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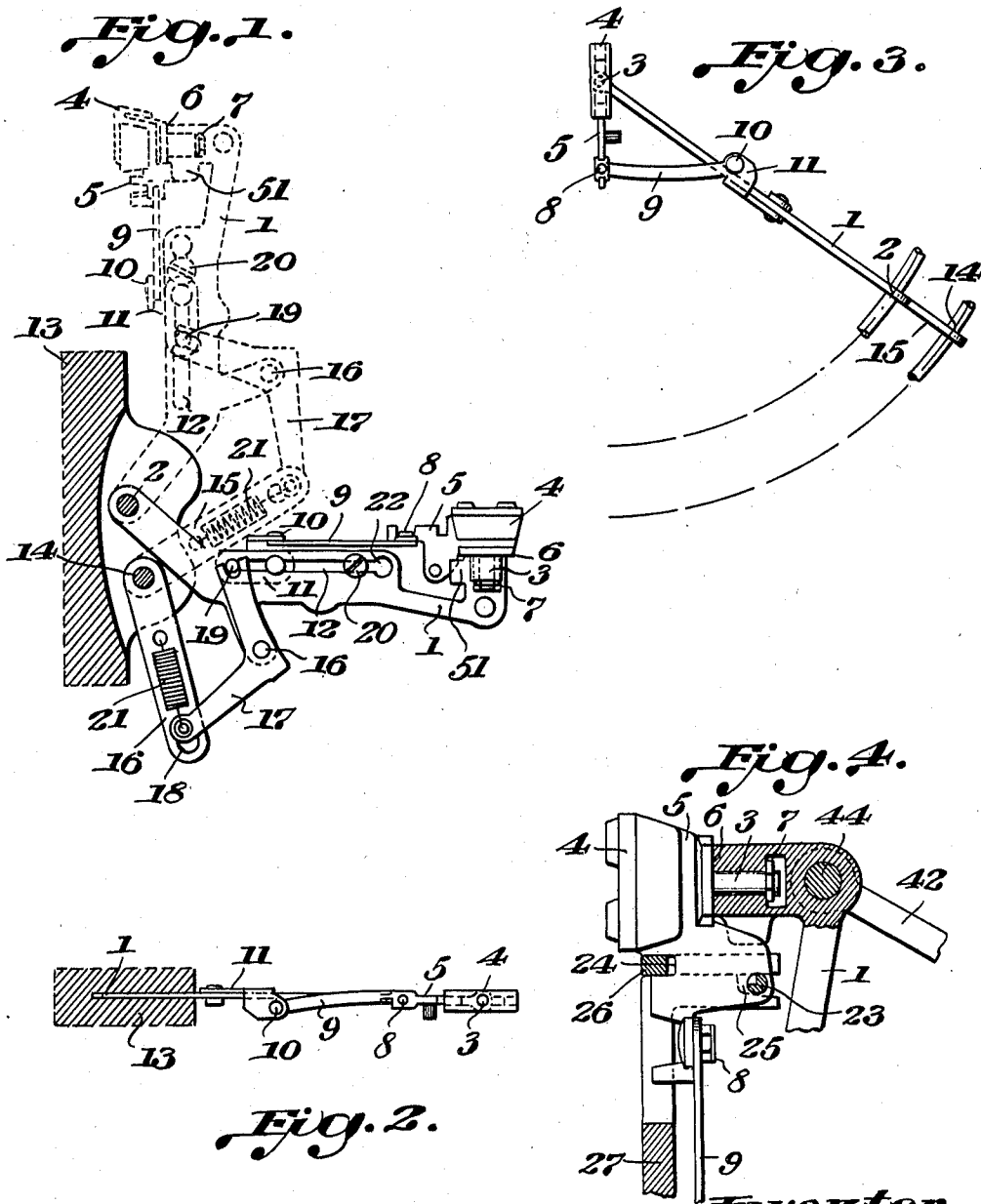
R. LEVI

2,153,720

NOISELESS TYPEWRITER

Filed July 14, 1936

2 Sheets-Sheet 1



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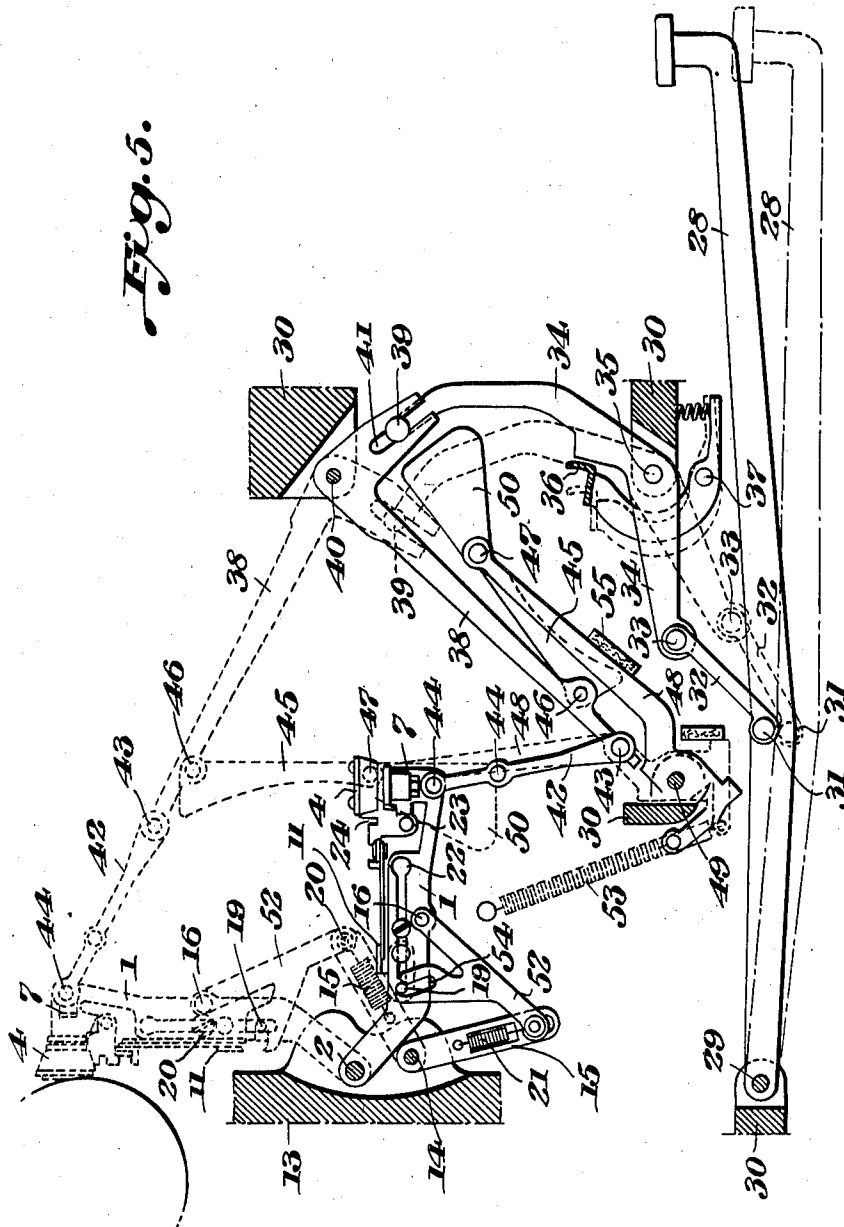
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UNITED STATES PATENT OFFICE

2,153,720

NOISELESS TYPEWRITER

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8 Claims. (Cl. 197—37)

It is well known that in ordinary typewriters the types have an impression surface which is disposed at right angles to the plane of movement of the type bars which carry them. In the following description the word "type" designates the metal part which in most cases carries two characters. These types are, however, secured to type bars with which they form a given angle, namely the same angle as the type bar itself makes with the plane of symmetry of the machine.

This angle is obtained by bending or twisting the end of the type bar or by providing the type with a pin which is welded to the type bar in such a manner as to form the desired angle. In all previous constructions for obtaining this angle, the body of the type is, however, always arranged out of the plane of the type bar, whereby the lateral space requirements are increased.

In the middle the space requirement is equal to the breadth of the type, whilst it increases towards the sides and for an angle of 90° is equal to its length. It must also be taken into consideration that the type, or the part which carries it, is usually provided with an extension the purpose of which is to engage in a central guide which is consequently known as the type guide. For this reason its length is in practice greater than the extent of the characters which it carries. On account of this increase in effective size, ordinary machines also have from the middle towards the sides greatly increased angular distances between each pair of adjacent type bars. Then also, due to the necessity of providing the machine with a large number of characters, use is made of the fact that the adjacent types, in spite of their gradually increasing inclination relative to the type bars which carry them, extend practically parallel to each other.

The present invention, which is chiefly applicable to noiseless machines, is essentially characterized in that the type or a part secured thereto by welding or the like is not rigidly connected to the type bar, but is pivotally connected to the head of the type bar in such a manner that, when in the rest position, it lies in the same or almost the same plane as the type bar, but, when in the writing position, it assumes the inclination necessary therefor. This is attained in that the type performs a progressive pivotal movement relatively to the type bar, which movement takes place during and as a result of the movement of the type bar. The movement of the type relative to the type bar must commence with a veloc-

ity, which is initially equal to zero or is very small, in order that the space required by the type should not in practice exceed its breadth shortly after leaving the rest position.

A preferred constructional form of the present invention is illustrated by way of example in the accompanying drawings in which:

Fig. 1 is a cross-section through the part which carries the type bar, taken in the plane of movement of a lateral typebar, the actuating mechanism of which is not shown,

Fig. 2 is a cross-section at right angles to that shown in Fig. 1 and shows the type bar in the rest position,

Fig. 3 illustrates a lateral type bar and its type in the writing position viewed from the direction of the platen,

Fig. 4 illustrates details of the mounting of the type and of the guide members on the type guide means, and

Fig. 5 illustrates the actuating mechanism for a moving unit near the middle, in which the angle of pivotation of the type is small.

In Figures 1 and 5 the rest position is illustrated in full lines and the writing position in dotted lines.

The type bar 1 is pivotally mounted on an arcuate wire 2 arranged in a fixed bearing member 13 and is guided in slots in the said bearing member. The type bar is provided at its head with a thickened part which forms a pivot bearing for a pin 3 connected with the type carrier 5 (Fig. 4). The type 4 is secured to the type carrier 5 by welding. Thus the type 4 can pivot about the axis of the pin 3 relatively to the type bar 1.

The writing pressure is transmitted from the type bar to the type at the plane supporting surface 6. A suitable head 7, which may have the form of a nut or of a washer and is as easily removable as possible, prevents the type carrier 5 from becoming detached from the type bar 1. The type carrier 5 in the rest position lies against a projection 51 on the type bar 1 and is connected by a pin 8 to a pushrod 9 which is in turn connected by means of a pin 10 to a slider 11 (Figs. 1, 2 and 3) which slides in a slot 12 in the type bar 1. As can be seen from Fig. 2 the pin 10 is arranged at the opposite end of the rod 9 to the pin 8 and at right angles to the type bar, in such a manner that, even in the rest position there is an adequately long lever arm relative to the pin 3 for effecting the pivotal movement of the type carrier 5 and the type 4. In other

words the type carrier 5, the push rod 9 and the slider 11 form a non-concentric crank mechanism (since the pin 10 does not move axially) if the type bar 1 is regarded as a fixed support, the type carrier 5 as a crank, the push rod 9 as a push rod and the slider 11 as a sliding shoe. In this crank mechanism the slider 11 is the force imparting member.

In order to effect the displacement of the slider 11, there is provided in the fixed bearing member 13 a further arcuate wire 14 which is bent about the same axis as the wire 2, is disposed in a plane parallel to that containing the said wire 2 and has a diameter of curvature greater than that of the said wire 2. In the recesses in the bearing member 13, which serve for guiding the type bars 1, there are also arranged for movement levers 15, which however are also pivotally mounted on the wire 14 already mentioned. A bell crank lever 17 is pivotally mounted on the type bar 1 by means of a pin 16 and is connected at one end to the lever 15 by a pin 18 and controls the movement of a pin 19 by means of a fork at its other end, which pin 19 is in turn secured to the slider 11. In order to explain the manner of operation of this arrangement, it must first of all be assumed that the type bar 1 is stationary while the bearing member 13 rotates relatively to it. The bearing member may then be regarded kinematically as a crank arm which is pivotally connected to the type bar 1 at 2 and is of a length equal to the distance separating the wires 2 and 14. The bell crank lever 17 is pivotally mounted at 16, acts as a driven crank and is connected to the driving crank by the lever 15 which acts as a push rod. It is clear then that the pivotation of the said crank arm between 2 and 14 brings about the rotation of the crank 17 which moves the slider 11 by means of the pin 19. This causes in turn a corresponding rotation of the type 4.

The movements described above, which are brought about by the pivotation imparted to the crank arm between 2 and 14, are in fact produced by the pivotal movement of the type bar 1. In this way each position of the type bar 1 corresponds to an accurately determined position of the type. Since at the commencement of the movement the points 2, 14 and 18 lie in or nearly in a straight line, the initial velocity of the lever 17 in its movement relative to the type bar 1 as well as the initial angular acceleration of the type are equal or nearly equal to zero. Thus the requirement is fulfilled that the type is disposed, not only when in the rest position but also when it is near that position, in a plane which is the same or nearly the same as that of the type bar which carries it. There is arranged for longitudinal adjustment in the slot 12 an abutment 20 which provides for the slider 11 or any desired part connected thereto a definite adjustable end position in order to enable the angle of pivotation of the type to be adjusted and to cause this rotation to finish somewhat before the end of the movement of the type bar 1. Since, however, the elements described form a definite kinematic chain, this premature cessation of movement necessitates the inclusion of a resilient member in the chain so that the type bar 1 can move still further, although the relative movement of the type has already ended. This resilient member may for example have the form of a spring 21, which resiliently connects the pin 18 to the lever 15. The pin 18 may slide in a longitudinal slot in the lever 15, but is normally held back by the spring 21. When, however, the slider 11 comes

to rest against the abutment 20, the spring 21 stretches so as to permit of a kinematic lengthening of the lever 15 and at the same time the further angular movement of the type bar 1.

The pivotal movement of the type must increase from the middle, where it is practically nil, towards the sides of the machine. The arrangement described makes this possible in a simple manner in that only the position of the pin 16 of the bell crank lever relative to the type bar 1 and to the ends of the bell crank lever need be altered. In other words the parts which are necessary for the pivotation of the individual types differ only in the lever transmission mechanism, which can be altered merely by varying the positions of the pin 16 and the abutment 20.

In the zones near the middle, however, the pins 16 must be disposed closer to the pins 19 in order to cause a very small movement of the slider 11 and at the same time a very small pivotal movement of the type. In this case (Fig. 5) the lever 17 may be replaced by a lever 52 which is pivotally connected to the lever 1 at a point 16 so chosen that it is moved by the lever 15, as described above with reference to the lever 17, and can act upon the pin 19 on the slider 11 through a curved guide which is so formed that a large pivotal movement of the lever 52 corresponds to a small displacement of the slider.

The kinematic chain which consists of the type 4, the type carrier 5 and the pin 3, the push rod 9, the slider 11 and the pins 8 and 10 can be disconnected from the type bar 1, both due to the removability already referred to of the head 7 and also because the guide slot 12 is provided with an enlarged part 22 at one end which is never reached in practice by the slider 11 during its movement, which part 22 permits the head of the guide pin of the slider 11 to pass through.

It is here recalled that the invention is concerned chiefly with noiseless machines, in which, as is well known, the writing is produced by means of the static pressure of a system of toggle links or other similar devices. The following description is concerned with the principal of these toggle links which co-operate directly with the type bar.

The types are each provided with two characters, one for the small letters and the other for the capitals. The connection of the principal toggle link with the type bar cannot lie in the axis of pivotation of both characters. The impression of the type against the roller produces an opposite pressure which does not pass through the pin 44 which connects the principal toggle link to the type bar (Figs. 4 and 5) and consequently produces a moment. In Fig. 4, the principal toggle link is connected in the middle between the two characters so that this moment is as small as possible. It acts, however, in both directions. If, instead of this, the connection were provided in the axis of one of the characters, e. g., of the small letter, the arrangement would have the advantage of being able to obtain a moment only when the pressure is applied to one of the capitals, but this moment is doubly large. To return to the case illustrated in Fig. 4, the moment is equal to the product of the writing pressure and half the distance between the small letter and the capital (usually 3.3 mm.).

In order to enable this moment to be transmitted to it, the type carrier 5 is provided with a pin 23 and with a recess 24 which correspond to a slot 25 and a rod 26 on the type guide 27.

Due to this arrangement the resultant of the forces, which act upon the moving mechanism, passes through the axis of the pin 3 of the type and is resolved into a pressure acting along the toggle link and a tractive force acting along the type bar 1.

It is obvious that the arrangement of the pin and recess on the type carrier 5 and type guide 27 correspondingly forms only one constructional example by means of which the problem can be solved, since the moment referred to can also be taken up from a fixed part by other means, in so far as these means constitute vertical supports which are consequently at right angles to the main force. It can also easily be seen that the vertical supports completely fulfil their purpose without moreover weakening the main writing force, but by a component of friction. Since the horizontal distance between the two supports can be very much greater than the lever arm (3.3 mm.) of the moment, the pressure and the corresponding frictional loss are very small. Finally the wear of the type guide 27, to which as has already been explained very little pressure is transmitted, cannot cause either alteration in the spacing or in the even level of the writing. This wear acts only as a reduction of the stiffness of the movable system, that is to say it reduces the writing force.

It is also clear that the noiseless operation of the type causes neither a reduction in the writing speed nor an increase in the initial velocity and consequently an increased finger pressure as compared with ordinary machines which operate by impact. This holds good, if the distance which has to be covered by the type is equal in both machines. If, however, this distance can be reduced, this disadvantage is reduced or avoided or the noiselessness as compared with ordinary machines is even improved upon. As regards the ability of the type to pivot, the space required from the middle to the sides is none the less constant, that is to say it is never greater than its actual breadth. Consequently the total space requirement of all the types is much smaller than in a machine with fixed type, and at the same time, if the angle between the lateral type bars and the axis of symmetry of the machine and the angle of pivotation, e. g. 90°, are both equal, the length of the type bars in the machine according to the present invention is much smaller than that in machines with fixed type. The shorter type bar has a shorter stroke and a smaller mass to be displaced and consequently produces a soft operation of the machine. It also follows that a further essential advantage of the machine according to the present invention is the possibility of reducing the length of the type bar and of making the touch more gentle. These advantages are especially important in noiseless typewriters the touch of which is, for other reasons already mentioned, worse than that of ordinary machines. Finally the reduction of the distance through which the type moves results in a reduction both in the space required and also in the distance to be travelled by all the parts interposed between the keys and the type bars, so that constructions are possible which were formerly impossible to carry out because of the large amount of space necessitated. It is thus made possible, to select a particularly suitable construction, which is described with reference to Fig. 5 as a constructional example of the invention.

The key lever 28, which is pivotally mounted,

by means of a wire 29, on the frame 30 of the machine which is in turn fixedly connected with the above mentioned bearing member 13 of the type bar 1, actuates the intermediate lever 34 by means of a connecting link 32 which is pivotally connected by pins 31 and 33 to the levers 28 and 34 respectively. The intermediate lever 34 is pivotally mounted in the frame 30 of the machine by means of a horizontal wire 35, which is parallel to the wire 29 on which the key lever is mounted. The distances are so chosen that at the end of a stroke (as shown in dotted lines) the axes of the pins 31, 33 and of the wire 35 lie in a straight line, and thus form a rigid and noiseless stroke limit for the key lever 28. The transmission ratios between the levers 28 and 34 are so chosen that, if the strokes of the keys in all rows of keys are equal, each intermediate lever 34 will rotate an equal amount. In this way a universal bar 36, which is pivotally mounted at 37 and cooperates with the levers 34, always rotates through the same angle, the movement being always derived from the said key. Consequently the part of the universal bar against which the levers 34 act may be made rectilinear, which results in a particularly simple constructional form. The universal bar 36 serves in known manner for causing the travel of the carriage and the movement of the ribbon.

The lever 34 cooperates directly with the push lever 38 which forms the first part of the main toggle link which actuates the type bar 1. The transmission between the levers 34 and 38 is effected by means of a spherical pin 39. The levers 38 are pivotally mounted on a wire 40 which is arcuate and extends parallel to the wire 2 of the type bar 1. Thus the intermediate levers 34 are of unequal length and since, as has already been explained, they all rotate through the same angle, their pins 39 travel different distances.

Nevertheless all the push levers 38 rotate through the same angle since the pins 39, which they move through forks 41, act on lever arms which are different to suit the lengths of the lever arms between 35 and 39. This transmission from the key levers to the push levers has the following advantages:—

1. The possibility of making use of a rectilinear universal rod.
2. The possibility of making all the key levers 28 of any one row and the connecting links 32 and push levers 38 of the whole machine equal in length.

Other systems designed to attain the same ends do not possess the above advantages.

The push levers 38, which are actuated from the keys by the mechanism described above, drive the type bars 1 through the connecting links 42 which are pivotally connected at 43 to the push lever 38 and at 44 to the type bar 1 (see also Fig. 4). The same lever 38 also actuates an inertia mechanism the first part of which, the link 45, is pivotally connected at 46 to the lever 38 and actuates a lever 48 by means of a pin 47. The lever 48 is pivotally connected to the fixed frame 30 by an arcuate wire 49 which is parallel to and coaxial with the wire 2 of the type bar 1 and the wire 40 of the push lever 38.

The link 45 has on its prolongation beyond the pin 47 an inertia mass 50. This may at first be moved with only a very small velocity in order not to tire the finger which presses down the key, which finger already has to accelerate the type bar in order to move it from the rest position to the proximity of the writing position. In a sec-

and phase it must receive the energy which the lever and type have previously had imparted to them, in order to retard the movement of these parts, so that the type itself is pressed with the smallest possible velocity against the paper, thereby attaining a noiseless contact. In a third phase the inertia mass 50 has to restore the energy previously imparted to it in the form of static pressure, which is exerted through the extended position of the toggle mechanism, for the necessary writing force. The construction described seems to be particularly advantageous in this respect. During operation the link 35 is first of all in the starting position and shortly after, the momentary axis of pivotation is close to the centre of gravity of the mass 50 which thus has a minimum velocity (phase I). When the type bar has had imparted to it by the main toggle link its highest velocity, the momentary axis of pivotation and the centre of gravity of the mass 50 move rapidly apart (phase II). Finally, the mass 50 tends thereafter to bring the three pins 46, 47, 49, together with the three pins 40, 43, 44 into a straight line (phase III).

A spring 53, which has to return the whole moving mechanism to the starting position, is secured to the lever 48. Thus it exerts the greatest force at the commencement of the return movement, so that it can move the toggle link out of the extended position. Furthermore, in this way the return is accelerated and the danger of the type bar sticking in the type guide due to friction is avoided. Obviously the spring may be arranged in another position and may be secured to other suitable parts of the moving mechanism.

I claim:

1. A typewriter comprising a frame, a type bar pivotally mounted on said frame, a type carrying member pivotally mounted on said type bar about an axis substantially tangential to the circle of movement thereof and arranged to lie substantially parallel to said type bar when said type bar is in the rest position, means for actuating said type bar, and a lever system connected between said type carrying member and said frame for causing said type carrying member to rotate during movement of said type bar into the correct position for writing.

2. A typewriter comprising a frame, a type bar pivotally mounted on said frame, a type carrying member pivotally mounted on said type bar about an axis substantially tangential to the circle of movement thereof, and arranged to lie substantially parallel to said type bar when said type bar is in the rest position, means for actuating said type bar, and means connected between said type carrying member and said frame for causing said type carrying member to rotate during movement of said type bar into the correct position for writing, said last mentioned means including a slider slidably mounted on said type bar, a push rod connected between said type carrying member and said slider and means connected between said slider and said frame for causing said slider to move when said type bar is actuated.

3. A typewriter comprising a frame, a type bar pivotally mounted on said frame, a type carrying member pivotally mounted on said type bar about an axis substantially tangential to the circle of movement thereof and arranged to lie substantially parallel to said type bar when said type bar is in the rest position, means for actuating said type bar, a slider slidably mounted on said type bar, a push rod connected between said type carrying member and said slider, a pin mounted

on said slider, a forked bell crank lever pivotally mounted on said type bar, the forked end of said bell crank lever engaging with said pin, a lever pivotally mounted on said frame about an axis near the axis of pivotation of said type bar and pivotally connected with the other end of said bell crank lever.

4. A typewriter comprising a frame, a type bar pivotally mounted on said frame, a type carrying member pivotally mounted on said type bar about an axis substantially tangential to the circle of movement thereof and arranged to lie substantially parallel to said type bar when said type bar is in the rest position, means for actuating said type bar, and adjustable means connected between said type carrying member and said frame for causing said type carrying member to rotate during movement of said type bar into the correct position for writing.

5. A typewriter comprising a frame, a type bar pivotally mounted on said frame, a type carrying member pivotally mounted on said type bar about an axis substantially tangential to the circle of movement thereof and arranged to lie substantially parallel to said type bar when said type bar is in the rest position, means for actuating said type bar, and means connected between said type carrying member and said frame for causing said type carrying member to rotate during movement of said type bar into the correct position for writing, said last mentioned means including a slider slidably mounted on said type bar, a push rod connected between said type carrying member and said slider, adjustable means for limiting the path of movement of said slider and means connected between said slider and said frame for causing said slider to move when said type bar is actuated.

6. A typewriter as claimed in claim 5 and comprising resilient means connected between said slider and said frame for enabling said type bar to continue movement after said slider has come to rest against said adjustable limiting means.

7. A typewriter comprising a frame, a type bar pivotally mounted on said frame, a type carrying member pivotally mounted on said type bar about an axis substantially tangential to the circle of movement thereof, and arranged to lie substantially parallel to said type bar when said type bar is in the rest position, means for actuating said type bar, and means connected between said type carrying member and said frame for causing said type carrying member to rotate during movement of said type bar into the correct position for writing, said last mentioned means including a slider slidably mounted on said type bar, a push rod connected between said type carrying member and said slider, an adjustable stop on said type bar for limiting the path of movement of said slider, a mechanism connected between said slider and said frame for causing said slider to move during movement of said type bar, said mechanism comprising a pin mounted on said slider, a bell-crank lever pivotally mounted on said type bar, said bell-crank lever having one arm connected to the pin on the slider, a link pivotally connected at one end to the other end of said bell-crank lever, and a pivot connecting the other end of the link to the frame.

8. A typewriter comprising a frame, a type bar pivotally mounted on said frame, a type carrying member pivotally mounted on said type bar about an axis substantially tangential to the circle of movement thereof, and arranged to lie substan-

5 tially parallel to said type bar when said type
bar is in the rest position, means for actuating
said type bar, and means connected between said
type carrying member and said frame for caus-
10 ing said type carrying member to rotate during
movement of said type bar into the correct posi-
tion for writing, said last-mentioned means in-
cluding a slider slidably mounted on said type
bar, a push rod connected between said type
15 carrying member and said slider, an adjustable
stop on said type bar for limiting the path of
movement of said slider, a mechanism connected
between said slider and said frame for causing
said slider to move during movement of said type
bar, said mechanism comprising a pin mounted
on said slider, a bell-crank lever pivotally mount-

ed on said type bar, said bell-crank lever having
one arm connected to the pin on the slider, a link
pivotally connected at one end to the other end
of said bell-crank lever, and a pivot connecting
the other end of the link to the frame, the pivot 5
about which the type bar moves; the pivot con-
necting the link to the frame and the pivot con-
necting the link to the bell-crank lever being in
alignment when the type bar is in the position
of rest, so that at the beginning of movement 10
of the type bar from its position of rest the bell-
crank lever remains practically immovable rela-
tive to the type bar whereby the slider and type
carrying member remain substantially immov-
able relatively to the type bar.

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