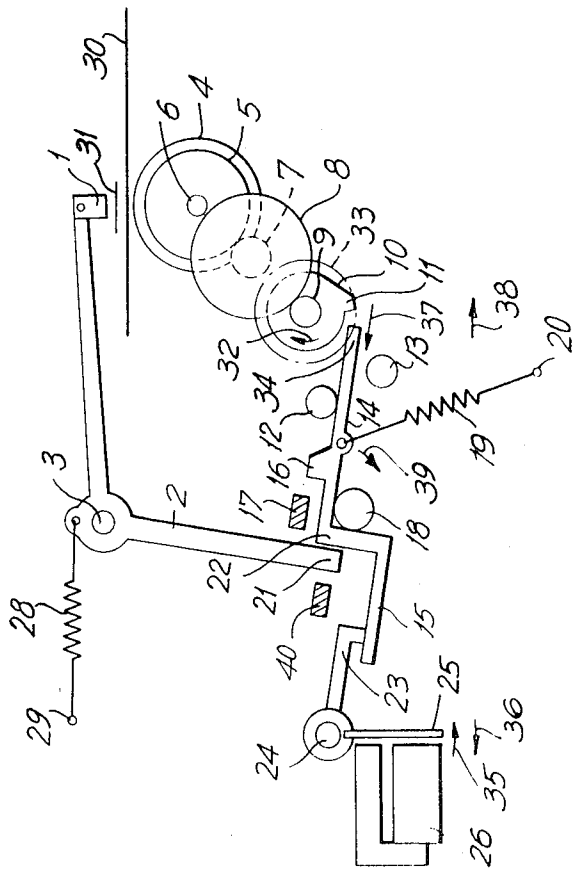
Nov. 30, 1971 ISSEI IMAHASHI ET AL 3,623,429

HAMMER LEVER CONSTRUCTION FOR FLYING PRINTER

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FIG. 1



HAMMER LEVER CONSTRUCTION FOR FLYING PRINTER

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FIG. 2

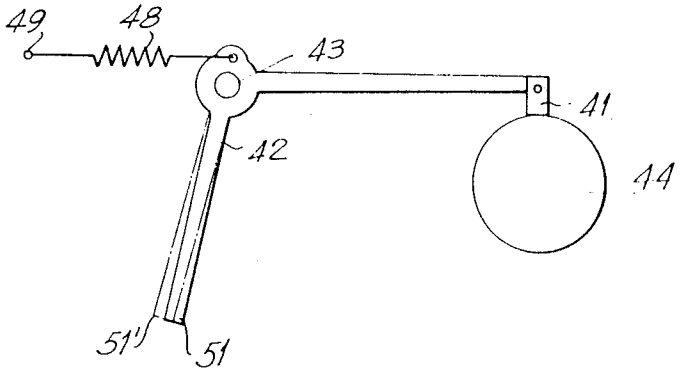
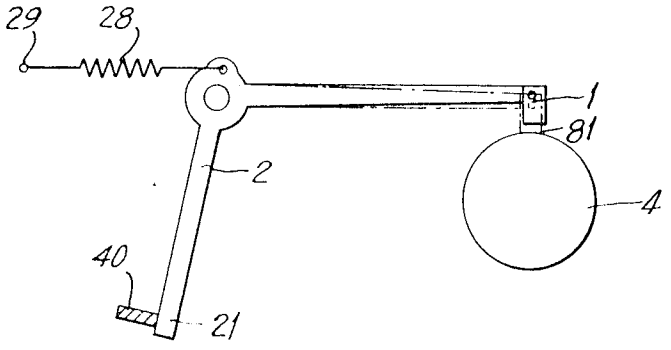


FIG. 3



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3,623,429

HAMMER LEVER CONSTRUCTION FOR FLYING PRINTER

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Int. Cl. B41j 9/26, 9/42
U.S. Cl. 101—93 2 Claims

ABSTRACT OF THE DISCLOSURE

The improvement in flying printers having a continuously rotating print drum, a hammer lever having a hammer mounted at one end thereof for striking said print drum upon the displacement of said hammer lever to effect printing and means for displacing said hammer lever, which includes the provision of a hammer lever stopper disposed to engage said hammer lever at a point spaced from said hammer to stop the displacement of said hammer lever immediately before said hammer strikes said print drum.

BACKGROUND OF THE INVENTION

This invention relates generally to a flying printer utilized in electronic desk calculators and other numerical readout devices. In such flying printers, the hammer strikes a character disposed on a continuously rotating print drum. However, the known arrangements of this type of printer have several substantial drawbacks. Specifically, shear will occur in the printing process if the contact time between the hammer and the print dum is too great, resulting in smudged printing or ripped paper. In order to overcome this defect, the contact time of the hammer with the character must be shortened, thereby increasing the operating speed of said hammer.

SUMMARY OF THE INVENTION

Generally speaking, in accordance with the invention, an improvement in flying printers having a continuously rotating print drum, a hammer lever having a hammer mounted thereon for striking said print drum upon the displacement of said hammer lever to effect printing and means for displacing said hammer lever, is provided. The improvement consists of providing a hammer lever stopper disposed to engage said hammer lever at a point spaced from said hammer to stop the displacement of said hammer lever immediately before said hammer strikes said print drum.

The hammer lever is preferably L-shaped and mounted for rotation about the corner defined by the two arms thereof. Said hammer is preferably mounted on one of said arms while said hammer lever stopper preferably engages the other of said arms.

Said means for displacing said hammer lever preferably consists of a trigger lever adapted for linear and pivotable displacement, a ratchet wheel having at least one tooth continuously rotated in synchronization with said print drum and adapted to linearly displace said trigger lever when said trigger lever is disposed in the path of said ratchet wheel tooth, and means for pivotably displacing said trigger lever into and out of the path of said ratchet wheel tooth.

Accordingly, it is an object of this invention to provide a flying printer having a minimum contact time between the hammer and print drum thereof, whereby extremely clear characters are printed.

Another object of the invention is to provide a flying printer wherein hammer stopper means are provided to stop the displacement of the hammer lever thereof immediately before the hammer strikes the print dum to effect printing.

Still other objects and advantages of the invention will in part be obvious and will in part be apparent from the specification.

The invention accordingly comprises the features of construction, combinations of elements, and arrangements of parts which will be exemplified in the constructions hereinafter set forth, and the scope of the invention will be indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the invention, reference is had to the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a schematic representation of one column of a flying printer according to the invention;

FIG. 2 is an exploded view of the hammer lever of the flying printer of FIG. 1 without the hammer lever stopper according to the invention, showing the action thereof during printing; and

FIG. 3 is an exploded view of the hammer lever of the flying printer of FIG. 1 with said hammer lever stopper showing the action of said hammer lever during said printing operation.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, a schematic representation of one column of a flying printer according to the invention is shown. The column includes a print hammer **1** mounted on one arm of an L-shaped hammer lever **2**. Said hammer lever is pivotably mounted at the corner defined by the arms thereof on hammer lever shaft **3**. Disposed immediately below hammer **1** is print drum **4** having characters spaced on the peripheral surface thereof. Said print drum and a print drum gear **5** are mounted on print drum shaft **6** for rotation therewith. Shaft **6**, which defines the axis of said print drum is disposed immediately below the position assumed by hammer **1** when it strikes said print drum, whereby said hammer is disposed normal to said axis when striking said print drum. Print drum gear **5** meshingly engages intermediate pinion **7** for the rotation of said pinion and intermediate gear **8** fixed thereto. Said intermediate gear, in turn, meshingly engages with ratchet gear **9** for the rotation of ratchet wheel **10**. Said ratchet wheel is shown formed with a single tooth **11** but could be formed with a plurality of circumferential teeth if desired. The gear ratio between gears and pinions **5**, **7**, **8** and **9** is selected so that the pitch time of tooth **11** equals the circumferential spacing of the characters on the peripheral surface of print drum **4**. Thus, each rotation of tooth **11** corresponds to the advancing of one character on said print drum.

First and second trigger lever guide pins **12** and **13** are provided disposed on either side of trigger lever **14**. Said trigger lever is formed with a tail portion **15** and a projection **16**. Trigger lever **14** is adapted for pivotal and linear displacement and trigger lever guide member **18** is provided to guide said trigger lever during said displacement. A spring **19** is secured between lever **14** and a fixing point **20** for biasing said trigger lever out of the path of tooth **11**. The end of arm **21** of hammer lever **2** is disposed to be engaged by shoulder **22** of trigger lever **14** upon the linear displacement of said trigger lever to pivot said trigger lever, whereby hammer **1** strikes print drum **4**. Timing lever **23** is disposed to engage tail **15** of trigger lever **14** and is pivotably mounted on timing lever shaft **24**. Fixed to said timing lever is a magnetic plate **25** adapted to cooperate with an electromagnet **26** for the pivoting of said magnetic plate and timing lever in response to the activation of said electromagnet. Spring **28**

is mounted between the corner of hammer lever 2 and fixing point 29 to normally bias said hammer lever in the position shown with hammer 1 spaced from print drum 4. Interposed between said hammer and said print drum are paper 30 upon which the character is to be imprinted and inked ribbon 31. Hammer lever stopper 40 is provided in the path of arm 21 of hammer lever 2.

In FIG. 1, only one column is illustrated by way of example. However, an actual printer would include the desired number of columns, each of which would comprise a hammer 1, a hammer lever 2, a trigger lever 14, a trigger lever spring 19, a timing lever 23, a magnetic plate 25, an electromagnet 26, and a hammer lever spring 28.

Turning now to the operation of the flying printer according to the invention, reference is had to FIGS. 1, 2 and 3. When the flying printer is activated but no timing signals are applied to the electromagnets, ratchet wheel 10 rotates in the direction of arrow 32, thereby also rotating print wheel 4 in the manner described above. Said print wheel rotates in the same direction as said ratchet wheel. The rotation of tooth 11 of said ratchet wheel follows a path defined by dashed line 33. In the absence of any signal energizing electromagnet 26, the column is disposed with end 34 of trigger lever 14 disposed outside of the path of tooth 11 and maintained in that position by spring 19. When so disposed, trigger lever 14 is positioned by means of second trigger lever pin 13 and trigger lever guide member 18. Magnetic plate 25 is also maintained spaced from electromagnet 26 in the direction of arrow 35 by spring 19 acting through tail 15 of said trigger lever which engages timing lever 23.

In order to print a character, a pulse signal is applied to electromagnet 26 immediately before the desired character on the peripheral surface of print drum 4 passes under hammer 1. The activation of said electromagnet rotatably displaces magnetic plate 25 in the direction of arrow 36, carrying timing lever 23 therewith. Said timing lever engages the tail 15 of trigger lever 14 to rotate said trigger lever in the counterclockwise direction about trigger lever guide member 18. When so disposed, as shown in FIG. 1, end 34 of said trigger lever lies in the path of tooth 11, whereby it may be linearly displaced in the direction of arrow 37 thereby.

The linear displacement of trigger lever 14 is transmitted to arm 21 of hammer lever 2 by means of shoulder 22 of said trigger lever. Said hammer lever is in turn rotated in a counterclockwise direction causing hammer 1 to strike the print drum through inked ribbon 31 and paper 30 at the moment that the desired character is positioned under said hammer.

At this point in the cycle, it is necessary to rotate hammer lever 14 in the clockwise direction to bring end 34 thereof out of the path 33 of tooth 11 before said tooth completes a single revolution. If this is not done, the trigger lever will be linearly displaced in the direction of arrow 37 a second time during the next revolution of ratchet wheel 10, resulting in the double striking of hammer 1 on a single line.

Several features of the flying printer according to the invention contribute to this result. The first of these is trigger lever stopper 17 which cooperates with projection 16 on trigger lever 14, to operate as follows. At the moment that end 34 of said trigger lever is struck by tooth 11, hammer lever 2 starts its rotation. Specifically, at the moment that said trigger lever is struck by said tooth, said trigger lever starts its linear displacement in the direction of arrow 37 at a speed slightly faster than that of said tooth. At the same moment, arm 21 of hammer lever 2 starts its displacement at a speed slightly faster than that of said trigger lever. This results from the fact that the coefficient of restitution at each striking point is not equal to zero. Further, after hammer 1 strikes the desired character, hammer lever 2 returns to its original position at a faster speed than does trigger lever 14. Accordingly, in the absence of trigger lever stopper 17, arm 21 of said hammer lever would tend to again strike shoulder 22 of said trigger lever, causing said hammer lever to again rotate in the clockwise direction causing hammer 1 to again strike a character. The resulting double striking on a single line is of course undesirable. This possibility is avoided by the striking of projection 16 against trigger lever stopper 17 immediately before hammer 1 strikes the character so that trigger lever 14 rebounds in the direction of arrow 38 before the return of hammer lever 2 to its original position. In this manner, arm 21 of said hammer lever will not strike shoulder 22 during said return.

The striking of projection 16 against trigger lever stopper 17 also serves to rotate said trigger lever in the direction of arrow 39 during the return thereof to its initial position. This effect serves to bring end 34 of said trigger lever out of the path of tooth 11. Also contributing to this rotation is spring 19 which tends to return said trigger lever to its original position with the inner surface of shoulder 22 resting against trigger lever guide member 18 and end 34 of said trigger lever out of the path of tooth 11.

The operation of hammer lever stopper is shown in FIGS. 2 and 3. In FIG. 2, the arrangement is shown without said hammer lever stopper. In response to the linear displacement of the trigger lever, hammer lever 42 is rotatably displaced about shaft 43 to bring hammer 41 into engagement with print drum 44. Spring 48 is connected between the corner of said hammer lever and fixed point 49 to return said hammer lever to its original position after printing. After hammer 41 strikes said print drum, arm 51 continues to bend, assuming the position 51' shown in dashed lines. This bending time is determined by the natural frequency of the hammer lever. During said bending action, hammer lever 42 vibrates horizontally. Further, the contact time of the hammer with the character will be relatively long, of the order of several hundred ms. This results in shear in printing, including the tearing of the paper and the smudging of the printed character.

On the other hand, when hammer lever stopper 40 is provided, this defect is avoided. Referring to FIG. 3, the hammer lever 2 is shown after being struck by trigger lever 14, with the arm 21 of said hammer lever engaged against hammer lever stopper 40. Hammer lever stopper 40 is positioned so that it engages arm 21 of said hammer lever before hammer 1 strikes print drum 4, so that a gap 81 remains between said hammer and said print drum at the instant of said engagement. After most of the kinetic energy of hammer lever arm 21 is absorbed by the striking of said arm against hammer lever stopper 40, hammer 1 strikes a character as shown in dashed lines. The hammer 1 can then immediately restore itself to its initial position so that the time during which said hammer contacts with said print drum is negligibly short. In this manner, shear in printing is avoided.

Since the hammer lever is not operated directly, but rather is operated indirectly through the trigger lever, the contact time of the hammer with the character is determined by the natural frequency of the hammer lever and the kinetic energy of the other arm of the hammer lever. Accordingly, in such flying printers, the provision of a stopper adapted to engage said other arm of the hammer lever substantially shortens the contact time of the hammer of the character on the printer.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed:

1. A flying printer having a continuously rotating print drum, a susbtantially L-shaped hammer lever formed from a single flat plate member having two flexible arms and mounted for pivotal displacement substantially about the junction of its two arms, said hammer lever having a hammer mounted on one of said arms for striking said print drum upon the displacement of said hammer lever to effect printing, means for displacing said hammer lever, including a separate trigger lever adapted for at least linear displacement, said trigger lever being positioned to strike the other of said hammer lever arms for the pivotal displacement of said hammer lever, and a hammer lever stopped disposed to engage said other of said hammer lever arms at a point spaced from said hammer to stop the displacement of said hammer lever at said point, immediately before said hammer strikes said print drum, said hammer mounting arm of said hammer lever being adapted to flex to permit said hammer to strike said print drum.

2. A flying printer having a continuously rotating print drum; a substantially L-shaped hammer lever adapted for pivotal displacement substantially about the junction of its two arms, said hammer lever having a hammer mounted on one of said arms for striking said print drum upon the displacement of said hammer lever to effect printing; means for displacing said hammer lever, including a separate trigger lever adapted for rotational and linear displacement and positioned to strike the other of said

hammer lever arms for the pivotal displacement of said hammer lever, a continuously rotating ratchet wheel having at least one tooth extending therefrom for linearly displacing said trigger lever when said trigger lever is disposed in the path thereof, means for selectively rotating said trigger lever into and out of the path of said ratchet wheel tooth to effect printing, and means for rotating said ratchet wheel in synchronization with said print drum; and a hammer lever stopper disposed to engage said other of said hammer lever arms at a point spaced from said hammer to stop the displacement of said hammer lever at said point, immediately before said hammer strikes said print drum, said hammer lever being adapted to flex to permit said hammer to strike said print drum.

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