April 23, 1968 C. J. ANTONUCCI 3,379,125

TYPE SLUG IMPACT CONTROL IN HIGH SPEED CHAIN PRINTERS

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Fig. 1.

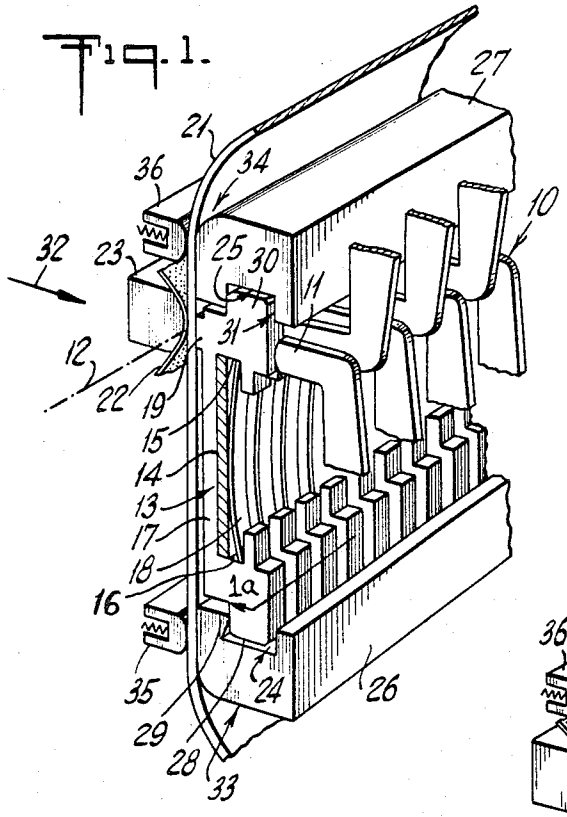
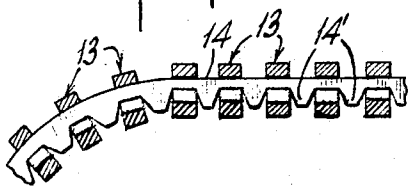


Fig. 1a.



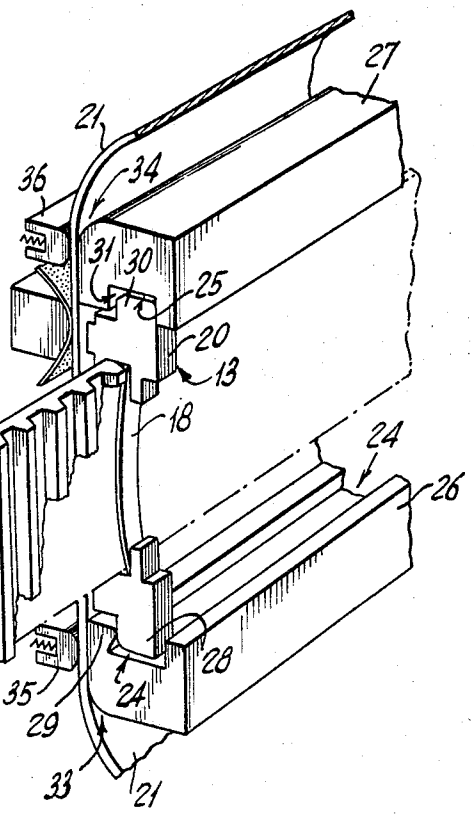
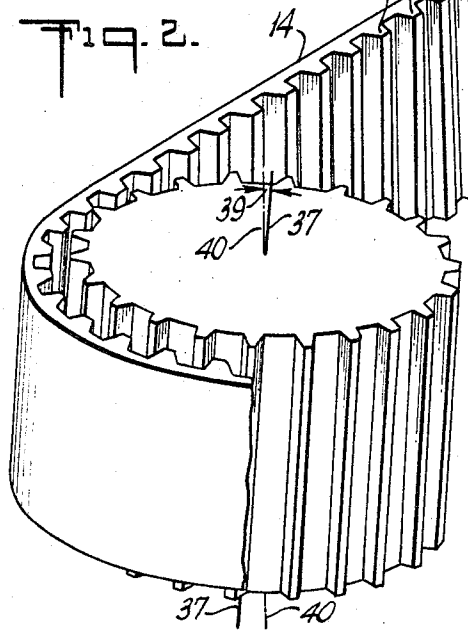


Fig. 2.



INVENTOR
CARMINE J. ANTONUCCI

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Fig. 3.

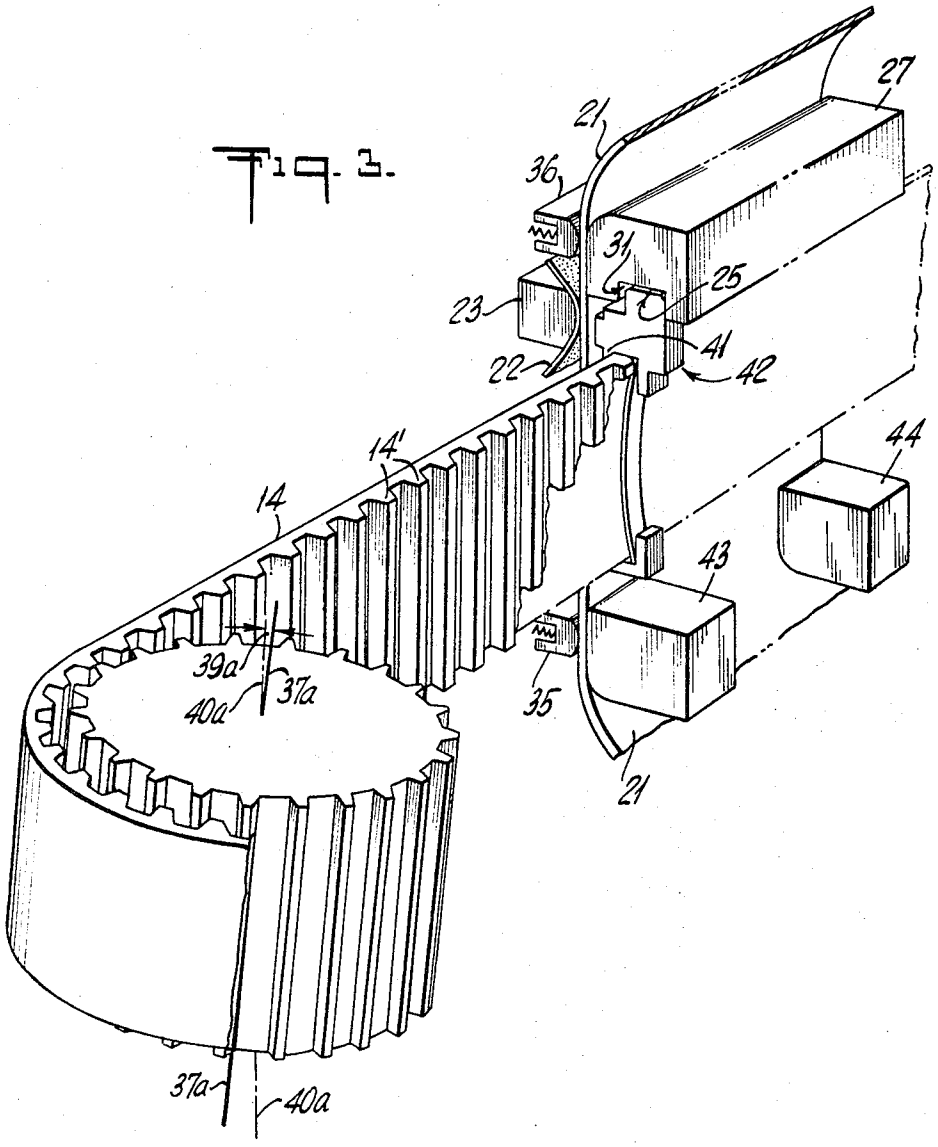
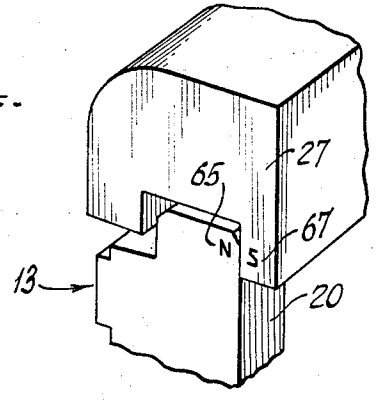


Fig. 4.



INVENTOR
CARMINE J. ANTONUCCI

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3,379,125

TYPE SLUG IMPACT CONTROL IN HIGH SPEED CHAIN PRINTERS

Carmine J. Antonucci, Commack, N.Y., assignor to Potter Instrument Company, Inc., Plainview, N.Y., a corporation of New York

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6 Claims. (Cl. 101—93)

ABSTRACT OF THE DISCLOSURE

The specification and drawings show a chain printer in which the type slugs are driven by free-flight hammers against a paper web. The penetration of the slugs is controlled by a surface that runs parallel to the print line.

In this impact printer, printing slugs mounted on an endless belt are guided as they move along the print line. Free flight print hammers drive the slugs against a printing surface and the guide serves to limit the travel of a struck slug.

This invention, generally, relates to high speed impact printers and, more particularly, an improved chain printer.

For a long time, efforts have been made in an industry wide struggle to improve the reliability of high speed printers, to make them more economical to manufacture and easier to service.

A most troublesome aspect in a high speed chain printer is limiting or controlling the flight of a hammer after a firing pulse has been applied to its operating coil.

It is a principal object of the present invention to provide a new and improved high speed chain printer.

It is another object of the invention to provide a hammer stop structure that effectively and economically controls the flight of the printing hammers.

A further object of the invention is the provision of a new high speed chain printer which permits substantial savings in space to be realized.

Briefly, a high speed printer in accordance with which the principles of the present invention are particularly applicable has the usual plurality of printing hammers with heads aligned along a printing line, along with a plurality of printing type each having a predetermined indicia adjacent one end for impact printing. A suitable flexible means moves the plurality of printing type along the printing line.

A stop bar or rail structure in accordance with the invention has a length along the printing line at least as long as the plurality of printing hammers and has a stopping surface to stop the printing type in a predetermined position after having been struck by a printing hammer, which may be a so-called free flight printing hammer. Means are provided to maintain the printing type, not being struck along the printing line, in a predetermined non-printing position.

The invention further resides in certain novel features of parts and further objects and advantages thereof will become apparent to those skilled in the art to which it pertains from the following description of the presently preferred embodiment described with respect to accompanying drawings in which similar reference characters represent corresponding parts in the several views, and in which:

FIGURE 1 is a view in perspective of component parts of a high speed printer as they relate to the structure of the invention;

FIGURE 1*a* is a fragmentary view of the print chain of FIGURE 1;

FIGURE 2 is a view in perspective similar to FIGURE 1 showing one means for biasing the type slugs away from the paper to be printed upon;

FIGURE 3 is a view in perspective similar to FIGURE 2 showing a printer similar to that shown in FIGURE 2 but modified by the omission of a lower pivot for the type slugs;

FIGURE 4 is a detail, fragmentary view of a type slug and upper positioning bar.

Referring now to FIGURE 1 of the drawings, the numeral **10** identifies a plurality of printing hammers of the "impact" type, and while the particular hammers shown have heads **11** in alignment along a printing line **12**, it will be understood that any suitable structural arrangement for the hammers **10** will be satisfactory.

Since printing hammers of various configurations and their related mechanical and electrical operating (or energizing) equipment are well known in the art, an elaborate and further detailed description here would seem to be inappropriate.

While any suitable flexible carrier may be used to move a plurality of printing type **13** along the printing line **12**, the present description refers to the kind shown, described and claimed in co-pending patent application Ser. No. 509,501, filed Nov. 14, 1965, entitled "High Speed Printer" and assigned to the assignee as the present invention. Therefore, the flexible carrier will be referred to hereinafter as a belt **14**.

Each one of the printing type **13** has an upper slot **15** and a lower slot **16** on one side of a body **17** to receive the respective upper and lower edges of the belt **14**. For a belt **14** constructed in the form of a "timing belt" as in the aforementioned application, the slots **15** and **16** may have their inner surfaces contoured to fit the teeth on the belt, so that they are supported firmly in place. Alternatively, the slugs may be located between the teeth **14'**, as shown in the drawings particularly FIGURE 1*a*. A spring **18** may be positioned against the belt **14** with its ends in the slots to hold the printing type in position.

A preselected indicia **19** adjacent one end of each printing type is raised in relief of suitable form for impact printing when an anvil surface **20** behind the indicia **19** is struck by a hammer head **11**. A printing media **21**, such as paper, is movable, usually in step fashion, by any of the well known paper feed mechanisms, and an inking media **22** of ribbon, preferably, approaches the printing media **21** at the printing line **12** from a different angle to reduce the chance of smearing. A platen **23** is positioned to support the printing media **21** along the printing line **12** where impact by the hammers occurs.

During the interval that the printing type **13** are moved along the printing line **12**, they are guided within slots **24** and **25** formed in a pivot bar **26** and a stop bar **27**, respectively. At least a part **28** of the lower end of each printing type is formed to fit the slot **24** with sufficient closeness so that the type are constrained for guiding purposes, yet with sufficient looseness to permit each type to be pivoted slightly about the edge **29** when the anvil surface **20** is struck by a hammer head **11**.

At least a part **30** of the upper end of each printing type is formed to fit the slot **25** with a looseness that is predetermined to give a clearance **31** which matches closely the desired distance of hammer travel during impact. As a practical matter, the dimensions of the slot **25** as well as the opposite surfaces of the part **30** may be machined with a high degree of accuracy, thus providing the desired clearance **31**.

Moreover, with the plurality of type **13** moving past the reverse side of the media **21** from the side normally viewed (along arrow **32**), a slight amount of sliding of the type on the media can be tolerated. The media is advanced rapidly enough to avoid wear of the media. A

small degree of wear of the type indicia would occur. However, such indicia do not wear excessively, and when they do become worn to the point that legibility is impaired, they are replaceable readily, either individually or all of the printing type at the same time.

With the construction in accordance with the present invention, periodic maintenance is reduced to a minimum, and the time involved is reduced also. It should be noted that replacing any one of the printing type not only replaces a worn indicia **19** but, also, replaces the guide surfaces on the lower part **28** and the upper part **30**.

Another reason or explanation that has been advanced for the parts **28** and **30** and for the surfaces of the slots **24** and **25** not wearing to any significant extent is that the rapidly moving printing type sweep molecules of air into the slots, and this provides just enough of a lubricant action.

While it is expected that the usual tension in the printing media **21**, together with the angle of partial wrap around arcuate surfaces **33** and **34** on the bars **26** and **27** would provide sufficient tautness in the media **21** for printing purposes, suitable pressure pads **35** and **36** are illustrated as another satisfactory means of accomplishing this result. Of course, bars may be used instead of individual, edge mounted pads if desired, and the inking media **22** in that case would wrap around such bars also but would still be directed away from the printing media **21** at a different angle to avoid smear and, also, to move away from the line of vision **42**.

It has been mentioned before that the clearance **31** is significant in that it represents a distance of travel for each indicia **19** for impacting against the media **21** and, therefore, is a significant factor in predetermining the hammer firing time. Such firing time is initiated in advance of the type arriving at the desired position in order to allow for all of the delays usually involved, such as inherent delays within the magnet energizing circuit to actuate the mechanical hammer and, also, for the interval of time required for the printing type to move the distance that is represented by the clearance **31**.

While the structure shown in FIGURE 1 contemplates any suitable arrangement for maintaining the part **30** normally along the opposite surface of the slot **25** (because this view shows the type **13** in the printing or impact position), the arrangement shown in FIGURE 2 illustrates a convenient structure for obtaining this result. This view shows the clearance **31** on the opposite side of the part **30** from that shown in FIGURE 1 and illustrates the position usually occupied by the printing type **13** as they traverse the slots **24** and **25**.

To maintain the printing type **13** so that the part **30** forms the clearance **31** as shown in FIGURE 2, the belt **14** is supported so that it passes along the printing line **12** at a preselected angle of the various arrangements that are available for obtaining the belt in this position, the structure of FIGURE 2 contemplates the axis **37** of rotation for the belt support cylinder **38** being offset by an angle indicated by the numeral **39** from a line **40** which is parallel with a line drawn through the surface of the slot **25** adjacent the clearance **31** (FIGURE 2) and through the edge **29**.

It should be noted that the print hammers **11** and type slugs **13'** lie on the same side of the web **22**. This permits the hammers to be positioned within the loop formed by the print chain, resulting in the substantial savings in space.

In some situations, particularly where the width of the printing line is relatively small, the arrangement shown in FIGURE 3 is quite useful. This structure is characterized by a smaller body **41** of printing type **42** which is permitted largely because of the type having only a stop bar **27** common to all the type. Since the printing line is short, the small stiffness inherent in the flexible belt **14** is sufficient to maintain the clearance **31** normally as

shown in FIGURE 3. In other words, a lower pivot bar is not necessary in this arrangement.

The usual tautness of the printing media **21** may, in the structure illustrated, be relied upon to maintain the media under control over the printing line. To assist in this, guide blocks **43** and **44** are positioned along the edge opposite from that under the guiding control of the stop bar **27**.

As described in connection with the structure shown in FIGURE 2, the axis of rotation **37***a* in FIGURE 3 is offset, as already described, so that the clearance **31** is as illustrated without the necessity of further structure. The angle **39***a* of such offset is at least, and preferably slightly greater than, the angle measured from a line **40***a* which is parallel to a line through the surface of the slot **25** adjacent the clearance **31**, FIGURE 3.

Referring now to FIGURE 4, the anvil **20** of each type bar **13** may be formed with a magnetic region **64** which cooperates with a magnetic region **67** of opposite polarity on the stop bar **27** in order to return the bar **13** to a retracted position after printing.

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

What is claimed is:

1. In a high speed printer of the chain type having:
- a plurality of printing hammers with heads aligned along a printing line,
- a plurality of elongated printing type slugs each having a predetermined indicia formed on one side of said slug adjacent one end for impact printing,
- said hammers disposed to strike said slugs on the side opposite said one side,
- flexible means for moving said plurality of printing type slugs along the printing line, and
- guide means for guiding said plurality of printing type slugs along the printing line,

said guide means comprising:
- stop bar means having a length along the printing line at least as long as the plurality of hammers and having a stopping surface to contact said slugs at said one end to stop the printing type slugs when struck by a printing hammer, and
- pivot bar means having a length along the printing line at least as long as the plurality of hammers and having a surface disposed adjacent the other end of said slugs against which the printing type slugs pivot when struck by a printing hammer.

2. In a high speed printer as set forth in claim **1** wherein said stop bar means has a slot extending throughout the length of said printing line and a width equal to the distance of travel predetermined for said printing type and said stopping surface is one side of said slot.

3. In a high speed printer as set forth in claim **2** including means to bias the plurality of printing type along the printing line in a direction away from said stopping surface.

4. A high speed printer of the chain type comprising;
- a plurality of printing hammers with heads aligned along a printing line,
- a plurality of printing type slugs each having a predetermined indicia on one side of said slugs for impact printing,
- means for moving said plurality of printing type slugs along the printing line,
- said printing hammers disposed to strike said slugs on the side opposite said one side,

stop bar means having a stopping surface disposed to limit the movement of a type when struck by a printing hammer, and

means to maintain said plurality of printing type slugs that moves along said printing line normally in a retracted non-printing position.

5. A high speed printer of the chain type as set forth in claim **4** wherein said stop bar is one side of a channel that extends along said print line and said slugs contact the other side of said channel in the retracted, non-printing position.

6. In a high speed printer as set forth in claim **3** further including means to twist said flexible means so that said slugs ride against the other side of said slot.

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WILLIAM B. PENN, *Primary Examiner.*