival of said type bar at a dynamic condition of speed and position which corresponds to one of the said known conditions required for giving the said desired type bar impact, and means responsive to the operation of said sensing means for operating said means for effectively uncoupling said type bar from said power roll.

11. Apparatus as defined by claim 10 wherein said sensing means includes a centrifugally sensitive fly weight yieldably connected for timed swinging movement with said type bar, and a bail tooth having an operative surface predetermined contour and position respect to the center of the swinging movement of said fly weight and adapted to be engaged at various spoints by said fly weight.

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