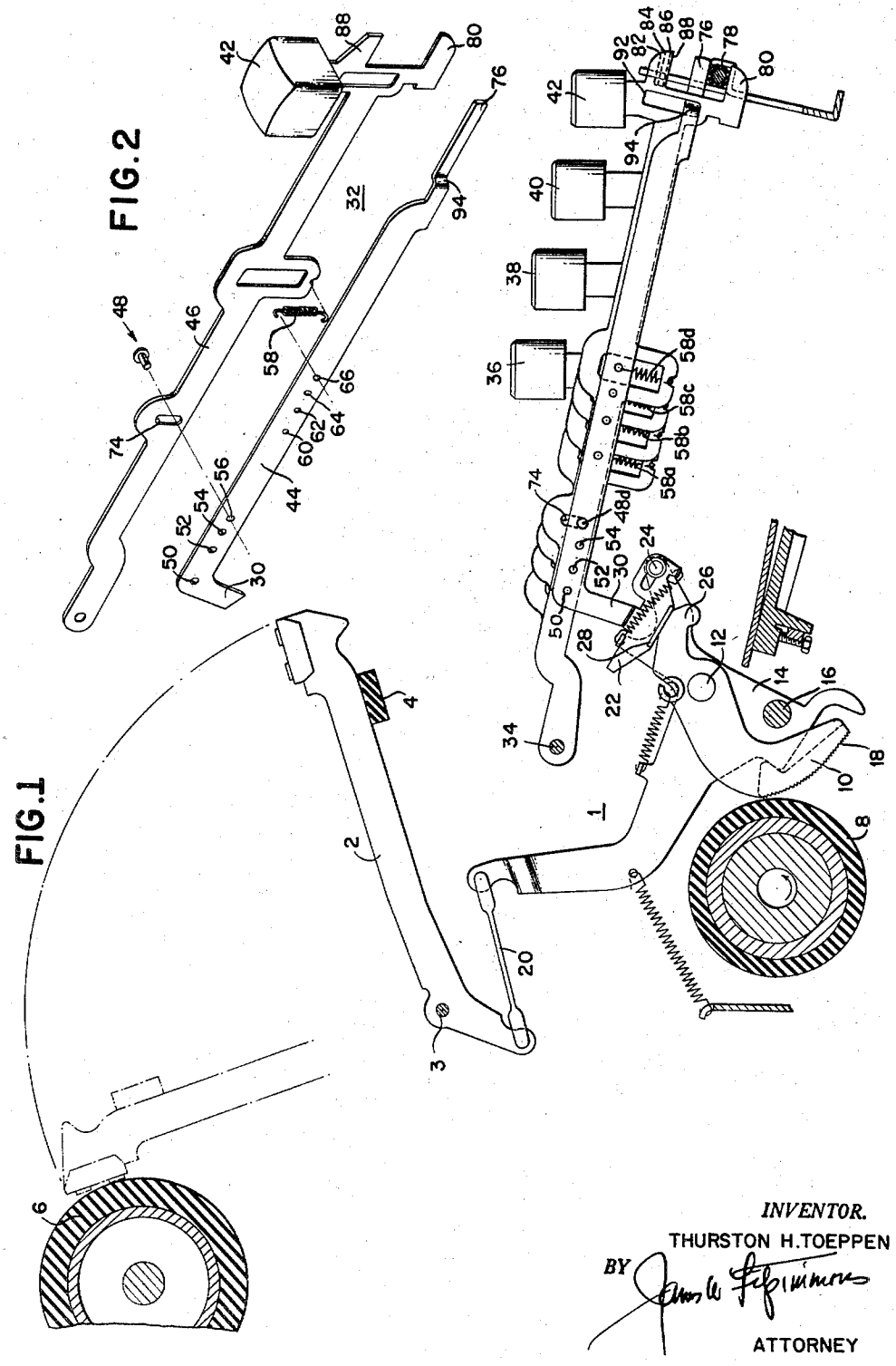
June 2, 1959 T. H. TOEPPEN 2,889,024

EQUAL KEY TRIP LEVER

Filed Dec. 30, 1954 2 Sheets-Sheet 1



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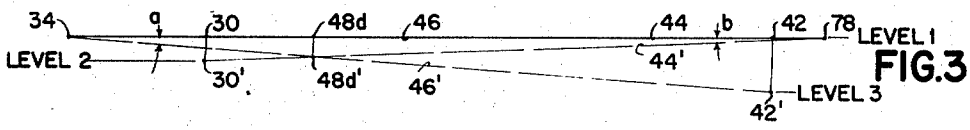


FIG.3

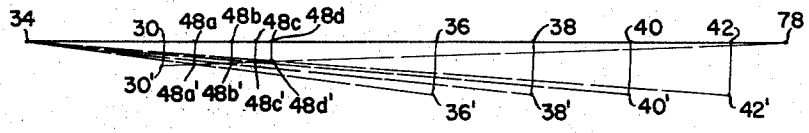


FIG.4

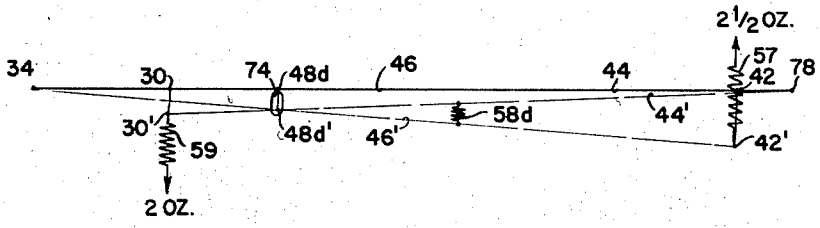


FIG.5

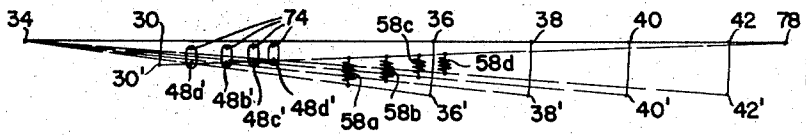
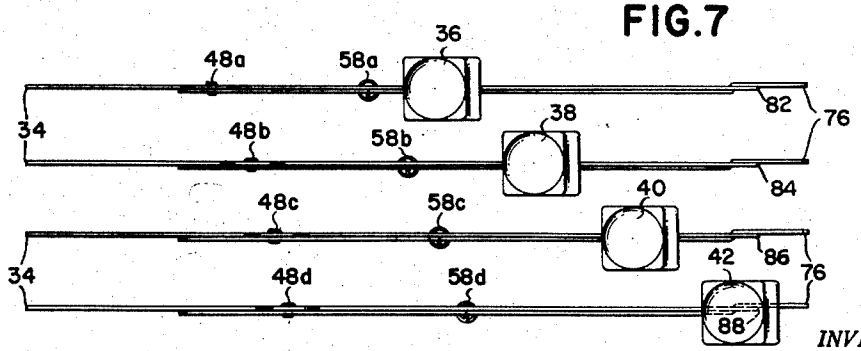


FIG.6

FIG.7



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EQUAL KEY TRIP LEVER

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5 Claims. (Cl. 197—17)

This invention relates to typewriters and more particularly to an improved key lever construction for the operation of a typewriter.

One of the problems in typewriter design has been the equalization of the travel of the different rows of key buttons in order to provide a uniform keyboard touch for the benefit of the operator.

Accordingly, it is a first object of this invention to provide an improved key lever construction for the typewriter, wherein the key buttons for each of the conventional rows on the typewriter keyboard will travel and equal distance for operation.

It is a still further object of this invention to provide an improved key lever construction which provides a degree of choice in the amount of travel for key buttons in any of the conventional rows of the typewriter keyboard.

It is a further object of this invention to provide an improved key lever construction wherein an equal force of operation can be provided for each of the rows of key buttons in the typewriter keyboard.

It is a still further object of this invention to provide an improved key lever construction wherein any combination of force and travel can be provided for the individual rows of key buttons at the typewriter keyboard.

It is a still further object of this invention to provide an improved key lever construction having a trip operating member movable through the same distance when selectively actuated by its respective key lever irrespective of the row in which the key button for that key lever might be located.

It is a still further object of this invention to provide an improved key lever construction wherein an equal force is applied at the trip point of any key lever irrespective of the location of its respective key button in the rows of the keyboard.

It is a still further object of this invention to provide an improved key lever construction wherein the force at the trip point of any key lever is identical irrespective of the speed of operation of its respective key button or the force applied thereto and irrespective of the row in the keyboard in which that particular button might lie.

It is a still further object of this invention to provide an improved key lever construction for a typewriter, wherein the shock to the operator's finger has been reduced to a minimum.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a side elevation of the power driving mechanism and key lever construction for operating the type bar of the typewriter.

Fig. 2 is an exploded perspective view of one of the improved key levers, while

Figs. 3, 4, 5 and 6 are diagrams graphically showing the combinations of forces and distance traveled by the components of the new key lever.

Fig. 7 is a top view of the four main key lever assemblies, one for each row of the standard typewriter keyboard, showing the relative locations of the pivot points and actuating springs with respect to the key button locations.

Briefly, this invention relates to an improved two-piece key lever construction for the keyboard of the typewriter wherein the individual pieces of any key lever may be so interconnected as to accomplish the objects of this invention irrespective of the location of its respective key button on the keyboard.

More specifically, the key lever comprises a universal portion and a variable portion wherein the interconnection between the two portions is selectively variable to provide a combination meeting the objects of this invention.

Referring to the drawings, type bar power driving mechanism **1** is provided for driving a type bar **2**, pivotally supported by fulcrum wire **3**, from its rest position wherein it is in contact with the rest pad **4**, into printing position where it strikes platen **6**.

The construction of this type bar driving mechanism is shown in complete detail in U.S. Patent 2,723,740 to Toeppen and consequently, it is felt that a simple description will suffice to explain the fundamental details of operation. More specifically, a power roll **8** is shown as being continuously operable in the direction of the arrow under the influence of some power driving means, and a cam **10** is shown pivotally supported on a stud or pivot point **12** carried by a cam lever **14**, in turn pivotally supported on a fulcrum rod **16**. When cam **10** is brought into contact with power roll **8**, a continuously increasing radius of its serrated surface **18** with respect to its pivot point **12** rocks the cam lever **14** clockwise about its supporting shaft **16** to drive the type bar **2** counterclockwise (as viewed in Fig. 1) into printing position through the interconnection of the link **20**.

Cam **10**, normally, is spaced slightly away from the power roll and is conditioned for a type bar print stroke by rocking it slightly clockwise to engage the point of minimum radius of its serrated surface **18** with the power roll. This slight clockwise rocking of the cam is brought about by a trip latch **22** pivotally and slidably supported on a stud **24** carried by the cam lever **14**. It is apparent that the counterclockwise rotation of the trip latch **22** acting on the tail **26** of cam **10** will bring the minimum radius point of the peripheral surface **18** into contact with the power roll **8** thereby initiating a type bar print stroke.

In order to pivot the trip latch **22**, it is provided with an ear **28** which is positioned for engagement with a trip finger or trip point **30** carried by a key lever assembly **32**.

Basically, the key lever assembly **32** is pivotally supported on the cross wire **34** so that any depression of the key button mounted thereon causes the trip finger **30** to push on the ear **28** thereby pivoting the trip latch **22** counterclockwise and the cam **10** clockwise into engagement with the power roll.

It has been mentioned that the first object of this invention is to provide an equal travel for each of the key buttons of the individual key levers respectively, and regardless of their location in the typewriter keyboard.

It is conventionally understood that four rows of key buttons are provided in a typewriter keyboard, each key button being respectively connected to a typewriter key lever. Since all key levers are, as a rule, pivotally supported for rocking movement about a common axis, and since the trip finger **30** is located at the identical point for all key levers, it is obvious that under ordinary con-

ditions, in order to provide the same motion for trip point 30, a greater travel would be required for a key button in row 38 than would be required in row 36 and a greater travel would be required in row 40 or 42 than required in row 38. Accordingly, the following structure has been provided so that with key levers pivotally supported on a common fulcrum an equal travel in an approximately vertical direction, at any row of key buttons 36, 38, 40, or 42, will produce an equal movement for the trip finger 30 into engagement with the trip latch 22. The structure and operation of the key lever assembly 32 will be described as it would apply in general to any position of the keyboard, after which the variations associated with any particular location will be considered in some detail.

Referring now to Fig. 2 of the drawings, the key lever assembly 32 is shown comprising a universal portion or universal lever 44 carrying the trip point 30 and the variable portion or variable lever 46, carrying the key button. It will be noted that universal portion 44 is furnished with 4 holes, 50, 52, 54 and 56, any of which will receive an interconnecting shoulder rivet 48, whereas variable portion 46, which is designed in four variations associated with the particular key button rows, has only one slot 74 to receive the rivet 48. The rivet 48 holds the two key lever portions in assembled relationship. Similarly, a choice of four holes 60, 62, 64, 66 is also provided in universal portion 44 for the mounting of a spring 58, whereas in variable portion 46 the only spring mounting place provided is the one designed for the particular key button position. In this way, the universal portion 44 can be used with any one of four variable portions depending on the location of the respective row of its key button 36, 38, 40 or 42.

The rest position of key lever assembly 32, when there is no pressure on the key button, is established by the tension of spring 58 which tends to pull down universal portion 44 (see Figs. 1 and 2). As a result, rivet 48 is pulled down against the bottom surface of slot 74, and projection 76 of universal lever 44 is pulled down against fixed fulcrum or rod 78. At the same time, spring 58 also tends to pull a projection 80 of variable portion 46 up against the under surface of rod 78. In this way, the key lever assembly 32 is firmly supported on fulcrum rods 34 and 78, with trip finger 30 in proper position to act on ear 28 of its associated trip latch.

When key button 42 is depressed with a sufficient pressure to overcome the preloading established by spring 58, projection 80 will move away from fulcrum 78 until an integral projection 88 contacts the top of fulcrum 78. It will be appreciated that corresponding stop projections 82, 84 and 86 are provided on the levers carrying the key buttons 36, 38 and 40 respectively. These projections are so arranged that the levers 46 are permitted to turn through angles inversely proportional to the spacing of the key buttons from the pivot wire 34.

As variable lever 46 swings downwardly around fulcrum rod 34 as a center, the projection 80 moves downwardly from fulcrum 78. The tension of spring 58 causes rivet 48 to follow the motion of slot 74 downwardly, universal lever 44 rotating about fulcrum 78 in the process. This results in a motion of trip point 30 which serves to rotate trip latch 22 counterclockwise by means of ear 28.

It has been shown that the tension of spring 58 pulls rivet 48 down against the bottom of slot 74, and projection 80 up against the bottom of fulcrum 78. This serves not only to keep the assembly in position but also provides the principal resistive force at the key button to prevent it from being too easily depressed. This force is usually set at about 2½ oz. In addition, the same spring provides a calculated resistive force at trip point 30 which limits the amount of pressure which can be applied to the cam trip mechanism, because if the key button 42 is depressed more rapidly, or with a greater force, than the cam trip mechanism will accept, trip point 30 will simply stop against ear 28. This, in turn, causes rivet 48 to stop while slot 74 is free to continue downward with the motion of key button 42. Spring 58 is, of course, extended a small additional amount if this action takes place, until the operation of the type bar drive mechanism 1 moves trip ear 28 out from underneath trip point 30.

By a suitable choice of locations for rivet 48, slot 74 and spring 58, any desired combinations of motion and spring pressure can be provided for key button 42 and trip finger 30, within reasonable limits. These quantities can be made the same for all rows of key buttons, or can be varied at the will of the designer. The general procedure by which these results are secured is shown diagrammatically by Figs. 3, 4, 5 and 6.

Fig. 3 represents the geometry of a single key lever assembly 32, the key button here being represented as in the bottom row or position 42.

The distance between level 1 and level 3 represents the desired travel of the key button from 42 to 42′, and the distance between level 1 and level 2 represents the desired travel of the trip point from 30 to 30′. As variable lever 46, carrying the key button, pivots about fulcrum 34 to position 46′, it rotates through angle *a*, and as universal lever 44, carrying trip point 30, pivots about fulcrum 78, it rotates through angle *b*. Where angle *a* intersects angle *b*, the vertical travel of each is equal, and if rivet 48 and slot 74 are located at the point of intersection of the angles, then trip point 30 will move from 30 to 30′ when the key button moves from 42 to 42′.

Because of the constantly changing effective length of the universal lever arm 44 in this example, it is necessary that a slidable relationship be established. It is usually most convenient to make this sliding provision at fulcrum 78, although it may be done at fulcrum 34 as well.

Fig. 4 shows the same principles as applied to all four rows of key levers when superimposed. It will be noted that the angular rotation of universal lever 44 remains constant, but the angular rotation of the variable key lever portion 46 is reduced as the key button position moves successively from 36 to 38 to 40 to 42. Consequently, the pivot (or rivet) location moves to the right from 50 to 52 to 54 to 56 (Fig. 2), and the corresponding rivet locations 48*a*, 48*b*, 48*c*, 48*d* are shown in Fig. 4.

Fig. 5 shows how the same approach is used in determining the position of the spring element in each case, although here force components are considered rather than physical displacements.

If a spring 57 is placed at any point to the right of pivot 48, in such a way as to tend to pull levers 44 and 46 together, it will produce an upward force at the key button position 42. If the spring is directly under the key button, then the key button load will be equal to the strength of the spring, e.g. 2½ oz. If the spring is moved to the left, its strength will have to be increased proportionately in order to provide the same load at the key button position; for example, at a point halfway between key button 42 and pivot 48, 5 oz. of spring force would be required to produce 2½ oz. load at the key button.

The spring force at trip point 30, which will provide the cushion action to prevent any excessive pressure on or travel of trip point 30 (by allowing rivet 48 to move up in slot 80) has been determined to be about 2 oz. For the purpose of this description, let it be assumed that it is desirable to limit the pressure at trip point 30 to this maximum. Reference to Fig. 5 will show that in this instance the lever arm involved is the whole length of universal lever 44 from fulcrum 78 to trip point 30, and that a spring pulling downward on this lever at any point between trip point 30 and fulcrum 78 could produce the desired cushion pressure of 2 oz. at trip point 30. If a spring 59 were located directly at point 30, its necessary spring force would be 2 oz., but as the location of spring

59 is moved to the right, the necessary spring force would be increased.

If in one case the necessary upward spring pressure (of spring 57) increases as the spring is moved to the left, and if in the other case, the necessary downward spring pressure (of spring 59) increases as the spring is moved to the right, it follows that at some common point the two forces will be equal in magnitude, and that because they are also opposite in direction, one spring 58 can serve both purposes at that point.

In Fig. 6, the relative positions of the pivot points and springs associated with all four rows of key buttons are indicated diagrammatically, and in Fig. 7 the same relationships are shown with respect to the actual physical construction of the four rows of key lever assemblies.

As an incidental feature of this invention, the fulcrum rod 78 which supports the projection 76 of the universal portion 44 of each of the key levers, is covered with a resilient plastic sleeve. The pressure of projection 76 and projection 89 on opposite surfaces of rod 78, therefore, results in a cushioned grip of the key lever assembly 32 on the rod 78, which is designed to reduce the noise level during operation, and to prevent vibration of the parts while the typewriter is idling.

Furthermore, each key lever has an aperture, such as the one 92, for interconnecting the outer ends of the two portions of the key levers. Specifically, the offset 94 of projection 76 is inserted through the aperture 92, thereby holding the two portions in parallel alignment while permitting the variable key button portion 46 to be depressed relative to the pivot point 78 of each of the universal portions 44 of the key levers.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In a typewriter having type bars with individual power driving mechanism therefor, a plurality of equal travel key levers having individual key buttons each arranged for movement through a unit distance to actuate its respective type bar driving mechanism, said key levers each comprising a variable portion having a key stem positioned thereon for mounting its associated button in a selected row of a typewriter keyboard, means pivotally supporting corresponding ends of each of said variable portions about a common axis, means limiting the pivotal movement of the opposite ends of each of said variable portions so that each key button will travel the same distance from an inactive to an active position irrespective of its row location, a universal portion for each key lever having a trip finger located proximate one end to actuate a respective type bar driving mechanism, said limiting means acting as a pivotal support for said universal portions adjacent their ends opposite said trip fingers, pin means pivotally connecting said variable and universal portions at such points that equal travel of each trip finger is obtained upon movement of its respective key button through said unit distance, and means yieldingly opposing movement of said variable and universal portions relative to each other by actuation of said key buttons.

2. In a typewriter having type bars, and driving means for each type bar, an improved key lever structure for actuating each type bar driving means comprising a variable portion having a key stem positioned thereon for locating an associated key button in a selected one of several rows of keys on a standard keyboard, means pivotally supporting said variable portion for pivotal movement about one end, means limiting the pivotal movement of said variable portion to a distance inversely proportional to the spacing of its key button from said supporting means, a universal portion having a trip finger proximate one end for actuating said type bar driving means, means pivotally supporting the opposite end of said universal portion proximate the movable end of said variable portion, means pivotally connecting said portions loosely between their ends whereby the pivotal movement of said variable portion produces a similar movement of said universal portion to move its trip finger to a position for tripping said driving means, and spring means holding said portions normally in alignment.

3. A mechanism in accordance with claim 2 wherein said loose pivotal connection and said spring means are interposed between said variable portion and said universal portion of each key lever structure at points spaced from said pivotal supporting means in direct proportion to the spacing of the key button for such structure from the same supporting means, said trip fingers operating by such connections to provide a constant force output to said type bar driving means.

4. In a typewriter having type bars, and driving means for each type bar, an improved key lever structure for actuating each type bar driving means comprising a variable portion having a key stem positioned thereon for locating an associated key button in a selected one of several rows of keys on a standard keyboard, means pivotally supporting said variable portion for pivotal movement about one end, means limiting the pivotal movement of said variable portion to an angle varying inversely with the spacing of its key button from said supporting means, a universal portion having a trip finger proximate one end for actuating said type bar driving means, means pivotally supporting the opposite end of said universal portion proximate the movable end of said variable portion, a pin projecting from said universal portion at a point between its ends, an elongated slot in said variable portion receiving said pin, a spring acting between said portions for urging said pin toward one end of said slot and said trip finger toward a position for actuating said driving means, said pin cooperating with said end of said slot to provide a pivot point about which said universal portion turns, on actuation of said key button, from a position in alignment with said variable portion to a position spaced angularly therefrom.

5. The mechanism of claim 4 in which said pin and elongated slot connections for said key lever structures are so located that the angular movements of said universal portions resulting from actuation of said key buttons, are the same.

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