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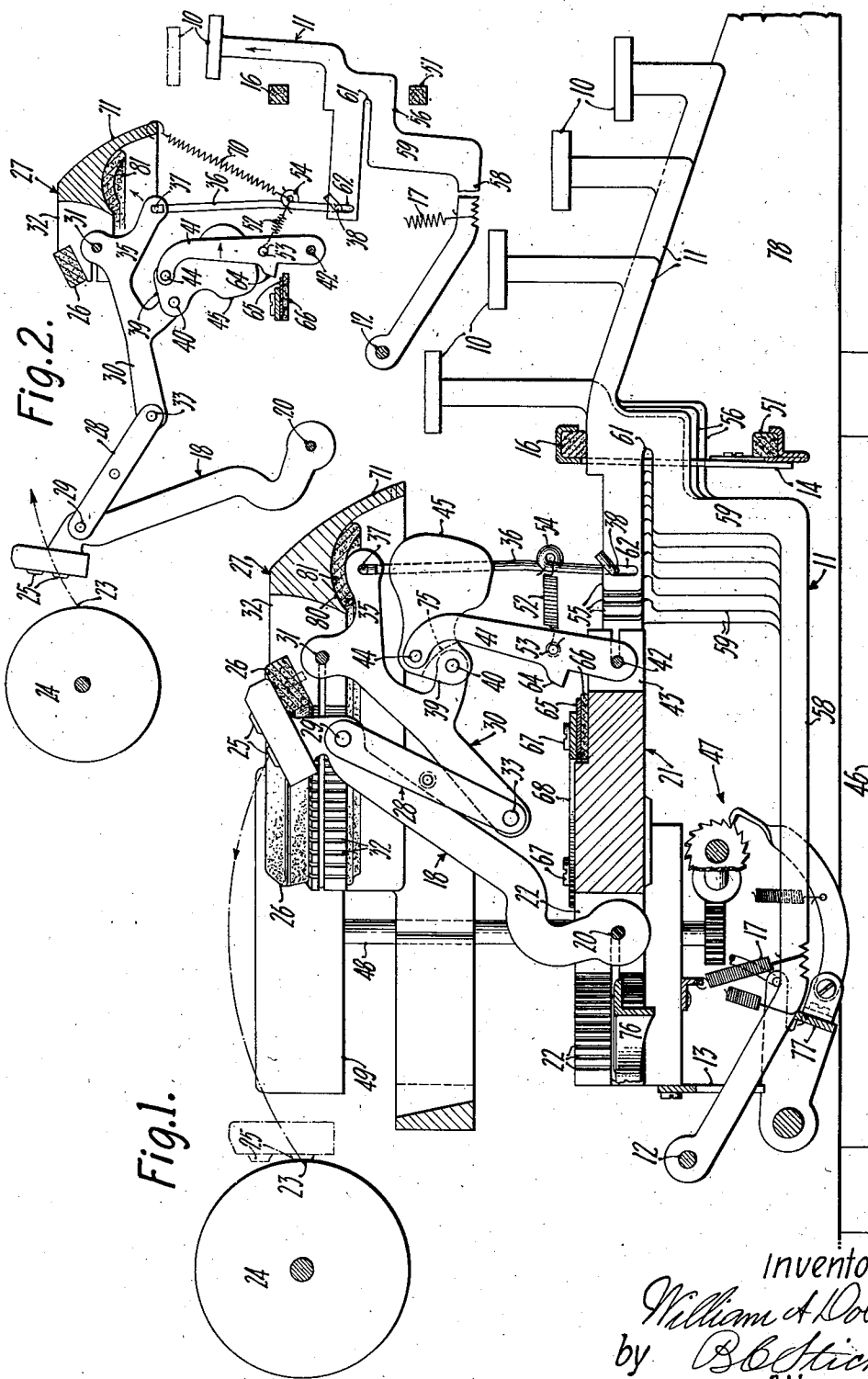
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2,131,135

TYPEWRITING MACHINE

Filed Dec. 14, 1934

3 Sheets-Sheet 1



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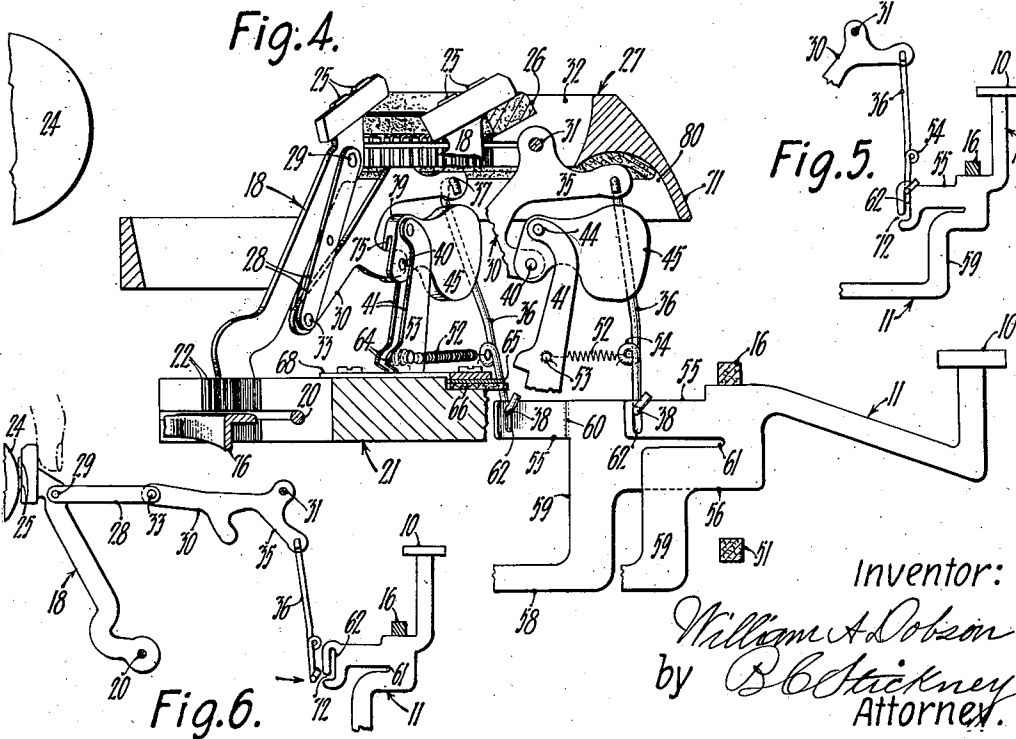
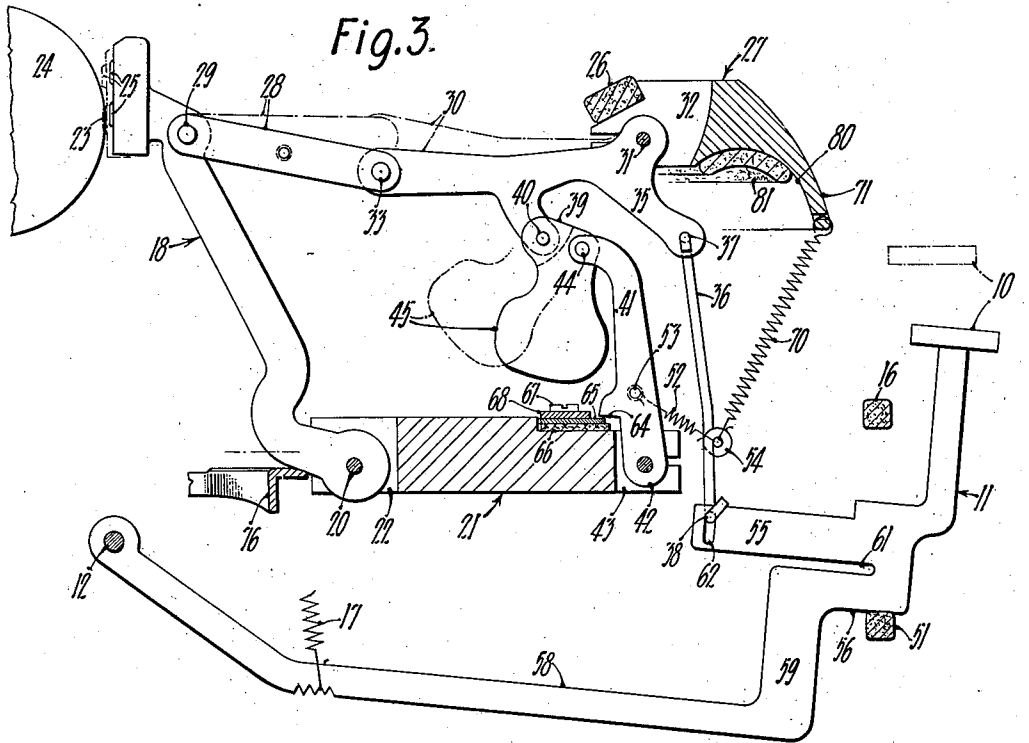
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2,131,135

TYPEWRITING MACHINE

Filed Dec. 14, 1934

3 Sheets-Sheet 2



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Sept. 27, 1938.

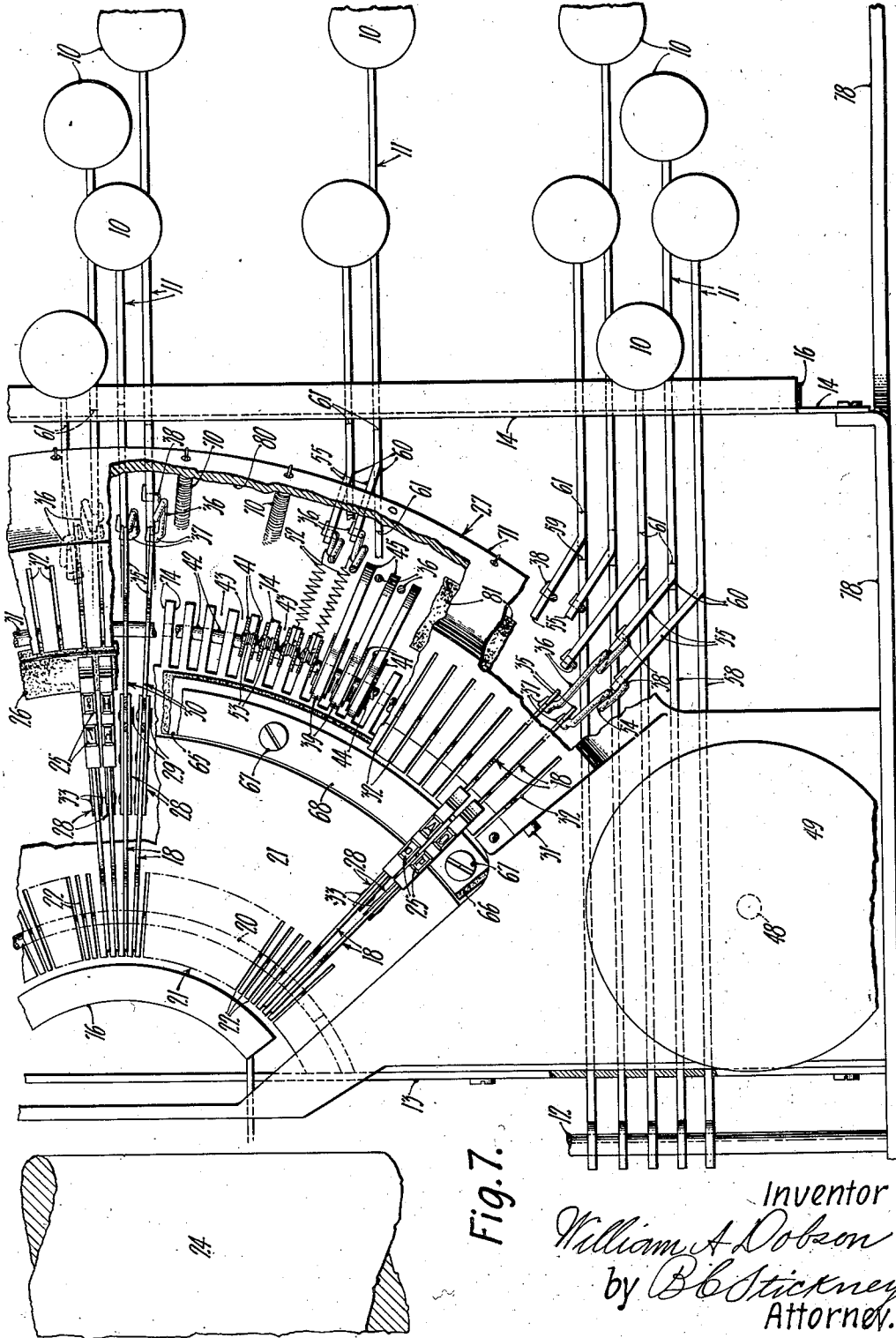
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TYPEWRITING MACHINE

Filed Dec. 14, 1934

3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,131,135

TYPEWRITING MACHINE

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Application December 14, 1934, Serial No. 757,515

15 Claims. (Cl. 197—25)

This invention relates to type-actions, and deals with the class of front-strike noiseless type-actions in which a type-key, a pressure-printing toggle, and a momentum-accumulating fly-weight co-operate to control the type-carrier.

An object of the invention is to produce such a type-action by a combination of a minimum number of parts, in order to simplify the type-action and its operation and to reduce the cost of manufacturing and servicing the typewriter.

Another object of the invention is to have such simplification of the type-action also conduce to greater ease of key-touch and to clear and quietly-effected printing and manifolding.

A further advantage of the contemplated novel type-action is that it may be compacted, and it is therefore particularly useful for typewriters of the portable class.

To these and other ends, there is employed, in the improved type-action, a type-carrier that is preferably a bar which carries the type at one end, and is fulcrumed at its other end for swinging movements.

Excepting the type-key-levers, which may extend parallelly fore and aft the machine, the several type-actions of the printing system radiate forwardly and laterally from the printing point; the type-bars being normally partly erect in an arcuate array confronting the platen, since in said array they are inclined, about the fulcrum-axis, upwardly and away from the printing point.

Each type-bar has connected thereto at a point near the type-head one of a pair of toggle-links, the other toggle-link reacting against a fixed fulcrum that is substantially in front of the type-head.

When the pressure-printing toggle formed by said links is extended, its direction of thrust is substantially toward the printing point to press the type-head against the platen; and in the normal, that is, idle, forwardly tilted position of the type-bar, said toggle-links are in suppressed folded position between the type-bar and said fixed toggle-fulcrum.

A secondary toggle, which includes a fly-weight, has one of its links pivotally connected to a point between the ends of the forward link of the primary or pressure-printing toggle, and has its other link upstanding from a fixed fulcrum below the fixed fulcrum of the primary toggle. One of the secondary toggle-links may have an enlargement that serves as the momentum-accumulating fly-weight.

The forward link of the primary toggle is thus a lever upon which the secondary toggle acts, under the impulse of the fly-weight momentum, to straighten the primary toggle for pressing the type against the platen.

According to the invention, said forward link

of the primary toggle is also utilized as a lever primarily acted upon by the type-key-lever through a simple link. For this purpose, said forward link of the primary toggle has, extending forwardly from the fixed fulcrum, an operating arm to which the upper end of said simple link is connected; the lower end of the link being connected to the key-lever which extends fore and aft of the machine, and is below the assembling point and comprises the type-bar and the primary and secondary toggles.

Since the primary toggle is provided with the aforesaid operating arm that is directly linked to the type-key-lever, the secondary toggle has nothing to do with starting the unfolding of the type-bar and primary toggle-links. Said secondary toggle therefore may be, in its normal position, in the most compactly folded relation to the primary toggle and its fixed fulcrum.

Moreover, the operating arm of the primary toggle, directly connected to the type-key-lever, is arranged so that it has a maximum leverage moment at the beginning of the printing stroke, because the leverage moment may decrease throughout the printing stroke, as the type-action, mainly under the impulse of the fly-weight device, gains in momentum during said stroke.

The maximum and decreasing leverage moment gained by such arrangement of the primary toggle-operating arm conduces greatly to ease of key-touch; while the provision of said primary toggle-operating arm and its simple link-connection to the key-lever also results in minimizing the number of parts in the type-action, and makes the compacting of the type-action feasible.

It further results from the provision of the primary toggle-operating arm and its simple link-connection to the key-lever that the only portion of the type-action that is below the lower or fulcrum ends of the type-bar and of the aforesaid upstanding link of the fly-weight toggle, is the key-lever. It is feasible, therefore, to dispose said fulcrum ends low enough so that, correspondingly, the array of type-heads, and certain contiguous parts of the framework are disposed at a minimized elevation. This feature is an important desideratum in portable typewriters, and it also conduces to visibility of the printing line.

Since the type-bars and toggles radiate from the printing point, the forwardly-extending primary toggle-operating arms will diverge to points that are sufficiently close to the planes of their respective key-levers to make connection of the latter to said operating arms by means of the aforesaid simple links feasible. For this purpose, the key-levers themselves may be provided with portions or branches to which the links are connected and which are bent inwardly, from the

main fore-and-aft-extending portions, to effect alignments of the links substantially within the planes of the primary toggle-operating arms.

The main fore-and-aft-extending portion of a key-lever may pass below the inwardly-bent portion of an adjacent key-lever so as to avoid interference.

The key-levers may have their printing-strokes arrested, just before the instant of printing, by a noiseless stop; the action of the secondary toggle and fly-weight being permitted to continue by momentum to complete the straightening action upon the primary toggle to press the type forcibly, but quietly, against the work upon the platen. Simple provision may be made for idle play in the link-connection between the aforesaid primary toggle-operating arm and the type-key-lever to permit the continuing action of the type-bar and toggles after the printing-stroke of the key-lever has been thus arrested. Other sound-deadening stops may be provided for limiting the action of the toggles in the printing and return strokes.

Other features and advantages will hereinafter appear.

In the accompanying drawings,

Figure 1 is a side view showing mainly the middle one of the novel type-actions in normal, idle position, some of the related parts being shown in section.

Figure 2 is a side-view diagram illustrating the positions of the parts of the novel type-action at the initial portion of the return stroke which follows the printing.

Figure 3 is a diagram illustrating in full lines the positions of the parts of the type-action at the instant when the printing-stroke of the key-lever has been arrested, whereupon, as indicated by the dotted lines, a fly-weight becomes effective to straighten the primary toggle to press the type against the platen.

Figure 4 is a side view showing mainly one of the novel type-actions that is at the side of the printing-system, the middle type-action being fragmentarily shown.

Figure 5 is a side-view diagram illustrating a key-lever detail which provides for detachable connection to the key-lever of the link extending from the primary toggle-operating arm.

Figure 6 is a side-view diagram illustrating the manner of manipulating the parts to effect connection or disconnection of the link and key-lever of Figure 5.

Figure 7 is a top-plan view showing only the left half of the type-action system, the right half being substantially the same. Parts are omitted or are shown broken away for clearness.

Type-keys 10 are mounted upon key-levers 11 which extend rearwardly to a fulcrum 12, and are transversely spaced by rear and front guide-combs 13 and 14. The normal positions of the key-levers are determined by a transverse sound-deadening stop 16 upon the front comb-plate 14. Each key-lever has a spring 17 for yieldably upholding it against said stop 16.

The key-levers 11 are operatively related to type-carriers 18 by means of an organization which is simple and compact, and which, nevertheless, comprises fully sufficient means for clearly and quietly printing and manifolding by momentum-controlled pressure and an easy key-touch. To these and other ends, the novel type-action organization is arranged as follows:

The several type-carriers 18 are bars pivoted at one end upon a common fulcrum-wire 20 of

a segment 21 having type-bar-retaining slots 22 that are in radial relation to printing-point 23 traversed by a platen 24 against which types 25 at the upper ends of said type-bars 18 print. The type-bars 18 thus work in planes radiating forwardly and laterally from the printing-point. In their normal, idle positions, as at Figure 1, the type-bars are semi-erect in that they are inclined upwardly and away from the printing-point, and are disposed in an arcuate array confronting the platen and in which array the type-ends of the type-bars rest against an arcuate pad 26 mounted upon an upper segment 27.

A primary pressure-printing toggle comprises a member or link 28 pivoted to the type-bar 18 at a point 29 near the type-head. A second member or link 30 of the primary toggle works about a fixed fulcrum-wire 31 in the upper segment 27 which has radial slots 32 for retaining the forward links 30 of the primary toggle in radial disposition corresponding to the radial disposition of the type-bars 18. The primary toggle-links 28, 30 are pivotally joined at 33. In the idle, Figure 1 position of the type-bars 18, their toggles 28, 30 are in suppressed folded condition between the type-bars 18 and the primary toggle-fulcrum 31.

For unfolding and straightening the primary toggle 28, 30, to bring the type-bar 18 from its idle position to the platen, the forward link 30 of said toggle is primarily acted upon by the key-lever 11, and finally by a secondary toggle which will presently be described and which includes a fly-weight device whose accumulated momentum acts to straighten said primary toggle to quietly press the type-bar and hence the type against the platen.

Simple and compact arrangement of the type-action is effected by having the forward link 30 of the primary toggle first acted upon as a lever by the type-key-lever 11, and then acted upon as a lever by the secondary fly-weight toggle, said arrangement being carried out as follows:

An operating arm 35 is provided upon the forward link 30 of the primary toggle and extends, when the parts are in the idle, Figure 1 position, forwardly from the fixed primary toggle-fulcrum 31. A pull-link 36 pivoted to said operating arm at 37 connects the latter to the key-lever 11, the lower end of the link and the key-lever being articulated at 38.

The aforementioned secondary fly-weight toggle, included in each type-action, comprises a member or link 39 pivoted to the forward link 30 of the primary toggle at a point 40 between the ends of said link 30, as indicated in Figure 1. A second member or link 41 of the secondary fly-weight toggle is upstanding from a fixed fulcrum-wire 42 presented by the segment 21 which has radial slots 43 in which the several upstanding links 41 are retained in radial disposition.

The secondary toggle-links 39, 41 are pivotally connected at 44, and the link 39 has an enlargement forming a fly-weight 45. Said fly-weight is disposed so that in the unfolding of the secondary toggle, started and maintained during the first part of the printing-stroke by the key-lever-effected unfolding of the primary toggle, the momentum of said fly-weight comes into play, before the end of the printing-stroke, to effect forcible straightening of the primary toggle, independently of the key-lever 11.

Since the fly-weight toggle 39, 41 has nothing to do with initiating the unfolding of the primary toggle 28, 30 from the Figure 1 position,

but, at first, follows the unfolding of the primary toggle, the secondary toggle may be, when the parts are in idle position, completely folded and therefore compacted, inasmuch as the point 40 may be between and substantially in line with the points 42, 44, as shown in Figure 1.

Further advantage results from the provision of the operating arm 35 for the primary toggle, and its simple link-connection to the key-lever 11, by pointing said arm 35, as indicated in Figures 1 and 4, so as to conduce to ease of key-touch. Comparing Figures 1 and 3, it will be seen that said operating arm 35 is pointed so that its leverage moment decreases from a maximum, when the parts are in the idle or Figure 1 position, to a least leverage moment, which obtains when the printing-stroke of the key-lever 11 has been arrested, as in Figure 3, by a transverse sound-deadening stop 51 mounted on the comb-plate 14. Said maximum leverage moment of the operating arm 35 at the beginning of the key-stroke conduces to the desired easy key-touch, it being understood that the decrease of leverage moment of the operating arm 35 during the printing-stroke is compensated for by the concurrent gain in momentum of the type-action parts.

The direct connection of the key-lever 11 to the primary toggle 28, 30, afforded by the operating arms 35 of the primary toggle and the link 36, not only makes the described compact folding of the secondary toggle feasible, but conduces otherwise to the compactness of the type-action. Thus it will be noted that the key-levers 11 are the only type-action parts below the segment 21, and that all the remainder of the type-action system is compacted between said lower segment 21 and the upper segment 27. The space between said lower segment 21 and a line 46, representing the machine-base or a table, may, therefore, be freely utilized for disposing mechanism, such as ribbon-spool-driving mechanism, indicated at 47, Figure 1, in which 48 and 49 represent respectively a vertical ribbon-spool shaft and a ribbon-spool. Furthermore, since there is nothing of the novel type-action system but the key-levers 11 below the lower segment 21, it becomes feasible to have the latter low with reference to the platen-axis and, correspondingly, to have the upper segment 27 and overlying array of type-heads 25 low enough to afford good visibility of the printing-line as indicated in Figure 1.

A spring 52 for each type-action may have one end connected at 53 to the upstanding link 41 of the fly-weight toggle, and may have its other end connected to a loop 54 of the pull-link 36, said spring acting to aid in breaking the straightened primary and fly-weight toggles after the latter have acted to press the types against the platen. Said spring 52 also serves to prevent rattling of the link 36.

Since the operating arms 35 of the primary toggles radiate forwardly and laterally from the printing-point, it will be seen that they diverge toward the planes of their associated key-levers 11 for connection of the latter by means of the links 36. To further the feasibility of such connection, the key-levers may have branches 55 presenting the points 38 to which said links 36 are articulated, said branches being bent, arranged and graded, as best seen in Figure 7, to offset said points 38 inwardly from the bodies of the key-levers, and thereby bring said points, which are appropriately located fore and aft of

the key-levers, toward the planes of the operating arms 35 to align the links 36 substantially within said planes. All except the few middle ones of the key-levers may have the described inward bending of the branches 55.

The depth of key-stroke at the several key-banks is made substantially uniform by grading the distances of stop-edges 56, Figure 1, of the key-levers from the key-lever-arresting stop 51. Thus, the key-levers of the foremost bank have their stop-edges 56 closer to the stop 51 than the next higher bank of keys, the stop-edges 56 for the key-levers of the rearmost bank being farthest from the stop 51. It follows that the angular displacement of the key-levers will not be the same for the several key-banks, the key-levers for the rearmost bank having the greatest angular displacement, and the foremost bank of key-levers having the least angular displacement.

Nevertheless, substantially uniform actuation of the type-bars and toggles throughout the system is produced, by grading the locations of the points 38 at which the links 36 are connected to the key-levers. It can be seen that the location of the point 38 along a branch 55—it being noted that the planes of branches 55 conform substantially to the planes of the operating arms 35—determines the angular displacement of the operating arm 35 resulting from a given angular displacement of the key-lever 11. The location of said point 38 determines not only its dip, but also determines the angle at which the link 36 pulls with reference to a line joining the points 31, 37, of the operating arm 35; it being evident, for example, that the more forward of the point 37 the point 38 is along the branch 55, the closer will be the line of pull of the link 36 to said fulcrum 31 about which the toggle-member 30, which includes the operating arm 35, turns. Thus, the location of the point 38 along the branch 55 involves two factors that are determinative of the throw of the toggle-member 30, namely, the resultant dip of the point 38 and the resultant aforementioned angle at which the link 36 pulls upon the operating arm 35.

The branch 55 of a key-lever 11 may cross the plane of one or more adjoining key-levers as indicated in Figure 7, and, to make this feasible, each key-lever may extend to the key-lever fulcrum 12 by means of a reach 58 which is dropped below the zone of the branches 55 by a pendent portion 59 of the key-lever. As shown in Figure 7, the branches 55 may be bent from points 60 of the key-levers, so that the array of all the branches 55 approximates conformation to the arcuate and radial array in which the operating arms 35 are disposed by the upper segment 27.

Figure 4 illustrates the extremes of location of the key-lever pendent portions 59 as between the key-lever for the type-action at the side of the system and the key-lever for the middle type-action. To provide for vertical adjustment of the points 38, by bending the branches 55 up or down, said branches may be relieved from the bodies of the key-levers by undercuts 61 which are of maximum forward depth at the middle of the system, and which may diminish in depth toward the sides of the system, as indicated in Figures 1 and 4.

The portion of the key-lever working in the front guide-comb 14 may be wide enough, as indicated in Figure 1, to afford a spread of bear-

ing in said comb-gulde, sufficient to counteract the eccentric reaction of the offset point 38.

The printing stroke of the key-lever is arrested by the stop 51 just before the type reaches the printing point, the parts of the type-action being then in the positions shown by the full lines in Figure 3. Thereupon the accumulated momentum of the fly-weight 45 acts through the secondary toggle 39, 41, to complete the straightening of the primary toggle 28, 30, to press the type quietly against the platen, the position of the types, the primary toggle and the fly-weight at the instant of printing being indicated by the dotted outlines in Figure 3.

In order that the type-bar 18 and toggles may thus complete their action independently of the key-lever 11, the latter has a loose connection, at the point 38, to the lower end of the link 36. The key-lever may accordingly be provided with an up-and-down extending slot 62, whose upper end forms a shoulder around and under which the lower stirrup of said link 36 may be hooked, as indicated. Thus, after the key-lever has been arrested, as in Figure 3, the lower end of the link 36 may move down idly from the upper shoulder of the slot 62 as the type-bar and toggles continue their described action under the impulse of the momentum of fly-weight 45.

To prevent overthrow of the toggles, the upstanding link 41 of each secondary toggle may have a shoulder 64 which, at the instant of printing, engages a stop-plate 65 to arrest the secondary toggle, and, through the latter, arrest the primary toggle 28, 30 in its straightened position indicated by the dotted outline, Figure 3. Said stop-plate 65 may rest upon a sound-deadening cushion 66, and may furthermore be of thin resilient material to conduce to the sound-deadening.

The stop-plate 65 and underlying cushion 66 may be supported by the lower segment 21, and be secured to the latter by means of screws 67 and a clamp-plate 68 arranged to leave the forward stopping rim of the stop-plate 65 exposed as indicated in Figures 1, 3 and 7.

The upstanding link 41 of the secondary toggle will tend to rebound after its contact with the stop-plate 65, and will thus tend to break the secondary toggle, and through the latter break the primary toggle, immediately after the types have printed. The breaking of the toggles is aided by the above-described spring 52, and the effect of the latter may be reinforced by a spring 70, hooked into the loop 54 of the link 36, the other end being hooked into a skirt 71 of the upper segment 27. Use of the reinforcing springs 70 may be limited to the type-actions associated with the rearmost bank of key-levers, since these type-actions have the shortest springs 52.

To facilitate connection and disconnection of the link 36 and key-lever 11, the latter may be arranged so that the link-articulating slot 62 is open at the bottom as at 72, Figures 5 and 6. The bottom stirrup of the link 36 may be entered into or withdrawn from the slot 62 by way of the opening at 72 when the key-lever 11 is in its normal position, while the rest of the type-action is manually held with the type at the platen as shown in Figure 6.

The upstanding link 41 of each secondary toggle may be doubled as shown at Figures 4 and 7, so that, for pivotal connection to the fly-weight link 39, 45, it straddles the opposite sides of the latter. The fulcrum-end of each double link may straddle the opposite sides of a fin 74 formed by

the slots 43 of the segment 21. A spacer at 53 where the spring 52 is connected is between the doubled parts of said link 41. The rear link 28 of the primary toggle may also be doubled, so that, for connection to the type-bar 18 and the forward toggle-link 30, it straddles opposite sides of these parts, as indicated in Figure 7.

To an under side 80 of the upper segment 27, there is attached a sound-deadening cushion 81 which serves to quietly arrest the return stroke, principally of the primary toggle 28, 30, by opposing the operating arm 35 of the latter, as shown in Figure 1.

76 represents an escapement universal bar, and 77 represents a universal bar for the ribbon-mechanism 47. As indicated in Figure 7, the segments 21, 27, the key-lever fulcrum-rod 12, and the front guide-comb 14 may be supported by and between side members 78, only one of which is shown, of the machine-framework. The rear guide-comb may depend from the lower segment 21.

It will be seen that besides being constituted of a minimum number of parts and a compact arrangement thereof, the novel type-action is also arranged so that the primary and fly-weight toggles can operate at maximum efficiency for quiet and clear printing and manifolding. After the key-lever stroke has been easily started, by reason of the provision of the operating arm 35 on the primary toggle and its link-connection to the key-lever, and, when the fly-weight momentum has taken over the bringing of the type-bar 18 to the platen, there is nothing, because of said provision, to impede free action of the type-bar and the toggles under the impulse of said momentum, since these are practically the only parts that work independently of the key-lever 11, the simple link-connection 36 obviously causing no restraint upon said free action.

It will further be seen that the key-driven power-lever 30, 35 co-operates with the toggle-link 28 to smoothly accelerate and then decelerate the type-bar 18 relatively to said power-lever, and that while the type-bar is being decelerated during the printing stroke the fly-weight 45 substantially continues to be speeded by said power-lever. Thus, referring to Figure 3, it will be seen that the primary toggle 28, 30 will have served to gradually decelerate the type-bar so that the final movement of the latter from its indicated full-line position just before printing is non-percussive; and that during said final movement of the type-bar the fly-weight 45 is working at maximum efficiency, since during the deceleration of the type-bar relatively to said power-lever 30, 35, the latter substantially continues to speed said fly-weight; and that these conditions conduce to easy key-touch and clear quiet printing and good manifolding.

Variations may be resorted to within the scope of the invention, and portions of the improvements may be used without others.

Having thus described my invention, I claim:

1. In a front-strike type-action system co-operative with a platen, a set of type-carriers working in planes radiating from the printing-point, a set of type-key-levers individually ranging substantially fore and aft of the machine and disposed below the type-carriers, and a system of operating connections between said type-carriers and levers, said system of connections including operating levers disposed above the key-levers and working in planes radiating forwardly and laterally from a given point, and links, one for

each type-action, connecting said radial operating levers to corresponding type-key-levers, said radial operating levers presenting an array of operating arms diverging toward the planes of the corresponding type-key-levers, the latter having branches to which the links are connected, said branches being of different extents and being bent at different angles inwardly from the fore-and-aft-extending body-portions of said type-key-levers, to converge toward the planes of said operating arms, to provide for connecting said operating arms to said type-key-levers by said links.

2. In a typewriting machine, a set of type-key-levers extending rearwardly from a banked keyboard to a common fulcrum-axis, stop-means to limit the key-lever movements to make the key-strokes of uniform depths throughout the several banks of the keyboard, a set of type-carriers, a toggle connected to each type-carrier and having an operating arm by means of which it is actuated to actuate the type-carrier, said type-carriers and toggles working in planes radiating forwardly and laterally from a common printing-point, and a system of links, one for each key-lever, connecting the latter to an operating arm provided on the toggle of the corresponding type-carrier, said key-levers having branches presenting points to which said links are connected, said branches offsetting said points laterally from the body-portions of said key-levers to bring the links substantially within the planes of the radial toggle-operating arms, said type-carriers and toggles being substantially uniform throughout the system, while the key-levers of the several banks of the keyboard have different angular displacements by reason of their common fulcrum-axis, and uniform depths of key-strokes, the location of the points of connection of said links to the key-levers being further graded by means of said branches, so that the different angular displacements of the key-levers produce uniform actuation of said toggles throughout the system.

3. In a typewriting machine having a platen, the combination with a system of type-carriers and members associated therewith, said members having operating arms by means of which they may be actuated to actuate the type-carriers, of a set of type-key-levers disposed below the system of type-carriers and associated members, said key-levers extending substantially fore and aft of the machine, said type-carrier-actuating members being radially disposed with reference to the printing-point so that their operating arms diverge forwardly and laterally, to tend toward the planes of the corresponding key-levers, and links pendent from said operating arms and connecting the latter to appropriate points on the corresponding key-levers, the latter having branches of graded extents and laterally graded inclinations so as to present said points in graded, laterally offset relations to the fore-and-aft-extending body-portions of the key-levers and at different locations lengthwise of the latter, thereby to enable said links to work substantially within the planes of said operating arms.

4. The invention as set forth in claim 3, said branches being differentially located along, and bent laterally from, the fore-and-aft-extending key-levers to form an array conforming substantially with the radial array of said type-carrier-actuating members, the fore-and-aft-extending body-portions of the key-levers being

offset downwardly, under said branches, some of said branches crossing the body-portion of one or more adjacent key-levers, but clearing the latter, at the key-strokes, by reason of said downwardly offset body-portions.

5. In a typewriting machine, a type-action for printing quietly by means of pressure and a pressure-controlling momentum-accumulator, said type-action being constituted of a minimum number of parts by the combination of a type-carrier having type at one end and fulcrumed at the other end, a primary toggle connected to the type-carrier and reacting against a fixed toggle-fulcrum, the toggle-member which engages said toggle-fulcrum having an operating arm by means of which said toggle may be actuated to actuate the type-carrier, and thereby cause the latter to print by the pressure exerted thereon by actuation of said toggle, a type-key-lever, a link directly connecting said type-key-lever to said operating arm of said toggle, and a secondary toggle, including a momentum-accumulating fly-weight, connected to the primary pressure-printing toggle and reacting against another toggle-fulcrum, said type-action furthermore having an easy key-touch in that said operating arm is pointed so that the leverage moment thereof decreases from a maximum which obtains at the beginning of the key-lever stroke to a certain least leverage moment which obtains at the end of the key-lever stroke.

6. In a typewriting machine, a noiseless, pressure-printing type-action system constituted of a minimum number of parts by the combination of a set of type-carriers, a set of primary toggles, each connected to a corresponding type-carrier and reacting against a fixed toggle-fulcrum, the primary-toggle member which engages said toggle-fulcrum having two operating arms, by which the primary toggle may be actuated, a secondary toggle, including a momentum-accumulating fly-weight, connected to one of said two operating arms of the primary toggle and reacting against another toggle-fulcrum, said type-carriers and their primary and secondary toggles working in planes radiating forwardly and laterally from the printing-point, a system of type-key-levers disposed below the type-carriers and primary and secondary toggles, each type-key-lever having a branch, the several branches being differentially bent laterally from the key-levers at points differentially located therealong, so that said branches form an array conforming substantially with the radial array of the primary toggles, and a system of links whereby the other one of said two operating arms of each primary toggle is linked directly to the branch of a corresponding key-lever.

7. In a front-print writing machine having a platen, a system of upstanding swinging type-bars having types at their upper ends and pivoted at their lower ends, a system of key-levers below the type-bars, power-links extending upwardly from the key-levers, type-bar power-levers radially arranged and articulated to the upper ends of said links, radial toggle-links connecting said power-levers to said type-bars to enable the key-levers to swing the type-bars to the platen, stops for the key-levers, and weighted supplemental toggles anchored to the framework and pivoted to said power-levers to be speeded thereby, to continue in motion after the arrest of their key-levers, to cause the supplemental toggles to effect supplemental type-pressure, each of the link-connections between the key-levers and the radial

power-levers being sufficiently loose to permit supplemental type-pressure to be produced by the supplemental toggle after the arrest of the key-lever by its stop.

8. Machine constructed according to claim 7, in which each power-link extends substantially towards the fulcrum of the power-lever at the arrest of the key-lever by its stop, permitting free supplemental movement of the power-lever and type-bar by the supplemental toggle.

9. In the described portable typewriting machine having a platen, the combination of a system of upstanding type-bars in converging planes in front of the platen and mounted to swing in said planes to present types to the platen, a system of key-levers below the type-bars, power-links driven by said key-levers and extending upwardly in front of the swinging type-bars, power-levers mounted to vibrate in converging planes, the power-links at their upper ends being attached to said power-levers to enable the key-levers to actuate the latter, a set of radiating toggle-links enabling the key-levers through said power-levers to swing said type-bars to the platen, stops for arresting the key-levers, and weighted means anchored to the framework and pivoted to said radiating power-levers to be speeded thereby, for enabling supplemental pressure to be imparted to the type-bars after the arrest of their key-levers by said stops.

10. In a portable front-writing machine, having a platen, a system of type-presenting and supplemental printing-pressure key-trains, each printing train being compounded of only six elements, viz., a key-lever, a key-powered link rising therefrom, a radial power-lever powered by said key-link, a swinging upstanding type-bar, a toggle-link connecting the type-bar to the said power-lever, and a supplemental weighted pressure device anchored at one end and connected at the other end to said power-lever to be speeded thereby, said type-bars, power-levers, toggle-links and supplemental pressure devices working in converging planes above said key-levers, each power-lever having an outer arm to which said key-powered link is attached, and an inner arm linked to the type-bar by said toggle-link.

11. In a typewriting machine, a type-action for printing quietly by means of pressure and a pressure - controlling momentum - accumulator, said type-action being constituted of a minimum number of parts by the combination of an upstanding radial type-carrier having type at one end and fulcrumed at the other end, a radial power-lever, a toggle-link connecting said power-lever to the type-carrier, said power-lever having two arms, a type-key-lever, a link directly connecting said type-key-lever to one of said power-lever-arms, and a supplemental weighted toggle anchored at one end to the framework and powered at the other end by the other arm of said power-lever.

12. In a pressure-printing and momentum-controlled type-action for a portable typewriter, an upstanding type-carrier having type at its upper end and fulcrumed at the lower end, a folded power-toggle connected at one end to the type-carrier and anchored at the other end, the anchored toggle-member having two operating arms, a type-key-lever, a drive-link directly connecting said type-key-lever to one of said arms of said toggle-member, a supplemental weighted toggle, anchored at one end to the framework and connected at its other end to the other arm

of said toggle-member to be speeded thereby, and a stop for arresting the printing-stroke of the key-lever just before the type-carrier prints, the momentum of the supplemental toggle being effective to further expand the power-toggle to bring the type-carrier to print, the direct connection effected by means of said link being arranged for idle play to permit supplemental expansion of said toggles when the key-lever has been arrested by said stop.

13. In a typewriting machine having a platen, the combination with a system of type-keys, of a system of upstanding type-carrying bars in front of the platen and pivoted to swing their upper ends to present the types to the platen, said type-bars working in planes which converge from front to rear, a system of radiating power-levers connected to said type-keys and pivoted upon the framework, toggle-links connecting said power-levers and type-bars to enable said keys and power-levers to swing said type-bars to their printing positions, each power-lever and link forming a normally folded toggle, and means operated by each of said power-levers, in the form of a normally folded sub-toggle pivoted at one end to the power-lever to be unfolded thereby, and anchored at the other end to the framework, each sub-toggle being inclusive of a weighted short momentum-link, for effecting supplemental pressure of the type against the platen.

14. Machine constructed according to claim 13, in which there is a key-lever for each type-key and a pull link connected to the key-lever, the pull link being directly connected to the power-lever to actuate the latter, and means for arresting the down stroke of the key-lever when its pull link is about in line with the fulcrum of its connected power-lever, to permit slight supplemental movement of the power-lever for effecting printing-pressure after the arrest of the key-lever.

15. In a front-print writing machine having a platen, a noiseless, easy key-touch type-action system including a system of upstanding swinging type-bars having types at their upper ends and pivoted at their lower ends, a system of key-levers below the type-bars, power-links extending upwardly from the key-levers, type-bar radial power-levers articulated to the upper ends of said links to be powered thereby, radial toggle-links connecting said power-levers to said type-bars to enable the key-levers to swing the type-bars to the platen, key-stroke stops for the key-levers, and supplemental toggles including elements pivotally anchored to the framework and weighted elements pivoted to said power-levers to be speeded thereby, to continue in motion after the arrest of their key-levers, to cause the supplemental toggles to effect supplemental type-pressure, each of the power-links between the key-levers and the radial power-levers being arranged to permit supplemental type-pressure to be produced by the supplemental toggle after the arrest of the key-lever by its stop, said supplemental toggles normally being folded compactly but being extensible by said key-lever-driven power-levers, said power-levers and said radial toggle-links cooperating to decelerate the type-bars as the latter approach the platen while said power-levers substantially continue to speed the weighted elements of the supplemental toggles, to conduce to noiseless printing by non-percussive pressure.

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