United States Patent

[11] 3,633,501

[72] Inventor James H. Edwards
Winchester, Mass.

[21] Appl. No. 862,237
[22] Filed Sept. 30, 1969
[45] Patented Jan. 11, 1972

[73] Assignee Mohawk Data Sciences Corporation
Herkimer, N.Y.

[54] PRINT SLUG MOUNTING MEANS IN TYPE CHAIN ASSEMBLY

5 Claims, 6 Drawing Figs.

[52] U.S. Cl. 101/111
[51] Int. Cl. B41j 1/20
[50] Field of Search ..... 101/93 C, 93 MN, 96, 111, 109, 368, 383, 93 R

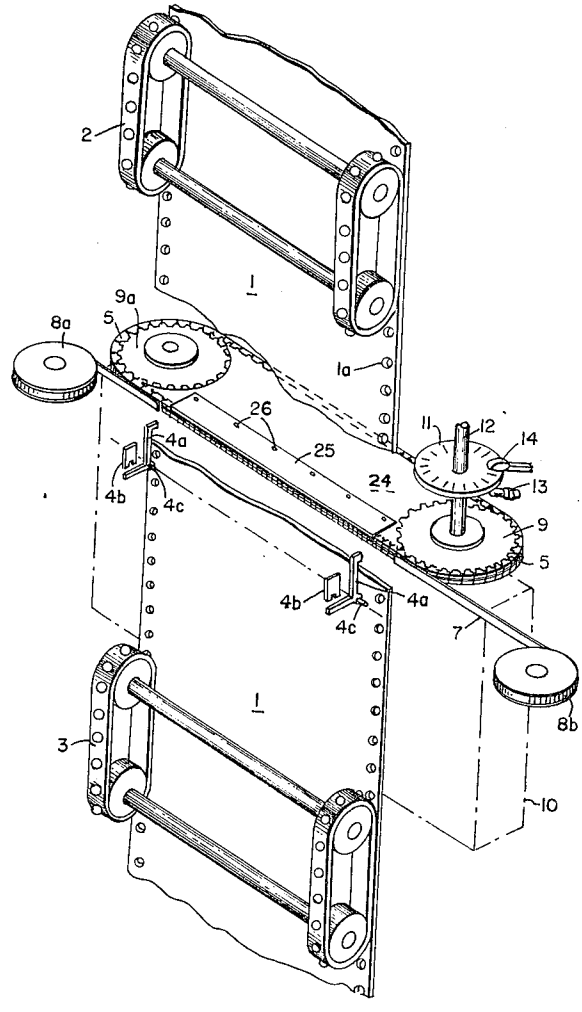
[56] References Cited

UNITED STATES PATENTS

2,267,661	12/1941	Meyers	101/111
2,936,704	5/1960	Hense	101/93
3,041,964	7/1962	Simpson et al.	101/111
3,041,965	7/1962	Sasaki	101/111
3,142,249	7/1964	Sasaki	101/111
3,216,348	11/1965	Oldenburg et al.	101/93
3,379,125	4/1968	Antonucci	101/93
3,379,126	4/1968	Staller et al.	101/111
3,402,657	9/1968	Potter et al.	101/93
3,416,442	12/1968	Brown et al.	101/93
3,113,509	12/1963	Simpson	101/111
3,399,619	9/1968	Sims	101/93 C
3,557,693	1/1971	Kuchenbecker	101/93 C

Primary Examiner—William B. Penn
Attorneys—Francis J. Thomas, Richard H. Smith, Thomas C. Siekman and Sughrue, Rothwell, Mion, Zinn & MacPeak

ABSTRACT: A chain printer having a type chain which comprises an endless flexible belt to which a plurality of abutting print slugs are attached. Each print slug contains a printing portion located on the outside of the belt and a pair of driving portions which are cantilevered from the printing portion and project across the belt's edges. Type characters are located on the printing portions and the driving portions have their cantilevered ends shaped to mesh with peripherally spaced notches in a driving pulley so that they thereby drivingly engage the chain with the pulley. Preferably, the pulley is made up of three parts: top and bottom parts having peripherally spaced notches, and a center part which projects between the slugs' driving portions and abuts the inside of the belt when the type chain moves around the pulley. In addition, preferably, the outside of the belt is toothed and each slug's printing portion contains a slot into which one of the teeth tightly projects.



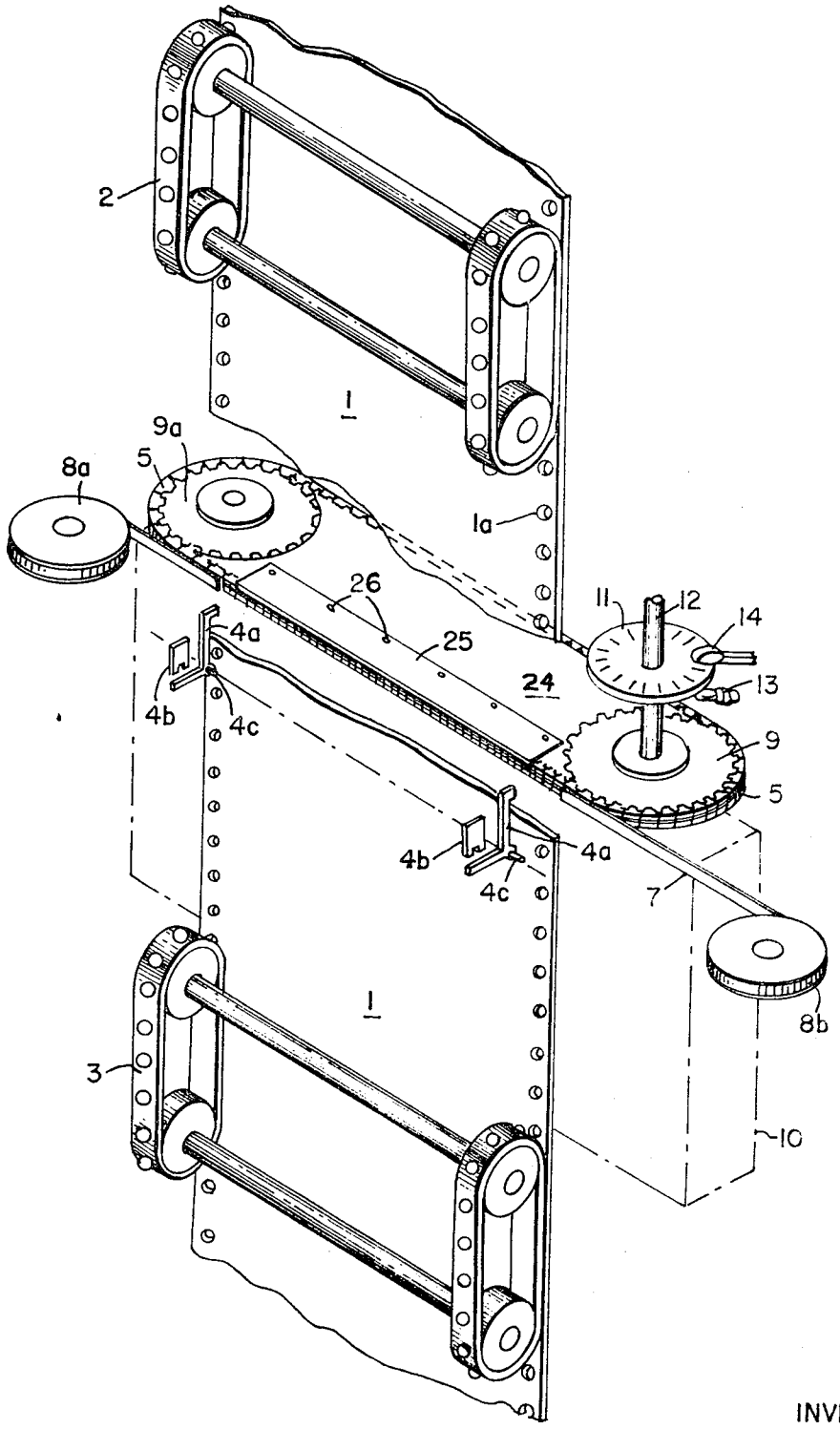


FIG. 1

INVENTOR
JAMES H. EDWARDS
BY,
Thomas C. Sickman
ATTORNEY

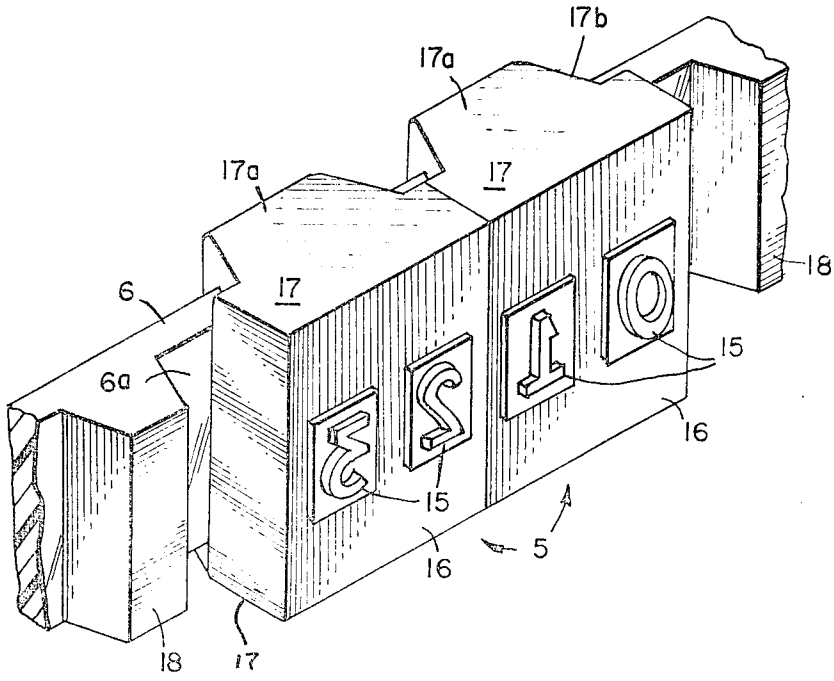

17b
17a
17
17a
17
18
6
6a
15
16
15
16
5
18
17

FIG. 2

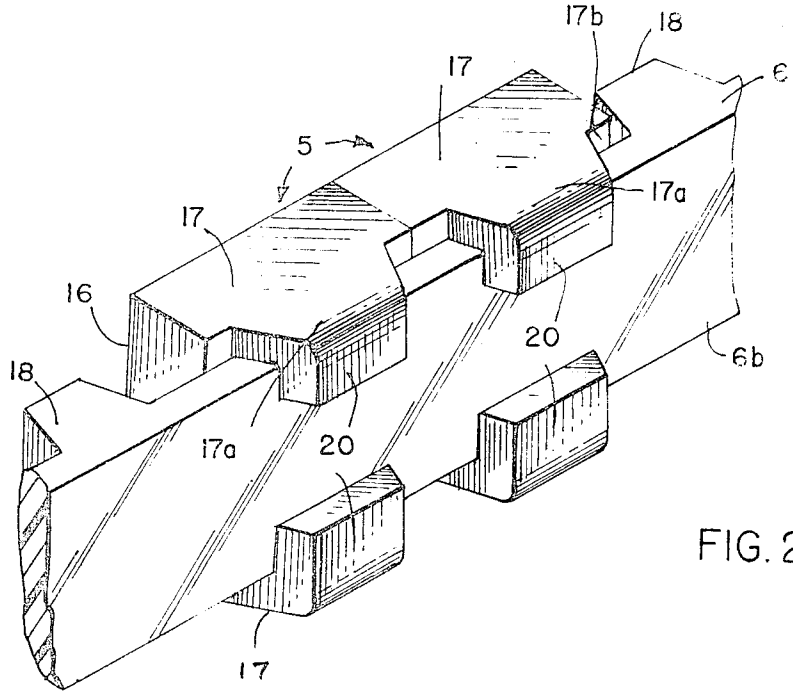

17b
18
17
6
5
17a
17
16
20
6b
18
17a
20
17

FIG. 2a

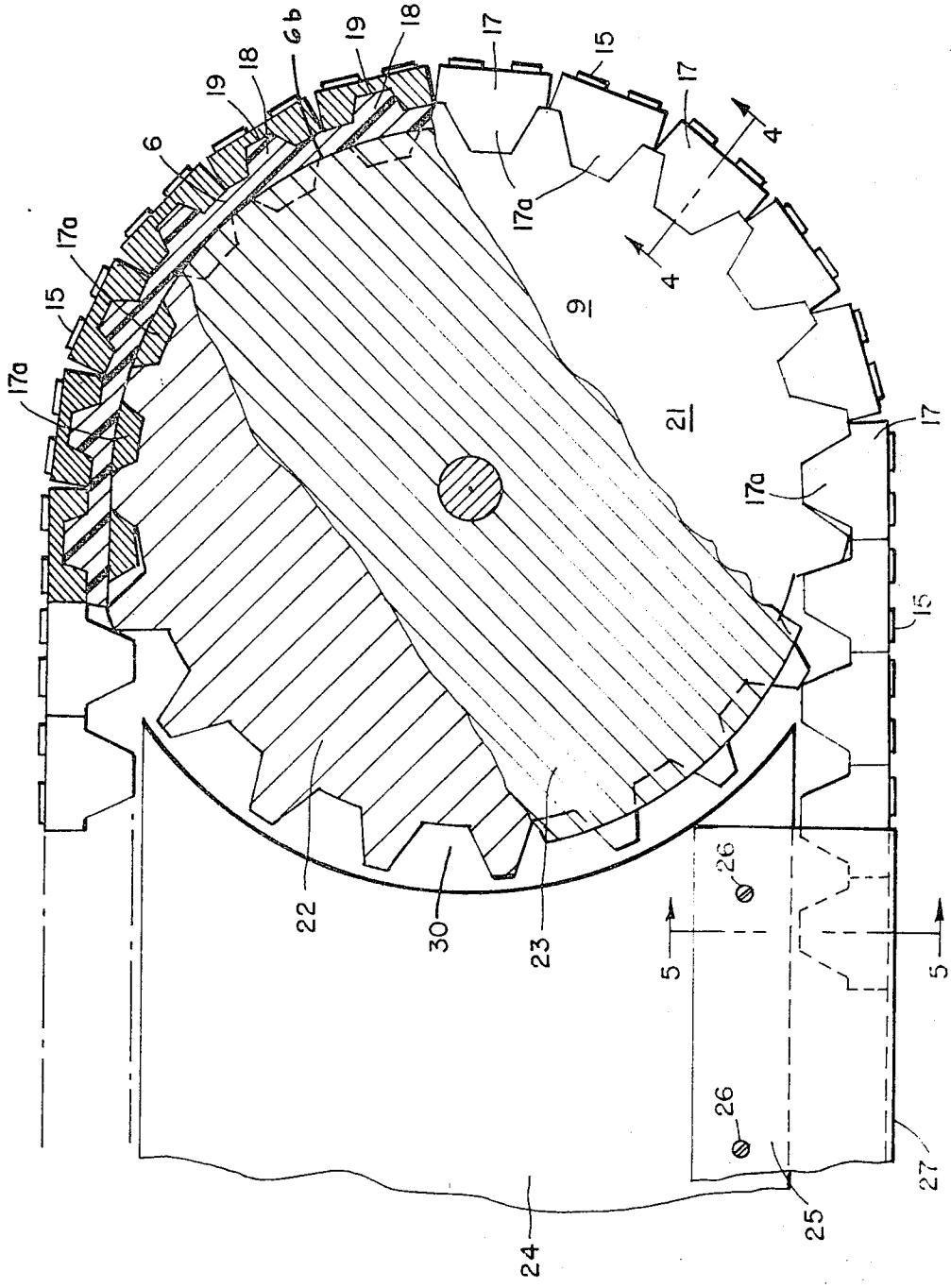

6b
19
18
17
15
17
4
6
17a
4
17a
15
9
21
17
17a
15
22
30
23
26
5
5
26
27
25
24

FIG. 3

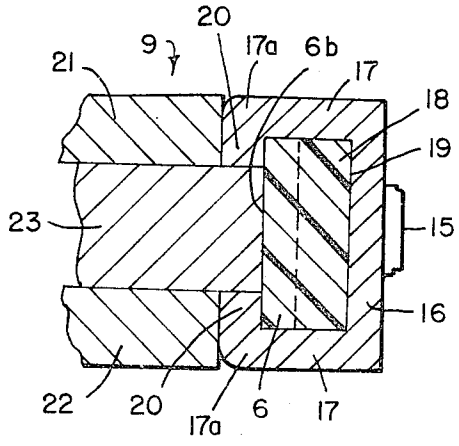

20
9
17a
6b
21
17
18
19
23
15
16
22
20
17a
6
17

FIG. 4

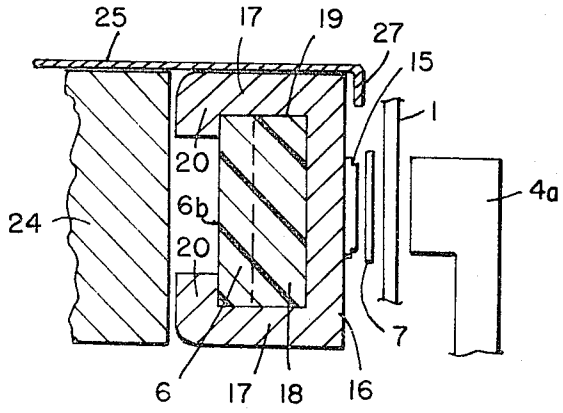

25
17
19
27
15
1
20
4a
6b
24
20
7
6
17
18
16

FIG. 5

PRINT SLUG MOUNTING MEANS IN TYPE CHAIN ASSEMBLY

BACKGROUND OF THE INVENTION

This invention relates to chain printers and, more particularly, to the type chain in such a printer.

Printers have been developed in which a type chain containing type characters on a continuous chain of print slugs is moved along the print line across the document being printed upon. In these printers, commonly called chain printers, one or more hammers adjacent the print line selectively strike the document against the moving type characters which pass on the back side of the document. The type chain moves around a pair of spaced-apart pulleys which contain peripherally spaced notches for engaging the chain. One of the pulleys is driven to move the chain across the document.

The type chain in some printers comprises flexible endless belt to which the print slugs are attached. Spaced teeth are located on the inside of the belt and the chain is moved by a driving engagement between these teeth and the notches in the driving pulley. Other chain printers utilize a type chain made up only of abutting print slugs which move along a raceway; each slug contains teeth for engaging the driving pulley which thereby moves the chain.

Both these type chains have drawbacks. In the former, since the chain engages the pulleys via the belt, some of the energy imparted to the chain when the hammers strike the document against it is transmitted along the belt to the pulleys. Because of the belt's elasticity, such energy transfer causes vibrations in the chain.

The second type chain avoids this problem by omitting the belt and transmitting the hammers' energy to the pulleys via the nonelastic abutting slugs. However, it is difficult to stabilize the positions of the slugs within a chain made up of unconnected slugs. In addition, since hammer impact on a slug has a braking effect on the struck slug, this chain design allows a gap to occur between the struck slug and the one which is moving ahead of it in the chain. Therefore, since it is necessary that the slugs be precisely positioned and tightly held within the chain to enable the hammers to strike the proper type characters at the exact time, this chain has inherent drawbacks.

SUMMARY OF THE INVENTION

It is, therefore, the primary object of this invention to provide a chain printer having a type chain which avoids the disadvantages of both of the above type chains and yet is economical to manufacture and maintain.

In accordance with the invention, there is provided a type chain adapted to be drivingly engaged by a peripherally notched driving pulley which moves the chain across the document. The type chain comprises a belt to which a plurality of print slugs are attached. Each slug contains a printing portion having type characters thereon and at least one driving portion which has an end shaped to mesh with the notches in the pulley to drivingly engage the chain and pulley. In the preferred embodiment, each slug has its printing portion located on one side of the belt and its two driving portions cantilevered from the printing portion and projecting across opposite edges of the belt. The cantilevered ends of these driving portions are shaped to engage the pulley.

Preferably, the belt is a standard low-cost endless timing belt having one toothed side. The toothed side is located adjacent the slugs' printing portions, each of which contains a slot into which a tooth tightly fits so that the slugs are maintained in place within the chain.

Also in the preferred embodiment, the driving pulley is made up of three parts; top and bottom parts containing peripheral notches, and a central part which is adapted to project between the slugs' driving portions and abut the belt as the type chain moves around the pulley.

Since the chain engages the pulleys via the print slugs and not the belt, the energy imparted to it by the hammer is transmitted to the pulleys by the slugs and not the elastic belt. However, the print slugs are securely held in place by the belt and, thus, a stable chain is provided.

Also, preferably, adjacent slugs within the chain abut. This further reduces vibrations within the chain by allowing energy from hammer impact to be transmitted along the abutting slugs to the pulleys.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic perspective view of a preferred embodiment of the printer.

FIGS. **2** and **2***a* are perspective views of two print slugs attached to the belt.

FIG. **3** is a plan view, partly sectioned, showing the driving pulley engaging the type chain.

FIGS. **4** and **5** are sections taken along lines **4**—**4** and **5**—**5** in FIG. **3** respectively.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **1** schematically shows a chain printer printing on a document **1** which is stepped upwardly by a pair of tractors, **2** and **3**, engaging edge perforations **1***a* in the document. The printer includes a plurality of hammer mechanisms disposed along the print line, i.e., that line along which characters are being printed. Each hammer mechanism contains a hammer **4***a* which, when activated by an electromagnet **4***b*, moves about a pivot **4***c*. One or more fonts of type characters are moved along the print line adjacent the hammers **4***a* by a type chain moving at a constant speed in a fixed continuous path. The type chain comprises a plurality of print slugs **5** on which the type characters are located, and an endless flexible belt **6** (FIG. **2**) on which the slugs are secured. During the printing operation, selected hammers impact an inked ribbon **7** and a document **1** against selected type characters on the slugs **5**. The inked ribbon is located between the document **1** and the type chain, and is fed from a supply spool **8***a* onto a takeup spool **8***b*.

The type chain continuously travels around a pair of pulleys: an idler pulley **9***a* and a driving pulley **9** which is driven by means not shown located within a printer support **10**. A conventional code disk **11** is mounted on the shaft **12** of the driving pulley **9**. It contains a plurality of radial slots which represent the rotating type characters and a further slot for indicating the end of each font. Light from a light source **13** is directed onto the code disk and passes through slots therein and onto a photosensitive unit **14**. By this well-known arrangement, the photosensing unit produces electrical outputs representing the positions of the type characters in the moving type chain. Such electrical signals are then used to properly time the activation of the hammer mechanisms.

As illustrated in FIG. **2**, each print slug **5** has two type characters **15** thereon. By using a plurality of type characters on each slug, the printing speed may be increased with respect to the speed of the type chain. The type characters are located equidistant from the top and bottom of the slugs so that the hammers do not tend to overturn the slugs when providing impact between the type characters and document.

As shown in FIGS. **2** and **2***a*, each printing slug is essentially channel-shaped and made up of a printing portion **16** and upper and lower driving portions **17**. The printing portion abuts the outside **6***a* of the endless belt **6** and has the type characters **15** thereon. The belt is formed from fiberglass-reinforced neoprene and is of a type currently manufactured by the United states Rubber Company as a timing belt. The toothed outside of the belt abuts the printing portions **16** of the print slugs **5** with each print slug containing a centrally located slot **19** (FIG. **3**) into which a tooth **18** of the belt projects and tightly fits. In this manner, the print slugs are precisely positioned at fixed locations along the belt within the type chain. Because of its elasticity, each tooth also serves to dampen hammer impact on the slug.

As best illustrated in FIGS. **2***a* and **4**, each slug's driving portions **17**, after projecting across the edges of the belt **6**, con-

tain ears **20** which extend substantially parallel to the printing portion **16** of the slug on the outside *6a* of the belt. These ears abut the inside *6b* of the belt and clamp the belt against the printing portion of the slug. In this manner, each slug is securely attached to the belt.

Referring to FIGS. **3** and **4**, the type chain is illustrated in driving engagement with the driving pulley **9**. The pulley contains notches **30** equally spaced around its periphery. The driving portions **17** of the slugs have their cantilevered ends *17a*, i.e., those ends away from the slugs' printing portions, shaped to mesh with the peripheral notches **30**. A driving connection is thus set up between the pulley and type chain as the chain moves around the pulley. In the preferred embodiment illustrated, the cantilevered ends *17a* of the driving portions and the notches **30** in the pulley are approximately trapezoidal.

As best shown in FIG. **4**, the driving pulley **9** is made up of three parts: top and bottom parts, **21** and **22**, which contain the peripherally spaced notches **30**, and a central part **23** interposed between the top and bottom parts. In effect, the top and bottom parts are circular gears. The central part is adapted to project between the cantilevered ends *17a* and ears **20** of the driving portions of the slugs when the type chain moves around the pulley. The central part **23** of the pulley abuts the inside *6b* of the belt and fits tightly between the ears **20**. Of course, the idler pulley *9a* around which the type chain also travels is constructed substantially identical to the driving pulley. With sufficient tension maintained in the type chain, the chain is effectively guided in its continuous path by cooperation between the central parts **23** of the pulleys and the ears **20** of the driving portions of the slugs.

Since the slugs constitute that part of the type chain which engages the pulleys, the energy from hammer impact on the chain is transmitted through them to the pulleys. The connection between the chain and pulleys involves only nonelastic elements and not the elastic belt. This reduces vibrations within the chain. Preferably, as illustrated in FIG. **3**, adjacent slugs in the chain abut. This feature also reduces chain vibrations as energy transfer from hammer impact is along abutting slugs to the pulleys.

FIGS. **1**, **3** and **5** show an impact resisting member **24** disposed between the pulleys **9** and *9b* and between the type chain. It is an essentially flat member having concave ends which adjoin the driving and idler pulleys. The impact resisting member is located adjacent the print line and provides the backstop necessary to resist the impact from the hammers *4a* as they force the document against the inked ribbon **7** and type characters **15** on the slugs **5**. The hammers return to their initial rest positions by rebounding from the slugs **5** and the impact resisting member **24**. When a hammer is operated to strike a type character on a slug, the cantilevered ends *17a* of that slug's driving portions **17** are forced against the impact resisting member. However, when they are not being forced together, a slight clearance is provided between the impact resisting member and the print slugs to reduce noise and friction.

FIGS. **3** and **5** also show a stop member **25** secured adjacent the print line to the impact resisting member with screws **26**. The stop member has a lip **27** extending parallel to the print line and placed adjacent that side of the slugs' printing portions **16** having the type characters **15** thereon. With this arrangement, the stop member **25** prohibits the print slugs from rebounding an unsatisfactory distance away from the impact resisting member **24** after the slugs are impacted by the hammers. As with the impacting resisting member, clearance is provided between the stop member and the slugs, thus reducing noise and friction.

I claim:

1. A type chain assembly comprising:

a. a driving pulley having notches spaced around its periphery;

b. an endless flexible belt adapted to move in a continuous path, at least part of which is around the pulley;

c. a plurality of abutting print slugs arranged along the length of the belt, each slug having a printing portion with at least one type character thereon adjacent the outside of the belt, each slug also having a pair of cantilevered portions projecting from its printing portion and across opposite edges of the belt, the cantilevered ends of each pair of cantilevered portions being shaped to mesh with the notches in the pulley to drivingly engage the slugs and pulley; and

d. a pair of ears on each of the slugs, each pair of ears projecting from the cantilevered portions of its associated slug and abutting the inside of the belt to clamp the belt between itself and the slug's printing portion.

2. The type chain assembly as recited in claim **1** further comprising a series of spaced teeth located on the outside of the belt, and wherein the printing portion of each slug contains a slot into which one of the teeth projects.

3. The type chain assembly as recited in claim **2** wherein each slot is centrally located within its printing portion and each tooth tightly fits into the slot into which it projects.

4. The type chain assembly as recited in claim **2** wherein each pair of ears abut the inside of the belt at a location along the belt where one of the teeth is located on the outside of the belt.

5. The type chain assembly as recited in claim **1** wherein the pulley comprises top and bottom parts which contain peripherally spaced notches, and a central part interposed between the top and bottom parts, the central part of the pulley adapted to project between the ears of the slugs when the slugs move past the pulley.

* * * * *