May 15, 1962 R. E. BUSCH 3,034,692

STRIP FEEDING DEVICE

Filed July 11, 1960 2 Sheets-Sheet 1

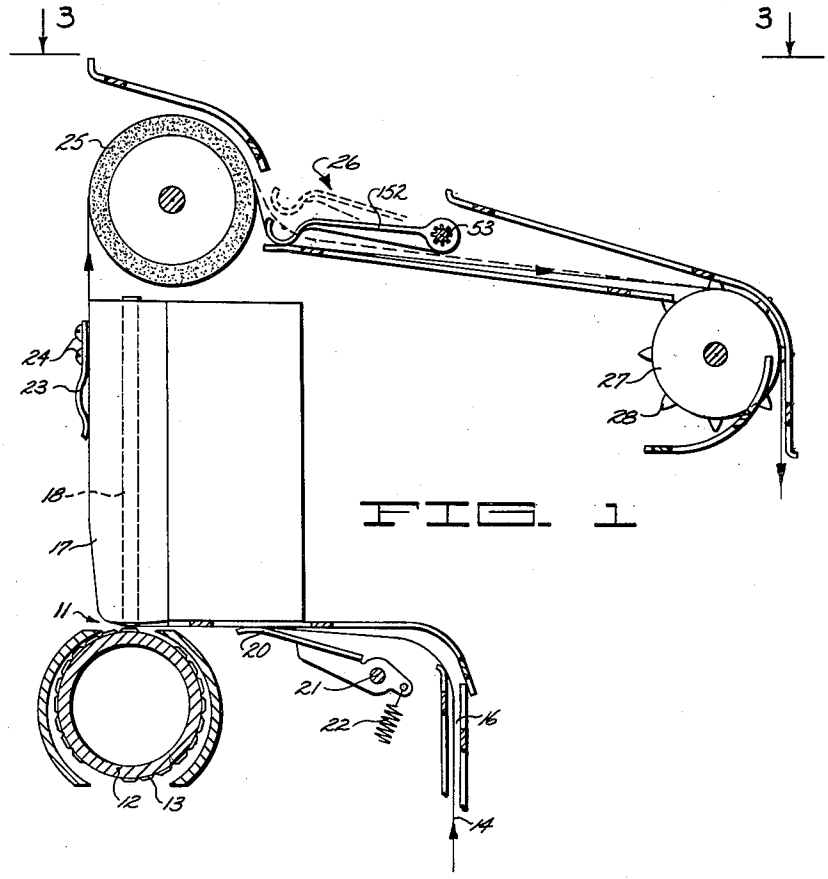


FIG. 1

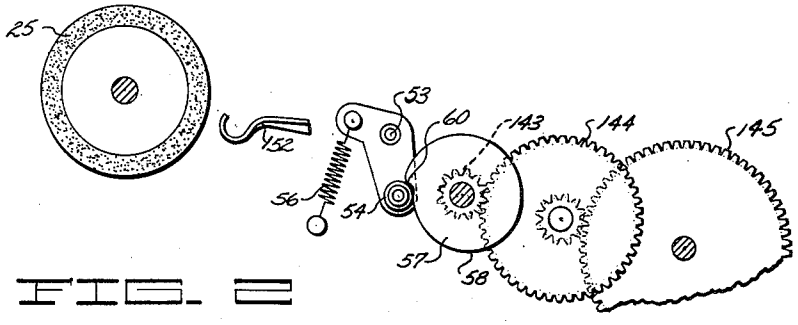


FIG. 2

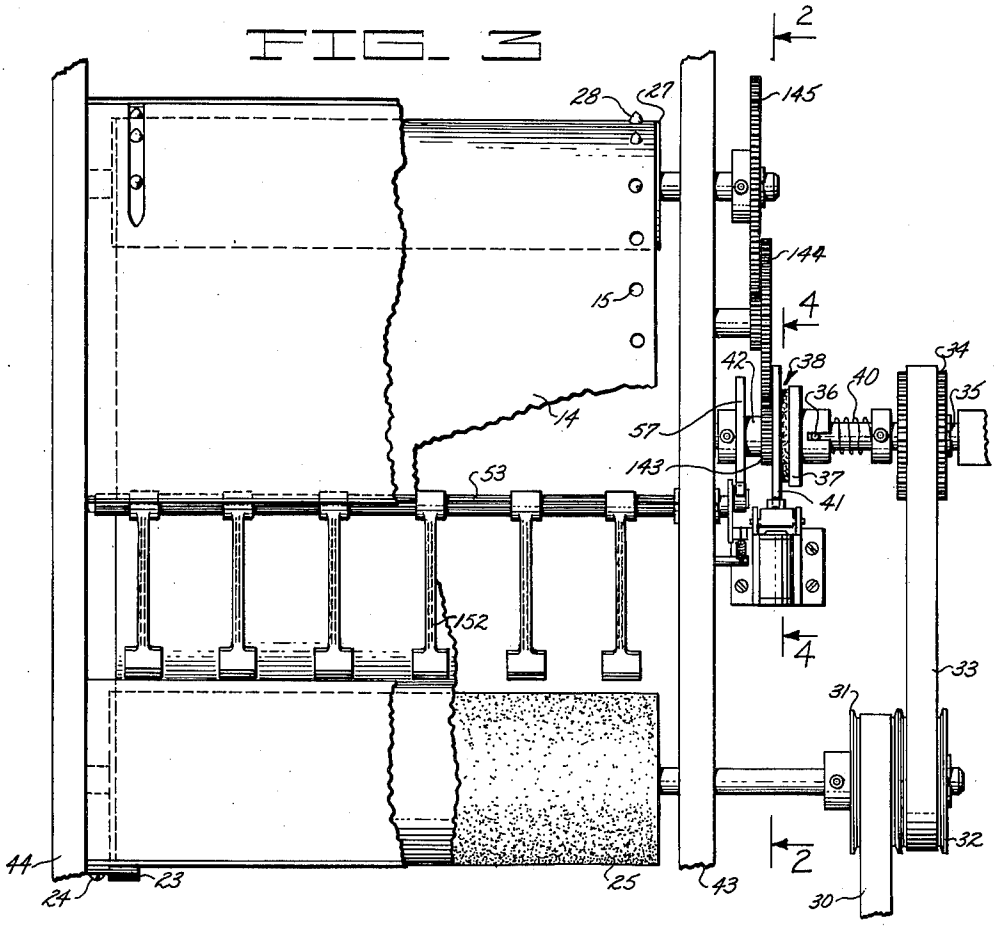
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FIG. 3



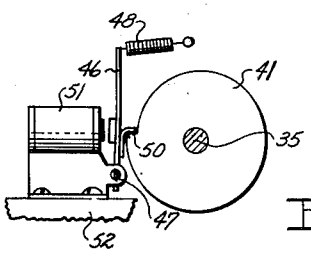


FIG. 4

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STRIP FEEDING DEVICE

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This invention relates to paper or record medium strip feeding devices for printers or the like and has particular reference to devices of this nature for intermittently feeding strips at high speeds.

High speed printers used to read out data from electronic data processing equipment and the like are, to a large extent, limited in speed of operaton to the speed of the recording strip. That is, the latter must be intermittently fed intermediate successive printing operations and the printing must be suspended during the traverse of the strip. In the case of serial printers, such recording strip must be fed from one character position to the next as an incident to each printing operation whereas in the case of parallel printers the record strip must be fed from one print line to the next, also as an incident to each printing operation.

Considering a parallel printer operating at a rate of 15 lines per second, at a line spacing of ⅜ inch per line and with a record strip advancement time limited to 10% (ten percent) of the total printing cycle time, it will be seen that such advancement must be accomplished in approximately .006 second. This imposes an excessive strain on operating parts normally used to advance the strip, such as a rotary printing platen, due to the acceleration forces which must be applied to the mass of such parts in order to accelerate the recording strip from zero to such average speed.

Although prior attempts have been made to overcome the above problem by intermittently engaging and disengaging a constantly driven frictional element with the record strip and thereby reducing the size of the mass necessary to be accelerated, problems arise in obtaining accurate spacing between printing points or printing lines due to the critical timing necessary in engaging and disengaging the drive element with the record medium.

It therefore becomes a principal object of the present invention to overcome the above noted problems.

Another object is to provide a high speed record medium feeding device in which only the record medium is intermittently and accurately advanced at high speed.

Another object is to eliminate tearing of sprocket fed paper or the like during intermittent high speed advancement of the paper.

Another object is to provide a simple yet highly reliable intermittent record medium feeding device.

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

FIG. 1 is a sectional view through a data printing device embodying a preferred form of the present invention.

FIG. 2 is a sectional view illustrating the gear train and related mechanism for driving the feed sprocket and for controlling the tension arms and is taken substantially along the lines 2—2 of FIG. 3.

FIG. 3 is a sectional plan view taken substantially along the line 3—3 of FIG. 1.

FIG. 4 is a sectional view taken substantially along the line 4—4 of FIG. 3, illustrating the cycle control device.

Referring to the drawings, the present invention is illustrated as being associated with a printer generally indicated at 11 (FIG. 1) and comprising a rotatable type drum 12 having a plurality of spaced circumferentially extending rows of type characters 13 thereon. A paper

strip 14 having sprocket perforations 15 spaced along opposite edges thereof is guided from a suitable source (not shown), through a guide way 16 and along the lower edge of a hammer support block 17. The latter slidably supports a plurailty of aligned hammers 18, each aligned with a corresponding row of type characters on the drum 12. Suitable electromagnetically operable means (not shown) are provided to move respective ones of the hammers 18 downwardly so as to contact the strip 14 when certain of the type characters are aligned with the hammers, whereby to transfer an imprint of such type characters onto the strip. Suitable means (not shown) is provided to apply ink to the type characters.

A drag device in the form of a friction shoe 20, pivotally supported at 21 and spring urged in a clockwise direction by a tension spring 22, yieldably presses the strip 14 against the lower surface of the block 17, thereby creating a drag on the strip as it is drawn past the printing hammers.

The strip 14 passes upwardly along the front surface of the block 17 and under a second drag device which comprises a pair of friction shoes, one of which is shown at 23. The latter takes the form of a leaf spring suitably secured at 24 to the block and effective to yieldably press the strip against the front surface of the block.

The strip passes around the upper portion of the periphery of a friction roller 25 having a sufficient friction characteristic to drive the strip when tensioned thereover. Thence, the strip passes under a strip tensioning device indicated at 26 and over a sprocket 27. The latter is provided with spaced sprocket pins 28 engageable with the perforations 15 in the strip for the purpose of advancing measured amounts of the strip downwardly to a suitable takeup receptacle (not shown).

The printer is driven by a continuously operated motor (not shown) through a belt 30 wrapped over a pulley 31 carried by the shaft of the roller 25. This shaft is rotatably mounted in bearings formed in side plates 43 and 44 forming part of the framework of the machine. A second pulley 32 attached to pulley 31 drives a second endless belt 33 which is wrapped over a pulley 34 secured to a shaft 35. The latter is suitably supported for rotation and is provided with a pin 36 fitted in a slot formed in the hub of a driving disc 37 of a friction clutch 38. The disc 37 is slideable on the shaft 35. A compression spring 40 surrounding the shaft 35 yieldably presses the disc 37 against a driven disc 41 of the clutch, which disc is attached on a hub 42 rotatably mounted on the shaft. Also attached on the hub is a gear 143 and a cam 57 to be described later.

The gear 143 is entrained with the sprocket 27 through a speed reducing gear train comprising gears 144 and 145, the latter being attached to the shaft of the sprocket 27.

Normally, the sprocket 27 is held at rest by means of a pawl 46, FIGS. 3 and 4, which is pivotally supported at 47 and held by a tension spring 48 in engagement with a shoulder 50 formed on the driven disc 41. The pawl 46 forms the armature of an electromagnet 51 supported by a bracket 52 suitably mounted on the frame plate 43.

The tension device 26 comprises a series of light tension arms 152 spaced along and attached to a shaft 53 which is rotatably mounted in bearings formed in the frame plates 43 and 44. Also attached to the shaft 53 is a cam follower 54 (FIG. 2) having a roller thereon which is urged by a tension spring 56 against the periphery of the control cam 57. The latter is provided with a relatively slow rise portion 58 extending throughout the major portion of its periphery and a relatively fast fall portion 60, the purpose of which will appear presently.

It will be noted that when the printer is in its normal condition shown wherein the sprocket 27 is arrested by engagement of the pawl 46 with the shoulder 50 of the

disc 41, the cam follower 54 and its roller engages the bottom of the rise portion 58 of the cam 57 wherein the tension arms 152 are held in their lower full-line positions shown in FIG. 1. In this condition, a slight amount of slack will be left in the portion of the strip extending between the roller 25 and the sprocket 27 whereby the roller 25 will be ineffective to drive the strip.

At the start of a print cycle, resulting in a print operation by one or more of the hammers 18 against the strip 14, a pulse is applied (through means not shown) through the electromagnet 51, causing the pawl 46 to release the disc 41 for rotation through one revolution. Accordingly, the sprocket 27 is rotated at a relatively slow speed compared to the speed of the roller 25. The sprocket is rotated an amount sufficient to advance the adjacent portion of the strip 14 through a distance equal to the distance between two adjacent print lines. It will be understood that such rotation of the sprocket occurs through approximately the entire print cycle although this is not necessary.

However, as the sprocket is so rotated the cam 57 causes the tension arms 152 to rise at a rate such that the strip is maintained in its slackened condition even though the portion of the strip adjacent the sprocket is being advanced by the sprocket relative to the portion extending over the roller 25.

Toward the end of the advancement of sprocket 27, the cam follower roller 54 is moved down the fall portion 60 of the cam 57 by spring 56, causing the tension arms 152 to drop from the dotted line position of FIG. 1 toward their full line position whereupon they yieldably engage the strip 14, thereby tensioning the same to frictionally engage the periphery of the roller 25. Accordingly, the roller becomes effective to rapidly advance that portion of the strip extending past the hammers 18. The tension arms 152 will reach their lowermost positons at approximately the same time or shortly before the sprocket 27 is arrested by the pawl 46 at which time the strip will be arrested due to slippage of the roller 25 relative thereto.

It will be noted from the foregoing that although the sprocket 27 and other parts of the paper feed mechanism having a relatively large mass are driven throughout the print cycle at a relatively slow speed, the portion of the strip which is moved past the printing station and which has a relatively small mass is advanced at a relatively high speed through only a small portion of such cycle. In the instant disclosure, such actual strip feed occurs throughout approximately only 10% (ten percent) of the entire print cycle. Accordingly, the only elements which move during this time are the strip itself, the tension arms 152, shaft 53 and cam follower 54, which are of relatively light mass.

Although I have described my invention in detail and have therefore used certain specific terms and language herein, it is to be understood that the present disclosure is illustrative rather than restrictive and that changes and modifications may be made without departing from the spirit or scope of the invention as set forth in the claims appended hereto.

Having thus described the invention, what I desire to secure by United States Letters Patent is:

1. Apparatus for intermittently advancing a flexible record strip comprising a source of drag for said strip, a drive element for advancing said strip, a roller frictionally engageable with said strip intermediate said source of drag and said drive element, means for continuously rotating said roller in a direction tending to advance said strip, means for causing said drive element to intermittently advance said strip, a tensioning device for said strip intermediate said roller and said drive element, and means for causing said tensioning device to tension said strip from a condition wherein said roller rotates relative to said strip to a condition wherein said roller frictionally advances said strip as an incident to advancement of said strip by said drive element.

2. Apparatus for intermittently advancing a flexible record strip comprising a source of drag for said strip, a drive element for advancing said strip, a roller frictionally engageable with said strip intermediate said source of drag and said drive element, means for continuously rotating said roller in the direction tending to advance said strip, means for causing said drive element to advance a portion of said strip through a predetermined distance, said roller being adapted to advance said strip at a higher rate of speed than said drive element, a strip tensioning device intermediate said roller and said drive element, and means for causing said tensioning device to tension said strip against said roller during a period of time less than the period of time during which said portion of said strip is advanced by said advancing means whereby to cause a frictional engagement of said strip with said roller to advance a remaining portion of said strip.

3. Apparatus for intermittently advancing a flexible record strip comprising a source of drag for said strip, a drive element for advancing said strip, a roller frictionally engageable with said strip intermediate said source of drag and said drive element, means for continuously rotating said roller in a direction tending to advance said strip, means for causing said drive element to intermittently advance a portion of said strip, a strip tensioning device intermediate said roller and said drive element, said tensioning device being adapted to tension said strip against said roller, means for moving said tensioning device from a position out of tensioning engagement with said strip through a predetermined distance to tension said strip whereby to cause frictional engagement of said strip with said roller, and means operable after commencement of movement of said drive element for causing operation of said last mentioned means.

4. Apparatus for intermittently advancing a flexible record strip comprising a source of drag for said strip, a drive element for advancing said strip, a roller frictionally engageable with said strip intermediate said source of drag and said drive element, means for continuously rotating said roller in a direction tending to advance said strip, means for causing said drive element to advance a portion of said strip through a predetermined distance, a strip tensioning device intermediate said roller and said drive element, means effective during at least a portion of said advancement of said strip by said drive element to first move said strip tensioning device out of tensioning engagement with said strip whereby to relieve tension on said strip, and means effective thereafter to move said tensioning device against said strip whereby to tension said strip into frictional engagement with said roller.

5. Apparatus for intermittently advancing a record strip having sprocket perforations therein comprising means forming a source of drag for said strip, a sprocket having sprocket pins engageable in said perforations for advancing said strip, a roller frictionally engageable with said strip intermediate said source of drag and said sprocket, means for continuously rotating said roller in a direction tending to advance said strip, means for intermittently rotating said sprocket to advance a portion of said strip, a strip tensioning device intermediate said roller and said sprocket, said tensioning device being normally out of tensioning engagement with said strip, and means for causing said tensioning device to tension said strip against said roller as an incident to rotation of said sprocket whereby to cause said roller to frictionally advance said strip.

6. Apparatus for intermittently advancing a flexible record strip having sprocket perforations therein comprising a source of drag for said strip, a sprocket having sprocket pins engageable in said perforations, a continuously rotating roller frictionally engageable with said strip intermediate said source of drag and said sprocket, said roller rotating in a direction tending to advance said strip, means for rotating said sprocket through a predetermined distance whereby to advance a portion of said

strip, a strip tensioning device intermediate said roller and said sprocket, means driven by said sprocket rotating means for first moving said tensioning device out of tensioning engagement with said strip whereby to relieve tension on said strip, and means for thereafter moving said tensioning device against said strip whereby to cause said roller to advance the portion of said strip adjacent said roller.

7. Apparatus for intermittently advancing a flexible record strip having sprocket perforations therein comprising a source of drag for said strip, a sprocket having sprocket pins engageable in said perforations, a continuously rotating roller frictionally engageable with said strip intermediate said source of drag and said sprocket, said roller rotating in a direction tending to advance said strip, means for rotating said sprocket wheel through a predetermined distance whereby to advance a portion of said strip, a strip tensioning device intermediate said roller and said sprocket, means including a cam driven by said sprocket rotating means for moving said tensioning device out of tensioning engagement with said strip during the major portion of said advancement of said strip by said sprocket, and means for thereafter moving said tensioning device into tensioning engagement with said strip whereby to cause said roller to advance the portion of said strip adjacent said roller.

8. Apparatus for intermittently advancing a flexible record strip having sprocket perforations therein comprising a source of drag for said strip, a sprocket having sprocket pins engageable in said perforations, a continuously rotating roller frictionally engageable with said strip intermediate said source of drag and said sprocket, said roller rotating in a direction tending to advance said strip, means for rotating said sprocket wheel a predetermined amount whereby to advance a portion of said strip, a strip tensioning device intermediate said roller and said sprocket, a cam driven by said sprocket rotating means, said cam having a slow rise portion and a fast fall portion, a cam follower operable by said rise portion for moving said tensioning device out of tensioning engagement with said strip during advancement of said strip by said sprocket whereby to relieve tension on the portion of said strip adjacent said roller, and spring means operable during movement of said cam follower along said fall portion for moving said tensioning device into tensioning engagement with said strip whereby to cause said roller to advance the portion of said strip adjacent said roller.

9. Apparatus for intermittently advancing a record strip comprising a source of drag for said strip, a drive element for advancing said strip, a constantly moving friction element adapted to engage said strip intermediate said source of drag and said drive element, said friction element tending to advance said strip, means for causing said drive element to advance a portion of said strip a predetermined distance, a strip deflecting device, and means for causing said deflecting device to deflect said strip from a condition out of frictional engagement with said friction element into frictional engagement with said friction element as an incident to advancement of said strip by said drive element, said last mentioned means being effective to move said deflecting device through a predetermined range of strip deflecting movement sufficient to cause said friction device to advance an adjacent portion of said strip a distance equal to the distance of advancement of said first mentioned portion by said drive element.

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