Dec. 24, 1963 RENTARO SASAKI 3,115,092

HIGH SPEED BELT PRINTER

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Fig. 1

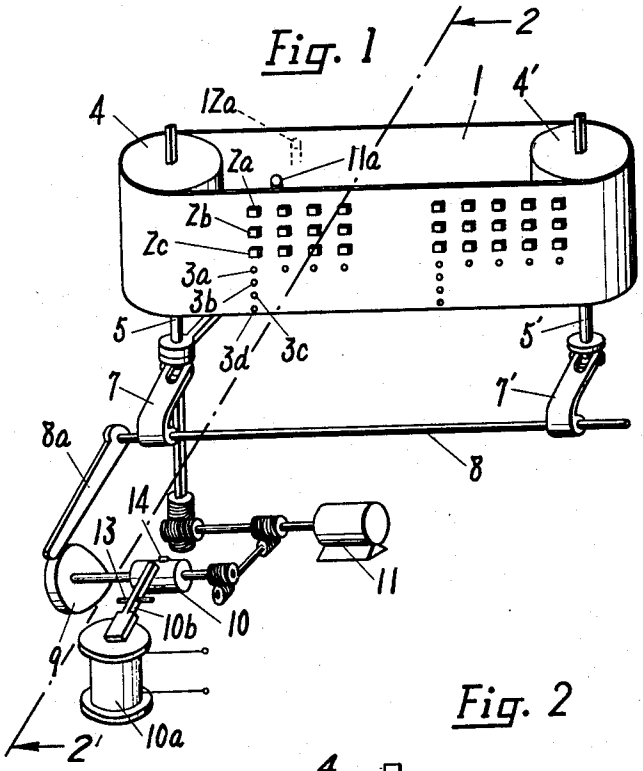
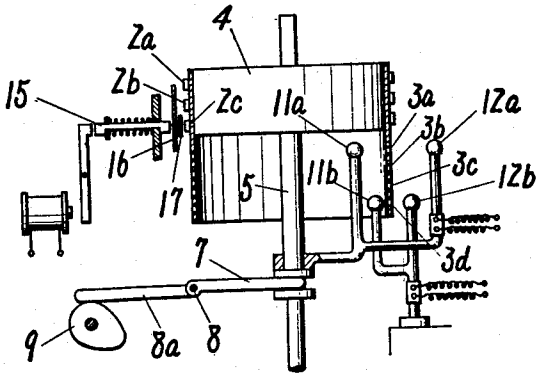


Fig. 2



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3,115,092
HIGH SPEED BELT PRINTER

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My invention relates to high speed printers, generally; and, in particular to an improvement of the high speed chain printer disclosed in my United States Patent No. 3,007,399 granted on November 7, 1961.

In this patent there is disclosed a chain printer wherein printing types are fixed to an endless belt which is continuously rotated. Slits are provided in the belt in positions corresponding to the positions of the respective printing types on the endless belt so that light from a lamp may be received by a photoelectric cell through said slit so as to indicate the relative positions of printing hammers and the printing types and to excite an identification circuit with a synchronous pulse.

In the present invention, an endless belt, on which groups of printing types are arranged in respective lines, is rotated continuously. Slits for timing, or synchronizing, are provided in the belt for the respective types in positions corresponding to said types and for the respective lines or groups of the types on said belt. The belt is moved upwardly or downwardly by the introduction of a signal or by operating an electric key to shift the line of the types corresponding to the hammers and the synchronous position for each line or group of the types. The relative positions of the hammers and the type, provided on the endless belt, are determined by providing slits, or apertures, in the endless belt. The position of such slits, corresponding to the relative hammers and types positioning enable rays of light from light sources to synchronously actuate hammer actuators to cause hammers to strike corresponding types so that lines of characters are printed on a recording medium such as recording paper.

An object of the present invention is to increase the number of types or, in other words, the number of characters in a high speed printer.

Another object of the present invention is to increase the rate at which characters are printed.

In the accompanying drawings:

FIGURE 1 is a perspective view of a high speed printer according to the present invention.

FIGURE 2 is a partly sectioned side view of FIGURE 1 as viewed along the section 2—2′ of FIG. 1.

With reference to the drawings, **1** has the endless belt on three lines of printing types **2***a*, **2***b* and **2***c* arranged in three rows. It is preferable to arrange the three rows according to groups. For example, one row having groups of numerals; another row having English letters; and, the other row having Japanese characters. The line of slits **3***a* is for timing or synchronizing purposes. There are made as many slits **3***a* as there are columns of types. The timing slits **3***b*, **3***c* and **3***d* are for the lines of type **2***a*, **2***b* and **2***c*, respectively. There are arranged light sources on one side of such slits and photoelectric cells or phototransistors on the other side. The belt driving rollers **4** and **4′** are continuously rotated by means of an electric motor **11**. **5** and **5′** are supporting shafts for the belt driving rollers **4** and **4′**, respectively, and are connected to a cam **9** through supporting arms **7** and **7′**, a shaft **8** and an arm **8***a* so that the belt driving rollers **4** and **4′** may be simultaneously moved up and down according to the position of the rotatable cam **9**. As shown, pulleys are provided on the shafts **5**, **5′** and forked ends of the supporting arm **7**, **7′** engage with the pulleys

5, **5′**. In accordance with the surface portion of the cam **9**, which is rotated into contact with an end of the lever arm **8***a*, the rollers **4** and **4′** may be moved upwardly or downwardly. And, as a result, the endless belt **1** will be shifted upwardly or downwardly to the position desired. The lever arm **8***a*, when moved according to the cam position **9**, and the shaft **8** connected thereto is also rotated about its longitudinal axis. As a result the support arms **7**, **7′** attached to the shaft **8** are rotatably moved thereby shifting the pulleys **5**, **5′** and their respective rollers **4**, **4′** upwardly or downwardly. When an electromagnet **10***a* is excited in response to a signal, an armature carried by a pivot **13** will have one of its ends attracted to the electromagnet **10***a*. As a result, a clutch **10** will be disengaged and, thereafter, will again stop in the next predetermined engaging position so that the position of the cam **9** may be adjusted. More particularly when the electromagnet **10***a* is energized, one end of the armature **10***b* is attracted to the electromagnet **10***a* while the other end of the armature **10***b* is raised so that it is not in contact with the projections **14** of the clutch **10**. The cam **9** is connected to the motor **11** through the clutch **10** and a group of gears. As indicated in the drawing, the clutch **10** is provided with three projections **14** so that the belt driving rollers **4** and **4′** may be shifted upwardly or downwardly to any of the positions corresponding to the three projections. **11***a* is a light source corresponding to the timing slits for the types. **11***b* is a light source corresponding to the group shifting timing slits for the groups of the types. The light source **11***a* is set in the position opposite the timing slits **3***a* for the types. The light source **11***b* is set in the position opposite any of the timing slits **3***b*, **3***c* and **3***d* in accordance with the vertical position to which the belt **1** is shifted. Respective photoelectric cells **12***a* and **12***b* are set on the other side of the endless belt **1** with respect to the light sources.

If the electromagnet **10***a* is excited by a shifting signal, the armature **10***b* will be attracted to the electromagnet **10***b* and will be therefore disengaged at the other end from one of the projections **14** of the clutch **10**. The clutch **10** will then be rotated by the motor and at the same time the cam **9** will rotate. When the cam **9** has come to a predetermined position, the lever **10***b* will engage at the forward end with another projection of the clutch **10** and cause the clutch **10** to disengage and the cam will also stop. In the case of the three-step, or three position, shift, the cam **9** is provided with, for example, three profiles so that the arm **8***a*, shaft **8**, arms **7** and **7′**, supporting shafts **5** and **5′** and the belt driving rollers **4** and **4′** may be moved upward and downward. Accordingly, the endless belt **1** is, therefore, moved upward or downward.

When the position of the step of the endless belt **1** has been thus set, the light from the light source will act on the photoelectric cell **11***a* through the slits **3***a* for synchronizing the types and a known identification circuit (not illustrated) connected with the photoelectric cell **11***a* will be operated. At the same time, since the photoelectric cell **11***b* is optically connected with the light source **12***b* through one of the timing slits **3***b*, **3***c* or **3***d*, according to the desired shift position, a new starting point for subsequent shifting (for example, to the second step) is set. Thus the input signal is detected and is stored in a memory stage, in advance, by a well known identification circuit, for example, an electronic accumulating circuit. When a type to be struck in one line has moved and has come to the position where it is to be struck, a hammer **15** corresponding to said type, among many hammers, will be operated in cooperation with the output pulse of said identification circuit so that the type corresponding to the input sign may be printed on a recording sheet **16** through an inking ribbon **17**.

What is claimed is:

1. A high speed printer comprising: an endless belt adapted for continuous rotation, said belt being adapted to be shifted in a direction substantially perpendicular to its rotational direction; a plurality of printing types affixed to the outside surface of said belt, said plurality of printing types being arranged on the outside surfaces of said belt in plural rows and columns, said belt having a first plurality of apertures therethrough for synchronization of each column of printing types, each aperture of said first plurality being located in line with an individual column of printing types; said belt further having a second plurality of apertures therethrough in line with each column of printing types for synchronization of the rows of printing types, each second plurality of apertures having as many apertures as there are rows of printing types; a plurality of printing hammers arranged in a row opposite an outside surface of said belt, said plurality of printing hammers being equal to the number of columns of printing types; signal responsive means operable for shifting said endless belt in a direction substantially perpendicular to its rotational direction so that any of said rows of printing types thereon may be aligned with said printing hammers; and, signal producing means for operating said signal responsive means; said signal producing means and said signal responsive means being arranged on opposite surfaces of said belt whereby said signal responsive means may be operated by said signal producing means when an aperture in said belt arrives at a position between said signal producing means and said signal responsive means.

2. A high speed printer according to claim 1, wherein said signal responsive means comprises an electromagnet, a clutch and a cam, said electromagnet being excited by said signal producing means when an aperture in said endless belt arrives at a position between said signal responsive means and said signal producing means to actuate said clutch and cam whereby said endless belt may be shifted by the action of said clutch and cam.

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