

[54] **PAPER FEED MECHANISM FOR DATA PRINTERS**

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[73] Assignee: **Addmaster Corporation**, San Gabriel, Calif.

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[51] Int. Cl. **B41j 21/00**

[58] Field of Search. **197/114, 116, 117, 197/118, 127; 101/66, 93, 235, 288, 233**

[56] **References Cited**
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Primary Examiner—Robert E. Pulfrey

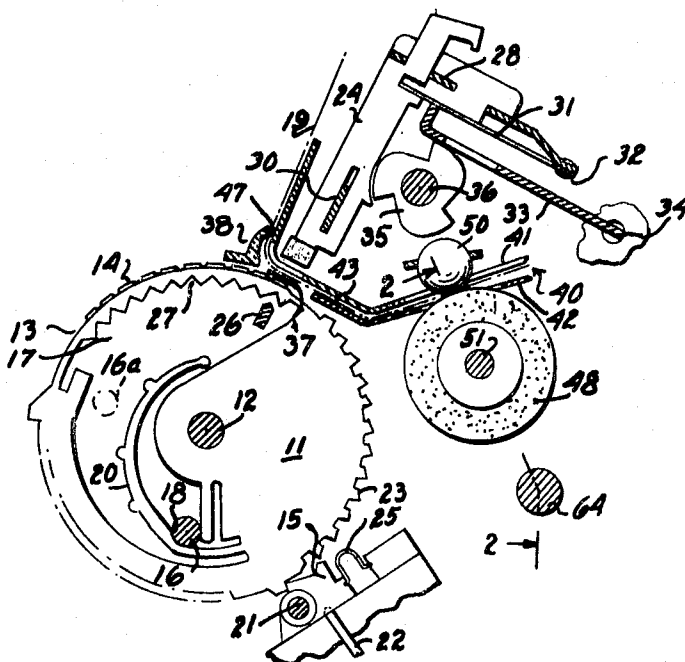
Assistant Examiner—R. T. Rader

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[57] **ABSTRACT**

A paper feed device for data printers in which the paper is pushed endwise through a guide channel past the printing station to line space the paper. In order to adequately space the paper to a position where the last printed amount can be read by the operator and to insure consistent line spacing, it is first retracted an amount equal to one line space plus a fraction thereof and is then pushed endwise in an advancing direction an amount equal to such fraction to correct for backlash in the paper drive mechanism and to compress the paper within the guide channel. Following printing, the paper is further advanced by an amount equal to two line spaces to enable the newly printed amount to be visible to the operator. When it is desired to double space the paper, the retraction thereof is limited to an amount equal to such fraction.

10 Claims, 6 Drawing Figures



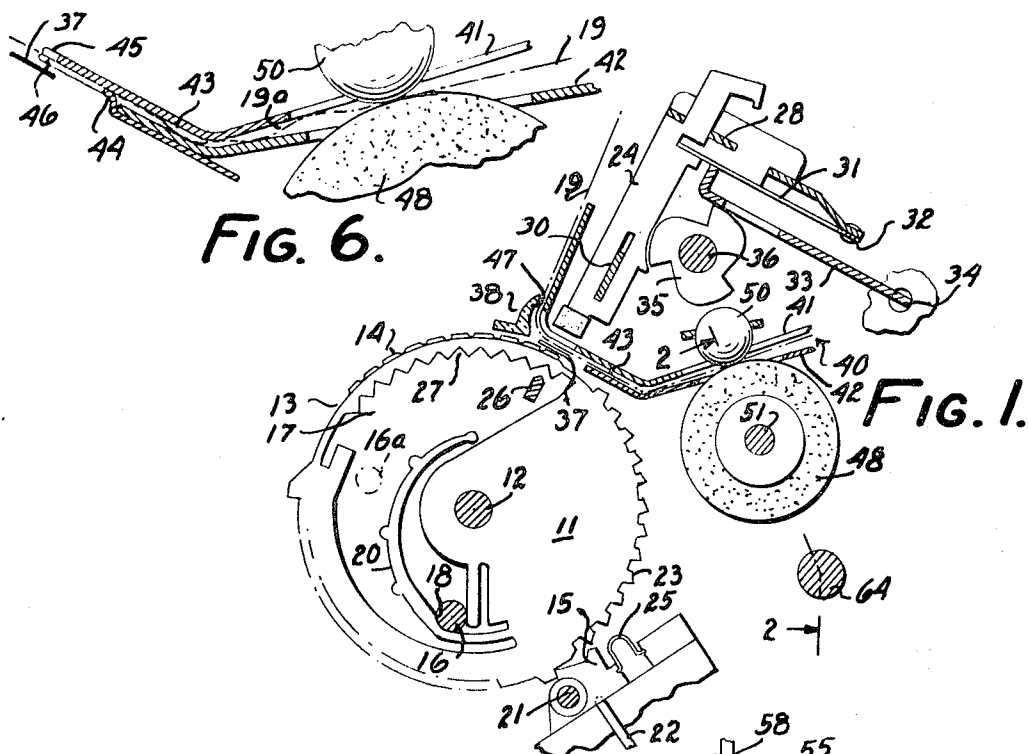


FIG. 6.

Fig. 1.

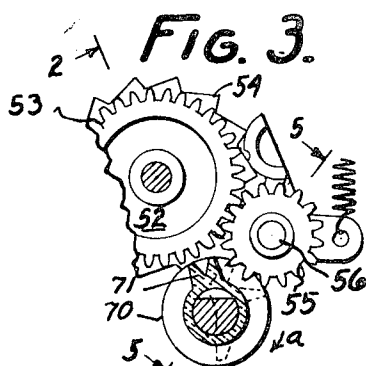


FIG. 3.

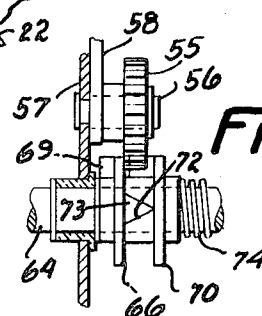


Fig. 5.

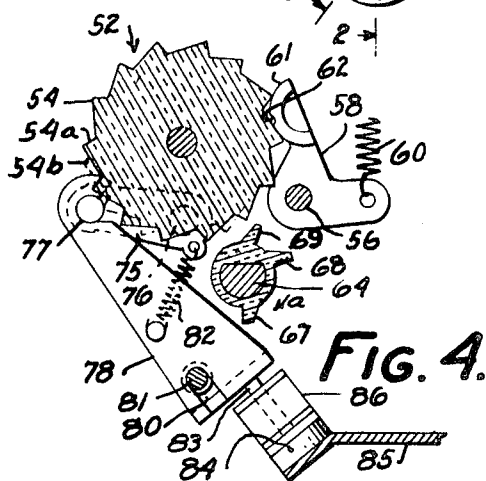


FIG. 4.

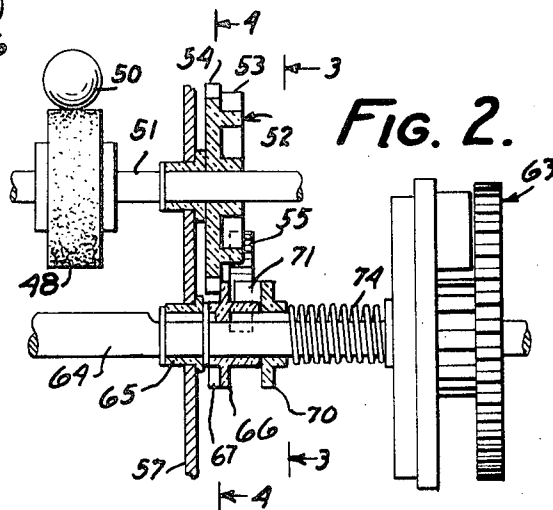


FIG. 2.

PAPER FEED MECHANISM FOR DATA PRINTERS

BACKGROUND OF THE INVENTION

1. Field Of The Invention

This invention relates to paper feeding mechanism for data printers and has particular reference to line-feed mechanism for such printers.

2. DESCRIPTION OF THE PRIOR ART

Data printers of the type disclosed and claimed in the U.S. Pat. to H. L. Clary et al., No. 3,151,546, issued on Oct. 6, 1964, and in the copending patent application of D. Weinkle, Ser. No. 52,264, filed July 6, 1970, have proved very satisfactory due to their low cost, simplicity and compactness. In such printers, the paper is pushed rather than pulled past the printing point during line spacing. Data is printed on the underside of the paper and the latter is then turned or folded at approximately 90° so as to make the last printed line of data visible. However, printers of this type present a unique problem in feeding the paper to different line space positions. That is, in order to make the last printed line of data visible to the operator and yet maintain single spaced print lines relatively close to each other, the paper must first be withdrawn or pulled in a retrograde direction to position a new printing line at the printing point and then, after printing a new line of data, it must be pushed to a position where such new line can be read. During the retrograde movement, the paper is substantially stretched taut within its guide channel, but after printing the paper must be pushed past the printing point to a position where such new line can be read.

Due to the location of the printing mechanism adjacent the printing point, the paper feeding device must, of necessity, be located upstream and a certain distance from such printing point. Since paper of the type used in such printers is normally on the order of 0.003 to 0.004 inches thick, it tends to buckle or collapse when pushed endwise and must be adequately guided within appropriate guide channels or chutes. However, in order to enable free movement of the paper and to provide for various tolerances in manufacture, it is necessary to form such guide channels with the paper guiding surfaces spaced apart considerably greater than the thickness of the paper. Accordingly, when the paper is pushed along the guide channel, it tends to compress and to form a wavy configuration within the channel, with the crests of such waves engaging the guiding surfaces. Due to such collapsing or buckling of the paper, it must be pushed a greater amount than would otherwise be necessary in order to compensate for the reduction in overall length because of such buckling and in order to move the last printed line to a position where it can be readily viewed. Another factor involved is the backlash occurring in the paper feeding mechanism itself when the direction of paper feed is reversed.

This problem is aggravated and becomes especially difficult to overcome when the paper is fed various amounts. For example, it is desirable in some cases to line space the paper double amounts following printing of totals, subtotals, or the like, wherein such double spacing is accomplished by omitting the retrograde movement of the paper prior to the next line of data. Since the paper is alternately stretched and then compressed endwise in the guide channel during normal single line spacing operations but is successively compressed endwise during double line spacing, inconsis-

tent line spacing results. Backlash in the paper feed mechanism which occurs when reversing the direction of paper feed also contributes to such improper spacing.

SUMMARY OF THE INVENTION

According to the present invention, the above noted problems in line spacing the paper in printers of the above type are overcome by first retracting or pulling the paper past the printing point somewhat more than a single line space in a retrograde direction (in single line spacing operations) and thereafter, but prior to printing, advancing or pushing the same forwardly a fraction of such line space, causing the same to compress or buckle within the guide channel and also taking up any backlash in the paper feeding mechanism. After printing, the paper is further pushed forwardly two line spaces to locate the last printed line in a position visible to the operator.

In order to double space the paper, it is first retracted only a fraction of a line space and is then pushed forwardly the same or a similar increment to likewise cause it to compress within its guide channel and to take up the backlash in the paper feed mechanism. Later, after printing, the paper is further advanced two line spaces as before.

It therefore becomes a principal object of the present invention to insure consistent paper line spacing in printers of the above type.

Another object of the present invention is to provide a variable line spacing mechanism for data printers of the above type.

Another object is to eliminate variations in line spacing in printers of the above type due to endwise compression of the paper within its guides or due to backlash arising from driving the paper in opposite directions.

BRIEF DESCRIPTION OF THE DRAWINGS

The manner in which above and other objects of the invention are accomplished will be readily understood on reference of the following specification, when read in conjunction with the accompanying drawings, wherein:

FIG. 1 is a sectional elevation view through a preferred form of the present invention.

FIG. 2 is a transverse sectional view taken substantially along the line 2—2 of FIGS. 1 and 3.

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 2.

FIG. 4 is a sectional view taken substantially along the line 4—4 of FIG. 2.

FIG. 5 is a sectional view taken substantially along the line 5—5 of FIG. 3.

FIG. 6 is an fragmentary enlarged sectional view illustrating the endwise compression or buckling of the paper in its guide channel.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The particular embodiment of the invention disclosed herein is adapted to the well known commercially available ADDMASTER READOUT PRINTER for printing data derived from electronic calculators, computers and other data processing equipment. Certain of the various operating instrumentalities for such printers are disclosed in the aforementioned H. L.

Clary et al. U.S. Pat., No. 3,151,546 and the pending D. Weinkle Pat. application, Ser. No. 52,264 which has matured into U.S. Pat. No. 3,664,259, issued on May 23, 1972. Accordingly, reference is hereby made to said patents for an understanding of details of mechanism not specifically disclosed herein. However, the invention is equally applicable to adding machines, calculating machines, cash registers and the like.

Referring particularly to FIG. 1, the printer comprises a plurality of printing sectors arranged in side-by-side relation, one of which is shown at 11. The sectors are pivotally supported independently of each other on a support shaft 12. Each sector has an arcuate type section 13 having printing type characters 14 spaced therealong and ranging in value from 0 to 9. Other symbols may also be added.

Cyclically operable motor driven means are provided for yieldably advancing the various sectors 11 in a clockwise direction from their illustrated home positions during the first half of a printer cycle until differentially arrested by respective pawls 15. Imprints are made from different type characters 14 onto a paper tape 19 and following printing, the sectors are again returned to their home positions. For this purpose, a bail rod 16 extends through openings 17 in the sectors and engages shoulders 18 formed on yieldable tails 20 which are integral with the sectors. During the first part of each cycle, the bail rod 16 is swung clockwise in an orbit about the shaft 12 from its illustrated home position to its dotted line position 16a to yieldably advance the sectors 11. At appropriate angular positions of the sectors, the pawls 15 are rocked counterclockwise about a pivot shaft 21 by push rods 22 which are actuated by suitable electromagnets (not shown) to engage teeth 23 on the sectors and thus lock the latter in positions to present selected ones of the type characters 14 to a printing line or station located directly under a series of print hammers 24. Toggle springs 25 act to hold the pawls 15 in locking condition, and an aligner bar 26 is moved upwardly to engage in notches 27 formed in the type sections 13 to centralize the sectors 11 for printing.

The print hammers 24 are aligned with respective ones of the sectors 11 and are guided for endwise movement radially of the sectors by stationary guide members 28 and 30.

Leaf springs 31 are connected at one end to respective ones of the hammers 24 and are anchored at 32 to a part of the printer frame. Such springs tend to impel the hammers downwardly but are normally held in their upper illustrated positions by a cam follower 33 pivotally supported at 34 and normally engaged by a three-lobed cam 35 carried by a printer control shaft 36. During the printing phase of a cycle and after the various sectors 11 have been differentially advanced, the cam 35 is rotated clockwise one third revolution, allowing the cam follower to drop off one of the lobes of cam 35 and enabling the springs 31 to impel the hammers 24 downwardly to impact the paper 19 against a printing ribbon 37 and underlying type characters 14 to transfer an imprint onto the underside of the tape. Thereafter, and during the latter part of the cycle, the bail rod 16 is returned counterclockwise to its home position and the tape 19 is advanced under a tear-off bar 38 so that the last printed amount will be visible to the operator, directly above the upper edge of such tear-off bar.

The paper tape 19 is fed from a suitable supply roll (not shown), through a paper guide chute or channel 40 comprising two spaced guide members 41 and 42 which converge slightly toward the left in FIG. 1 to a throat portion 43 where they extend parallel and upwardly toward the printing point or printing station which is located directly below the hammers 24. As seen in FIG. 6, a thin flexible shroud member 44 is suitably attached to the lower guide member 42 and lightly presses the tape 19 upwardly into frictional engagement with the underside of the upper guide member 41 adjacent the printing point to normally separate the paper from the ribbon 37. The guide member 41 has openings 45 therein to permit the various hammers 24 to pass therethrough into engagement with the paper 19. The forward portion of the guide member 41 is bent upwardly at substantially 90° to form an upwardly extending guiding surface for the paper.

The tear-off bar 38 has an inner concave paper guiding surface 47 adapted to guide the leading edge of the paper tape upwardly during threading of the tape through the printer. Such surface causes the paper to bend upwardly and to substantially follow the vertical forward portion of the guide member 41 so that the last printed amount will be visible to the operator.

The paper 19 is moved in either direction by a roller 48 of elastomeric material and is pressed into intimate frictional engagement with such roller by a ball 50 which is spring urged toward the roller.

In accordance with the present invention, and during printing operations requiring single line spacing of the paper, the roller 48 is rotated clockwise to retract the paper one and one half line spaces during the first part of a cycle and prior to the printing phase. During this movement, the paper is stretched relatively taut between the shroud member 44 and the roller 48. Thereafter and also prior to printing, the roller is advanced counterclockwise, an amount equal to one half line space, compressing the paper endwise in the chute 40 and causing it to assume a wavy or buckled configuration, as seen at 19a in FIG. 6. After printing, the roller 48 is again advanced counterclockwise an amount equal to two line spaces to bring the last imprint on the paper directly above the tear-off bar 38. Such imprint will be located a single line space below a previously formed imprint.

When the paper 19 is to be double spaced, however, the roller 48 is first retracted an amount equal to one half line space to stretch that portion of the paper in the throat 43, etc., and is then advanced one half line space in a counterclockwise direction to again compress the paper in its guide channel. After printing, the roller is further advanced two line spaces, as before, leaving the last imprint directly above the tear-off bar 38. However, such last imprint will be spaced two line spaces below the previously formed imprint.

Describing now the means for advancing and retracting the paper different amounts as noted above, the paper feed roller 48 is secured to a rotatable shaft 51, to which is also secured a gear member 52 having two sets of teeth 53 and 54 thereon. The gear teeth 53 are in continual mesh with a gear 55 rotatably mounted on a stud 56 supported by a member 57 forming part of the printer framework.

The pitch of teeth 54 is twice as great as that of teeth 53 and the nominal trailing surface 54a of each tooth is steeper than its leading surface 54b. The angular

spacing of adjacent ones of such teeth 54 is equal to a single line space of the paper 19. A detent pawl 58 is pivoted on the stud 56 and is urged counterclockwise by a tension spring 60 to engage an arcuate detenting surface 61 thereon between adjacent ones of the teeth 54. A slight depression 62 is formed on the detenting surface 61 and is effective to detent the tip of one of the teeth 54 and thereby detent the gear member 52 and the paper 19 in a position midway between two line space positions.

The drive means for the gear member 52 comprises a main motor driven cyclic clutch generally indicated at 63 which forms the main cyclic clutch for the printer. Such clutch 63 is mounted on a main drive shaft 64 which is rotatably mounted in bearings, one of which is shown at 65, carried by the framework, including frame member 57. During a cycle of the printer, under control of the clutch 63, the latter drives the shaft 64 one complete revolution in the direction of the arrow (a) in FIGS. 3 and 4.

A interrupted tooth gear 66 is firmly keyed to the shaft 64 and has three teeth 67, 68, and 69 thereon, each effective to engage the trailing surface 54a of a tooth 54 on the member 52 to incrementally advance the paper. A second mutilated gear 70 is rotatably and slidably mounted on the shaft 64 and has two teeth 71, (FIG. 3), effective to engage the teeth of gear 55 to incrementally retract the paper 19 one and one half line spaces. The gear 70 has an axially extending triangular notch 72 (FIG. 5) formed in the hub thereof which is normally engaged by a mating triangular tongue 73 extending axially from the gear 66. A compression spring 74 surrounding the shaft 64 is compressed between the clutch 63 and the gear 70 to normally maintain the two gears 66 and 70 in driving engagement with each other.

During normal single line spacing operations, the gears 66 and 70 are allowed to remain in driving engagement with each other, and shortly after the start of a cycle, the teeth 71 of gear 70 engage the gear 55 to drive the gear member 52 and paper one and one half line spaces, in a retrograde movement, leaving the tip of a tooth 54 engaged by the detenting indentation 62 on the pawl 58. The tooth 67 subsequently engages one of the teeth 54 and advances the gear member 52 and paper forwardly one half line spaces, to become fully detented by the pawl 58. After the ensuing printing operation, the tooth 68 will engage a succeeding tooth 54 to advance the paper one line space and thereafter, the second tooth 69 will also engage a successive tooth 54 to again advance the paper a second line space so that the last imprinted amount will now be visible directly above the tear-off bar 38.

Means are provided to selectably block the gear member 52 from retrograde movement beyond one half line space increment. For this purpose, a blocking pawl 75, (FIG. 4), is pivotally supported at 76 and carries a stud 77 engageable with a tooth 54 of the gear member 52. The pawl 75 is engaged by a hook 78 of ferrous material. The hook 78 is provided with a slot 80 slidably and rockably supported by a stationary frame stud 81. A spring 82 is tensioned between the pawl 75 and hook 78, which urges the pawl toward engagement with the gear member 52. Normally, however, the hook 78 is held in its illustrated position whereby to maintain the pawl 75 out of blocking position. For this purpose, the hook normally engages a magnetic core 83 attached to a permanent magnet 84 carried by a frame-

piece 85 and the magnetic flux developed in the cone holds the hook in such position. A bucking coil 86 is mounted directly over the magnet 84 and surrounds the core 83. When it is desired to double space the paper, the coil 86 is energized to buck the magnetic flux developed in the core and thus allow the spring 82 to move the pawl clockwise against an underlying tooth 54 of the member 52. Thereafter, when the shaft 64 is rotated as an incident to a printer cycle, the teeth 71 of gear member 70 will, as before, retract the gear member 52 through the gear 55. However, after a retrograde movement of one half increment, i.e., one half line space, the stud 77 of pawl 75 will block the succeeding tooth 54, thus also blocking the gear member 70 from further rotation. As the shaft 64 continues to rotate, the triangular tongue 73 on gear member 66 cams the gear member 70 axially along the shaft 64 against the action of spring 74 until the teeth 71 move endwise out of mesh with the gear 55. As the teeth advance past the gear 55, the gear member 70 will again be returned to its initial axial position by the spring 74. Subsequently, the tooth 67 of gear member 66 will engage a tooth 54 to advance the gear member 52 one half increment into its fully detented position where it will remain during the printing phase of the cycle. After printing, the succeeding teeth 68 and 69 will again advance the gear member 52 and consequently the paper two increments or line spaces so that the last printed amount will be located directly above the tear-off bar 38 but will be located two line spaces from the previously imprinted amount.

It will be seen from the foregoing that with obvious modifications the mechanism could be arranged to alternately triple space the paper.

I claim:

1. In a data printer having a printing station, printing means adjacent said station, cyclically operable drive means for said printing means, and means forming a channel for guiding a strip of paper past said station in either of opposite directions, said paper being of such flexibility that it will buckle against the sides of said channel when said paper is pushed endwise in said channel; the combination comprising retracting means operable prior to operation of said printing means for pulling said paper endwise in one direction in said channel a first predetermined amount whereby to present a print line to said printing means, advancing means operable after operation of said retracting means and prior to operation of said printing means for pushing said paper endwise in the other of said directions in said channel an amount sufficient to cause said paper to buckle against the sides of said channel, and advancing means operable after operation of said printing means for further pushing said paper a second predetermined amount whereby to line space said paper relative to said printing means.
2. The combination according to claim 1 comprising means for selectively causing said retracting means to pull said paper different amounts.
3. The combination according to claim 1 wherein said retracting means is yieldable,

comprising means for selectively arresting said retracting means when said retracting means has pulled said paper an amount less than said first predetermined amount.

4. The combination according to claim 1 wherein said channel has an entrance remote from said station and wherein said advancing means and said retracting means include a common paper feed roller adjacent the entrance of said channel and drivingly engageable with the paper.

5. In a data printer having a printing station, printing means adjacent said station, cyclically operable drive means for said printing means, and means forming a channel for guiding a strip of paper past said printing station; said paper being of such flexibility that it will buckle against the sides of said channel when said paper is pushed endwise in said channel; the combination comprising feeding means for said paper including a roller adjacent said channel; yieldable means operable prior to operation of said printing means for normally rotating said roller a predetermined amount in one direction to pull said paper in said channel, means operable after operation of said last mentioned means and prior to operation of said printing means for rotating said roller an amount less than said predetermined amount in the opposite direction to push said paper in said paper in said channel an amount to cause said paper to buckle against the sides of said channel, means operable after operation of said printing means for rotating said roller in said opposite direction to push said paper a second predetermined amount whereby to line space said paper, and selectively operable means to arrest said yieldable means when said paper is retracted an amount less than said first mentioned predetermined amount.

6. In a data printer having a printing station, printing means adjacent said station, cyclically operable drive means for said printing means, and means forming a channel for guiding a strip of paper past said station from one printing line to another, said paper being of such flexibility that it will buckle against the sides of said channel when said paper is pushed endwise in said channel, the combination comprising retracting means operable by said drive means prior

to said operation of said printing means for pulling said paper in said channel an amount equal to one line space plus a fraction of said line space,

advancing means operable by said drive means after operation of said retracting means for pushing said paper in said channel an amount equal to said fraction whereby to cause said paper to buckle against the sides of said channel, and

advancing means operable after operation of said printing means for pushing said paper an amount equal to a multiple of said line space.

7. The combination according to claim 6 comprising means for selectively causing said retracting means to pull said paper an amount equal to said fraction of said line space only.

8. In a data printer having a printing station, printing means adjacent said station, cyclically operable drive means for said printing means and

means forming a channel for guiding a strip of paper past said printing station, said paper being of such flexibility that it will buckle against the sides of said channel when said paper is pushed endwise in said channel,

the combination comprising a paper feed roller adjacent said channel and engageable with said paper,

said feed roller being rotatable in a direction to pull said paper relative to said printing means and rotatable in an opposite direction to push said paper relative to said printing means,

first gear means operable by said drive means prior to operation of said printing means for rotating said feed roller in said paper pulling direction,

second gear means operable by said drive means after operation of said first gear means and prior to operation of said printing means for rotating said feed roller in said paper pushing direction whereby to cause said paper to buckle against the sides of said channel,

said second gear means being operable by said drive means after said printing operation for further rotating said feed roller in said paper pushing direction whereby to line space said paper.

9. The combination according to claim 8 wherein said first and second gear means comprise interrupted gear teeth whereby to incrementally move said paper.

10. The combination according to claim 8 comprising means for selectively varying the extent of rotation of said feed roller by said first gear means.

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