Dec. 29, 1959 R. HENATSCH 2,919,004

TYPEWRITERS

Filed March 12, 1958

FIG. 1

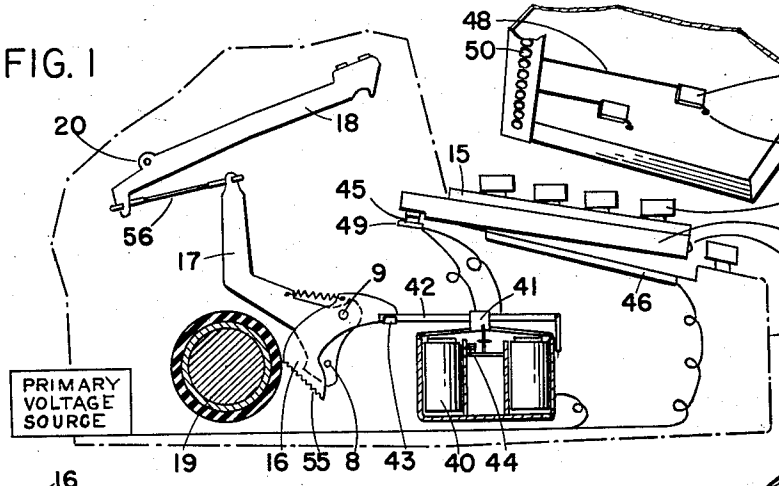


FIG. 2

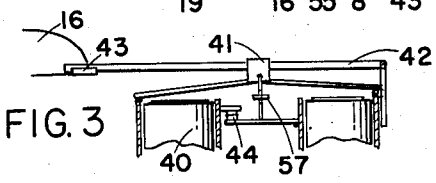


FIG. 3

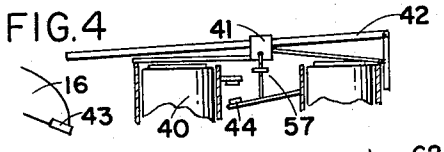


FIG. 4

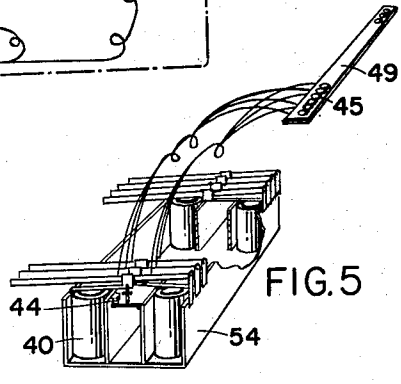


FIG. 5

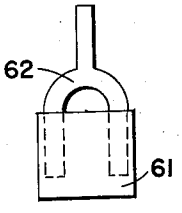


FIG. 11

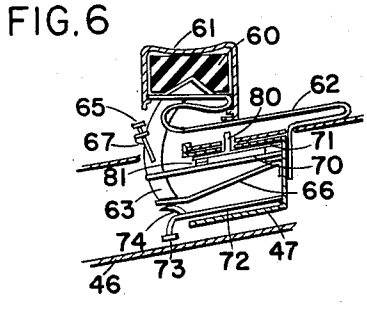


FIG. 6

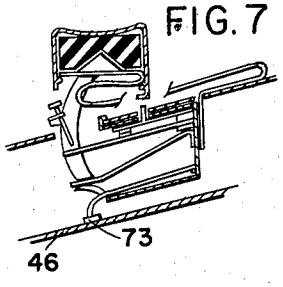


FIG. 7

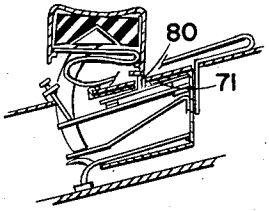


FIG. 9

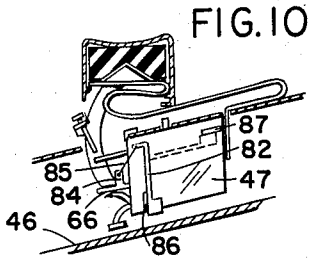


FIG. 10

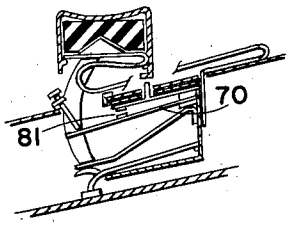


FIG. 8

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BY

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2,919,004

TYPEWRITERS

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Application March 12, 1958, Serial No. 720,853

10 Claims. (Cl. 197—19)

This invention relates to improvements in typewriters and especially in electric typewriters. It refers to electric typewriters as they are being manufactured by a number of leading manufacturers today, in which the key-action is actuated by a power-driven roller.

Although the electric typewriter is a great step toward advancement over the mechanical models, I believe that the manufacturers have not utilized all of the possibilities for advancement which presented themselves when the change-over to power operation was made. This is particularly evident in the keyboard, the one now generally in use being still practically the same as it was in the early forerunner of the present type of machines which was patented by Mr. C. L. Sholes in 1868. The keyboard deemed most suitable by him at that time was one which best met the mechanical requirements and helped him overcome difficulties which presented themselves. His mechanism required a manual pressure of approximately two pounds and a depression of the key-head of about one-half inch, in order to give the type-bar the striking blow necessary for the printing operation. In the modern electric typewriter a pressure of only about two ounces is required and the depression is only about one-eighth inch. Manufacturers have failed to utilize these two factors to improve the keyboard of the typewriter. This has been largely due to the steady trend toward standardization, but it is my contention that standardization of defects is deterring to progress rather than helpful.

Typewriters, with keyboards very much like the one Mr. Sholes invented, were in use for about ten or fifteen years before schools began teaching what is known as the "Touch System" of typewriting, in which all the fingers are used and certain keys are assigned exclusively to certain fingers. For fear of inconveniencing a few thousand operators at that time who had become accustomed to the original keyboard, manufacturers were reluctant to make any changes in the keyboard to fit the new Touch System of typewriting. As a result, millions of users since that time have been forced to use typewriters in which it is necessary to adjust the human anatomy to the mechanical requirements, rather than adjust the mechanism to fit the human anatomy. When the two hands are identical, except in reverse, it is illogical to force the left hand into a cramped position and use a different set of motions from that required of the right hand and since even the fingers of one hand are all of different lengths, it is illogical to retain the key arrangement in four horizontal rows, which seemed adequate to Mr. Sholes, who never dreamed of using more than the index finger of each hand and certainly not the entire hand. These two instances of short-comings in the mechanical typewriter which have been carried over into the electric typewriter are sufficient to point out the need for improvement and the usefulness of the disclosure which I am now making.

In my opinion the prime factor responsible for this condition is the retention of key-levers in the construction

of the machine. By these, I refer to the series of some forty-odd levers which are arranged horizontally in the front part of the typewriter to connect the key-heads themselves with the mechanisms that operate in connection with the power roller. These multiple key-levers, which of necessity have to be quite close together, impose a lateral restriction on the placement of the key-heads themselves. To avoid very complicated cross-mechanisms they also impose a certain correlation between the placement of the key-heads and the placement of the type-bars which do the printing. For instance, because Mr. Sholes had difficulty with the type-bars becoming stuck at the common point of convergence, especially when two letters which occur frequently in combination are placed side by side in the type-bar arrangement, he assigned such letters to the outer ends of the type-bar arrangement, which naturally assigned the keys for these letters to the outer and weakest fingers of the hands. Since speed in the Touch System is based on mastery of often-used combinations, rather than on pecking at single letters as is done when only the index fingers are used, such an arrangement throws too much of the work on the weakest fingers, with resulting loss of speed.

These defects which I have mentioned have been called to the attention of manufacturers many times, but the issue of making any improvement has been dodged under the guise of standardization. From time to time certain reforms have been advocated but none of them has met with marked success and at the present time the idea of ever securing any marked improvement in the keyboard of typewriters seems very remote.

One of the best known of the reforms I have mentioned is that of Patent 2,040,248, issued to August Dvorak and William L. Dealey on May 12, 1936. The patent covers a specific assignment of characters to the keys in a more scientific manner according to frequency of use, etc. However, in line 25 of this patent, it specifically states: "It is a further object to provide such an arrangement of the keys which will require no change in the typewriter mechanisms or in the relative spacing and position of all of the keys of the keyboard considered as a whole and which can be readily effected upon any standard typewriter now made by the simple interchanging of type and key-cards or labels." It can be pointed out that this reform which contemplates assigning the most frequently used letters to the stronger central fingers, also necessitates assigning of the type-bars for these letters to the center of the typewriter, where escapement becomes a problem and it does nothing to relieve the left hand of the cramped position made necessary by unfavorable placement of the keys.

The main object of my invention is to teach a method of construction in which the use of key-levers, which necessitate a certain front-to-back alignment and correlation between the key-heads and type-bars, can be eliminated.

Another object is to show how keys which are freed from the restrictions imposed by key-lever type of construction, can be disposed in more scientific arrangements on the keyboard so as to conform to the anatomical structure of the human hand.

Another object is to disclose how the necessary rebounding action of the key-heads can be made to be self-contained within the keyboard panel construction rather than relying on the key-lever type of construction which was designed for quite a different purpose.

Another object is to disclose a key-construction, together with necessary switching mechanisms, which can be confined entirely to the panels and yet perform other functions for which the key-lever type of construction has been relied upon, such as a repeating action when it is desired.

Another object of my disclosure is to show how my concept of having a rebounding action self-contained within the keyboard panel makes it possible to easily detach the panels for more convenient access to the working mechanisms. By allowing a certain amount of slack in the wiring, the contact plate beneath the panel can also be made removable and since the operating arms of the electro-magnets need not be attached to the linkage which operates in connection with the power roller, the entire bank of electro-magnets together with the row of contacts, can be easily removed through the keyboard opening for any necessary repairs or adjustment, provided a certain amount of slack is allowed in the wiring.

Another object, in addition to that of teaching how the individual keys can be placed in any desired arrangement on the panels, is to teach how the panels themselves can be placed in other locations when freed from direct relation with the typewriter which is required when key-levers are used.

Another object is to disclose a resilient type of key construction which can be self-contained within the keyboard panels and still provide adequate rebounding action necessary for good operation and a method of attaching the keys to the panels, to give greater comfort to the operators.

I recognize that the use of electro-magnets in typewriters is not new and have found their use in patents as early as 1896. In that year Patent 560,572 was issued to G. H. Davis for an electric typewriter. In this and other early attempts, however, the use of magnets was relied upon for producing the necessary striking action of the type-bars which in most modern machines is performed by the power-roller.

I also recognize that in late years electro-magnets have been shown to place the type-bar linkages in contact with the power-roller, but in these instances the use of key-levers has been retained. I seek to patent a combination in which the electro-magnets replace the key-levers and in which the electro-magnets are controlled by keys which can be equipped with action which is self-contained within the keyboard panel, whereby I achieve a new and useful result of making possible more scientifically arranged keyboards.

I have based my electro-magnet disclosure on an arrangement shown in Patent 765,640 issued to W. G. Spiegel on July 19, 1904. I have, however, incorporated the use of automatic switching devices responsive to the armature arms, which I believe would eliminate the use of certain mechanical structure for which the use of key-levers has been retained, to obtain a repeating action and by making my armature arm directly responsive to the stroke producing mechanisms of the type-bars, I eliminate the need for any separate knock-off device to get rid of any residual magnetism.

While a number of manufacturers today produce electric typewriters that are mechanically operable with a degree of efficiency which is making their use more and more common, none of them has done anything to remedy the basic faults in the design of the keyboards. I seek to combine certain well-known elements together in a new way to achieve results which are not obvious. My disclosure is more than merely an equivalent for the usual key-lever type of construction, since in addition to performing the same function, I achieve the novel and unobvious result of securing flexibility in the arrangement of the keyboard which would overcome harmful standardization and promote progress in typewriting.

In the drawings:

Figure 1 is a partial sideview, partly in cross-section, showing a typical type-bar linkage in association with a power roller, an installation of eelctro-magnets to replace the customary key-levers and a keyboard panel which is partly detached.

Figure 2 is a bottomside perspective view of a detached keyboard panel showing two typical individual key mechanisms wired to contact points along one edge.

Figure 3 is a partial cross-sectional view of the end of the electro-magnets, showing the switch closed.

Figure 4 is a similar view showing the switch open when the armature arm is down.

Figure 5 is a partial perspective view of the bank of electro-magnets wired to a detached strip containing a contact point for each of the magnets.

Figure 6 is a cross-sectional view through the center of a key installation, except that it also shows the main fork-shaped attaching-spring which does not appear at the center.

Figure 7 is practically the same view showing the position of the key when enough pressure has been applied to make contact with the plate beneath the keyboard panel.

Figure 8 is practically the same view when a slightly greater pressure on the key has opened the switch.

Figure 9 is practically the same view when an additional pressure on the side of the key away from the operator has again closed the switch to produce a repeating action.

Figure 10 shows the key in the same position as Figure 6 but with a free-flying regulator device attached to the outside of the housing to simulate the stroke of a type-bar.

Figure 11 is a plan view of the forked attaching-spring which supports the floating key-head in horizontal position.

By referring to Figures 1 and 2, it will be seen how I propose to replace the key-lever type of construction with electro-magnets which are controlled from a keyboard in which the action is self-contained and which therefore may be made detachable. Key-heads **14** are springably attached to separate panel **13** on which a second panel **15** is superimposed to conceal the operating mechanism for the sake of appearance. Panel **13** is recessed in a space provided for it in the typewriter frame **10** where it can be held in place by a friction catch device **7**.

By referring to Figure 2, two typical housings **47** for the key mechanisms will be seen protruding downward beneath the surface of the panel. Each key is connected by an electric wire **48** with its contact element **50**, a row of which are shown disposed along the edge of the panel. It will be seen that when the panel is attached to the machine each of the contact elements **50** will coincide with its corresponding contacting element **45** attached to a detachable strip **49** which is retained in proper position within the machine.

In Figure 5 it is shown how each of the contact elements **45** incorporated in strip **49** is flexibly wired to its corresponding electromagent **40**. One such magnet for each key or operation to be performed, is contained in a compact unit, the housing **54** for which is comprised of two channels with a space between them to contain the switching devices **44**. The construction of these switching devices, together with the magnets is shown more clearly in Figures 3 and 4. Each magnet **40** has an armature arm **41** which hooks over an operating lever **42** hinged to one side of the housing **54**. The free end of this operating lever rests in a hook **43** attached to a cam **16** which is part of the linkage which produces the striking action of the type-bar, which will be explained later.

Being springably hinged to the housing **54** the armature arm **41** is normally held away from the magnet **40** but when the magnet is energized by being placed in electric circuit when its key **14** is depressed, the armature arm **41** is drawn downward, pulling the operating lever **42** with it. It will be seen that when the armature arm descends, it opens up the switch **44** which de-energizes the magnet by cutting it out of the circuit. However, the downward progress of the armature arm was sufficient to lower the operating lever sufficiently to depress cam

16 enough to place it in contact with the constantly revolving power-roller 19 which takes over the action from there.

Cam 16 which revolves around pivot 9 in a clockwise direction, has a serrated face 55 which is brought into contact with the power-roller 19. When the roller is revolved in a counter-clockwise direction by a motor which is not shown, the serrated edge 55 of cam 16 is forced upward. Since pivot 9 is attached to sub-lever 17 which is part of the type-bar linkage, this sub-lever is forced to revolve in a clockwise direction around its pivot 8 which is a stationary rod extending across the typewriter frame. It will be seen that the clockwise motion of sub-lever 17 causes the type-bar 18 to revolve in a counter-clockwise direction about its pivot 20 by means of a flexible linkage 56 which permits free flight of the type-bar.

By referring to Figure 1 it will be seen that all that is necessary to start a succession of actions which will produce a striking blow of the type-bar, is to place one of the keys in contact with a contacting surface 46 shown directly beneath the panel when it is attached to the typewriter. Such a completed circuit energizes the electro-magnet corresponding to the key depressed, which lowers the operating lever of that magnet the small fraction of an inch necessary to place the corresponding cam in contact with the roller. It must be understood that to permit the striking blow necessary for printing, the free flight of the type-bar, mentioned above, is necessary. For this reason, as soon as the operating lever 42 starts the action, it disengages itself from the cam until the blow is completed, at which time the hook 43 on the cam again picks up the operating lever 42 as it returns to its normal resting position. Since the switch de-energized the magnet soon after the armature arm began to descend, the spring-action in the hinge of the armature arm would urge it back to its normal position. However, to overcome any residual magnetism that may remain, the action of the type-bar 18 in falling back to its resting position at the end of the blow, automatically acts as a knock-off device, should the armature arm be stuck. To produce the desired adjustment of the switch in relation to the armature arm, a small turnbuckle arrangement 57 is provided.

In Figures 6 to 9 is shown a key installation which can be self-contained within the keyboard panel which, as has been explained, can be made to be detachable. After explaining the details of the mechanism, the numerous advantages will be pointed out. Because the concept is quite different from the conventional key construction used in typewriters, reference will be made to each of the component parts. For example, instead of having a key-head attached to a key-lever, only the shell 61 of the key-head is attached to the panel 13 at an opening by means of a spring 62, from which the shell of the key-head can be easily detached. Fitting within the key-head shell is a resilient member 60, in this case a pad of elastic material having a cone-shaped recess centrally located in the bottom.

In a compact housing 47 below the panel and shown only in cross-section, is situated the switching mechanism which is responsive to the movement of the key-head and will be explained in detail. Near the bottom is a springable lever 72 with a contact element 73 projecting downward from its free end. This is used to make contact with the plate 46 situated directly beneath the panel. Extending slightly upward from the free end of lever 72 is a small spring 74. Next above this, springably fastened to the housing 47 is a hinged lever 66 which has its free end normally held in position just above spring 74. Held in suspension between lever 66 at the bottom and the cone-shaped recess in pad 60 at the top, is a transmission member 63 which extends through the opening in the panel 13 without making contact with it. The switching mechanism comprises a pair of contact elements 81 between two springable members 70 and 71. Extending upward from the upper member is a small projection 80 which passes through openings in both the housing 47 and the panel 13, so that its upper extremity is just beneath the shell of the key-head. Attached to the transmission member 63 is a small adjustable set-screw 65 which is easily accessible. Just beneath the head of the set-screw is a small projection 67 on the side of 63 which stops the progress of the transmission member 63.

To operate the key, manual pressure is applied on the key-head in the usual manner. As the transmission member 63 is forced downward, its lower extremity presses against the free end of lever 66 which, in turn presses on spring 74 to force lever 72 downward, carrying the contact element 73 with it to make the desired connection with plate 46, as shown in Figure 7. As soon as the contact has been made, any additional pressure would send the transmission member 63 further downward, pressing against spring 74 until set-screw 65 presses downward on spring member 70 forcing the contact elements 81 of the switch apart and breaking the circuit, as shown in Figure 8. This will prevent unwanted repetitions, as the pressure must be removed from the key-head in order to again close the circuit.

However, on certain keys where it is desirable to have a repeating feature, this can be achieved as shown in Figure 9. Because of the resilient construction of the key-head, an intentionally greater pressure on the side of the key-head away from the operator, will place the shell of the key-head into contact with the projection 80 forcing the upper springable member 71 downward to again close the contact, as shown in Figure 9. It will be seen that retaining the key in this position would keep an electro-magnet permanently energized and prevent a series of repetitions, but the switching device 44 incorporated in the magnets and made to be responsive to the motion of the armature arm would make and break the circuit to permit a series of repetitions.

One feature of electric typewriters which has been objected to by some operators is the "dead" feeling of the keyboard which results from the light pressure and the small distance of depression required. It is recognized that some attempts have been made to overcome this objectionable feature, but I believe it is mainly due to carrying over from the mechanical typewriters the key-lever type of construction which is no longer required or suitable. The key-lever type of construction, together with the free-flight action of the type-bar, was designed to produce the necessary striking blow to do the printing.

It will be noted that three different means for giving resilience to the key-action are shown, all of which are incorporated in each individual key-mechanism. To prevent pounding the contact element 73 against plate 46, spring 74 is designed to absorb some of the blow. As soon as the contact has been made, the stopping device 67 prevents further downward progress of the transmission member 63, causing spring 62 by which the key-head shell is attached to the panel, to absorb the rest of the blow. Besides serving as a means for pivoting the top of transmission member 63, the resilient pad in the shell of the key-head is capable of absorbing pressure and to make the key-heads adjust themselves to even a glancing blow such as may occur in rapid typing, the forked nature of spring 62 as shown in Figure 11, affords some "give" while still retaining the key in horizontal alignment.

All of these resilient features are capable of giving the key-action a more responsive feeling to the operator and reducing the drudgery of long continued pounding. Although it is recognized that electric typewriters require less of the pounding wrist-action and more finger-

action, still a natural rhythmical rebounding motion does much to reduce fatigue.

If full advantage were taken of the disclosure I am making to free the keyboard from the restrictions heretofore imposed by the key-lever type of construction, the keys for the left hand could be made to fall more naturally under the fingers, which would greatly facilitate typing without watching the keys and thus reduce nervous fatigue.

The feature shown in Figure 10 is optional. It consists of a small mechanism which simulates the free-flight action of the type-bar. A small lever **82**, which is weighted at the lower end, is pivoted near the upper end to form a long and a short arm. The weighted end normally holds the lever in downward position against a small stop **86**. The short arm is joined by a flexible connecting link **85** to a small projection **84** on lever **66**. Because of the flexible nature of the connecting link **85**, a small downward motion of lever **66** causes the weighted end of **82** to fly upward in a counter-clockwise direction until it strikes another small stop **87**, after which it falls backward to resume its normal position. As it falls back, it causes the flexible connecting link **85** to give a slight tug on lever **66** which urges the key-head upward to signal to the operator the end of the stroke.

The chief concern of this invention is to improve typewriter keyboards from the operator's standpoint and to disclose how certain changes could be made which would utilize to better advantage the human equipment which is necessary to operate machines of this type. I do not seek to show how certain mechanical features can be made to co-operate with greater precision, but to teach how a typewriter can be built so that it may be manipulated with a greater degree of accuracy and efficiency by the person who operates it. While I combine certain old elements which produce results which are to be expected, I achieve an unusual and unexpected result of liberating the keyboard from its present inefficient arrangement, so that keys may be arranged to utilize human energy to the best advantage.

Just as the speed of a runner would be impaired by a pair of shoes which cramped his feet and would not allow natural functioning of the muscles of the legs, so the speed and efficiency of a typist is impaired by a keyboard which necessitates a cramped position and interferes with the normal functioning of the muscles of the hands.

It is to be understood that while I refer to electromagnets and use them to illustrate my disclosure, any electrical means which produces the same result would be considered an equivalent, so that the term electrodynamics is more appropriate.

The drawings are intended to illustrate means of achieving the greater degree of co-operation between the operator and the machine, rather than a specific method of manufacture and the appended claims are intended to cover all modifications as fall within the true spirit and scope of this teaching.

What I claim is:

1. In an electric typewriter having type-bars and other functional instrumentalities linked with mechanisms which control them, in combination; a power-driven roller capable of activating the mechanisms; an electro-dynamic device for each mechanism, capable of placing it in contact with the roller; a keyboard comprising a panel having openings and keys springably attached to the panel adjacent to an opening, said keys being constructed and arranged to have rebounding and switching action which is self-contained within the panel, making various arrangements of keys on the panel possible without regard to location of the operations which they control; and means for flexibly establishing electrical connection between said switching action of each key and the electro-dynamic device controlling the operation on the typewriter which the key controls at the will of the operator.

2. The same as claim 1, the means for flexibly connecting the switching action of each key with its corresponding electro-dynamic device being in two separate sections, one of which is associated with the typewriter and the other with the keyboard panel, whereby complete detachment of the keyboard panel from the rest of the typewriter is made possible in a simple operation which simultaneously parts the two sections of each flexible connection, thereby facilitating adjustments and repairs.

3. In an electric typewriter having linkages connected with the type-bars and other functional instrumentalities which are activated by means of a power-roller and controlled by means of keys embodied in a keyboard, each linkage having associated with it an electro-dynamic device which places it in contact with the roller, the improvement for eliminating restrictions imposed on keyboard arrangements by the key-lever type of construction which is well-known in the art, said improvement comprising a keyboard panel having a complement of keys usually found on a typewriter, each key being equipped with rebounding and switching means which is self-contained within the panel, said switching means being constructed and arranged to prevent more than one performance of an operation in normal manipulation of the keyboard unless the pressure on the key controlling it is released.

4. The same as claim 3, some keys, where it is desirable, being equipped with additional switching means which permits repetition of an operation by applying greater force than normal in a manner different from that used in normal manipulation of the keyboard.

5. In an electric typewriter having type-bars connected with mechanical linkages which are activated by a power-roller, the improvement for eliminating restrictions imposed on keyboard arrangements by the key-lever type of construction well-known in the art, said improvement comprising, in combination; electro-dynamic means for placing said linkages in contact with the roller, and means for individually controlling each of the eletcro-dynamic means for a keyboard panel in which a full complement of keys is embodied, each key being equipped with a rebounding and switching mechanism which is self-contained within the panel, thereby permitting keys to be placed on the keyboard without regard to the arrangement of the type-bars.

6. In an electric typewriter having an assemblage of keys which constitute a keyboard such as is well-known in the art and in which said keys are associated with linkages controlling type-bars and other functional instrumentalities, in combination; a power-roller for activating the linkages when they are brought in contact with it; electro-dynamic means for placing the linkages in contact with the power-roller; a keyboard panel in which the assemblage of keys is mounted, each key being equipped with rebounding and switching action which is self-contained within the panel, thereby providing an action which is independent of the linkages; and means for electrically connecting each electro-dynamic means with a key which controls it at the will of the operator, whereby no continuous mechanical linkage is established between the key and the function it controls and placement of keys on the panel need have no definite fixed relationship with the mechanism on the typewriter which it controls.

7. The combination with an electric typewriter having no key-levers but having type-bars and other functional instrumentalities linked with mechanisms which activate and control them when placed in contact with a motor-driven roller, of electro-dynamic devices suitably positioned to produce the necessary activation to place said mechanism in contact with the roller; means for contacting the electric supply suitably disposed directly

beneath the customary position for a keyboard, a plurality of elements suitably disposed on the typewriter for ready accessibility, each of said contact elements being connected to one of said electric devices; a detachable keyboard panel in which a full complement of leverless key-heads is springably mounted for action; means for establishing electric contact between said panels and the panels and the contact elements on the typewriter and means for transmitting and controlling manually applied force from a key-head to the electro-dynamic device which activates the mechanism with which that key-head is associated.

8. The combination with an electric typewriter having linkage capable of placing type-bars and other functional instrumentalities in contact with a power-roller and electro-dynamic devices to place the linkages in contact with the roller; of a keyboard for completing and breaking the circuit used to energize the electro-dynamic devices, said keyboard comprising a panel having openings, a leverless key-head attached by spring construction to one side of the panel adjacent to one of the openings and means for closing and opening the circuit, said means being constructed and arranged so as to be responsive to the key-head, one pressure on the key-head establishing the contact desired to energize the magnet and further pressure on the key-head breaking the circuit in order to limit the duration of the contact.

9. The same as claim 8, each key being equipped with a free-flying stroke-regulating mechanism responsive to the key movement, said stroke regulating mechanism

being constructed and arranged to resemble the free-flight of a type-bar in order to more clearly define the duration of a stroke applied on the key-head.

10. In combination with an electric typewriter having linkages capable of placing type-bars and other functional instrumentalities in contact with a power-roller and electro-dynamic devices to place the linkages in contact with the roller; a keyboard for completing and breaking the circuit, said keyboard comprising, a panel having openings, a leverless key-head springably attached to one side of the panel adjacent to one of the openings, and means responsive to pressure on the key-head, for closing and opening the circuit, said means being constructed and arranged so that when one pressure is applied on the key-head the circuit closes, when a relatively greater pressure is applied on the key-head the circuit is open and when still greater pressure is applied on the key-head at the edge furthest from the operator, the circuit is again closed and capable of being kept closed as long as the greater pressure is maintained.

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