United States Patent [19]

Hegi et al.

[11] **3,830,154**

[45] **Aug. 20, 1974**

[54] **HIGH-SPEED PRINTER**

[75] Inventors: **Nobumitsu Hegi**, Kitakyushu; **Sueo Matsubara**, Tokyo, both of Japan

[73] Assignees: **Nippon Steel Corporation; Kabushiki Kaisha Saginomiya Seisakusho**, both of Tokyo, Japan

[22] Filed: **June 7, 1972**

[21] Appl. No.: **260,495**

[52] **U.S. Cl.** **101/235**, 100/172, 101/212, 101/245

[51] **Int. Cl.** **B41f 13/24**

[58] **Field of Search** 101/91, 232, 233, 234, 101/235, 181, 245; 100/172

[56] **References Cited**

UNITED STATES PATENTS

2,641,998	6/1953	Donald	101/235
2,647,455	8/1953	Adams	100/172
2,683,413	7/1954	Muller	101/235
3,102,471	9/1963	Auer et al.	101/181
3,191,526	6/1965	Ross	101/233 X
3,217,639	11/1965	Kelly	101/233
3,225,205	12/1965	Berkin	101/235 X
3,438,323	4/1969	Smitzer et al.	101/233
3,468,249	9/1969	Tseo	101/235
3,537,393	11/1970	Hegi	101/235

FOREIGN PATENTS OR APPLICATIONS

958,709	5/1964	Great Britain	101/181

Primary Examiner—Robert E. Pulfrey
Assistant Examiner—Paul T. Sewell
Attorney, Agent, or Firm—Toren, McGeady and Stanger

[57] **ABSTRACT**

A high-speed printer for printing marks or indications on materials such as steel sheets and veneers, in which the printing drum is rotated and stopped by a hydraulic system such as a hydraulic motor actuated by signals from a speed signal operating means, and the supply speed of the material is synchronized with the rotation of the printing drum.

6 Claims, 2 Drawing Figures

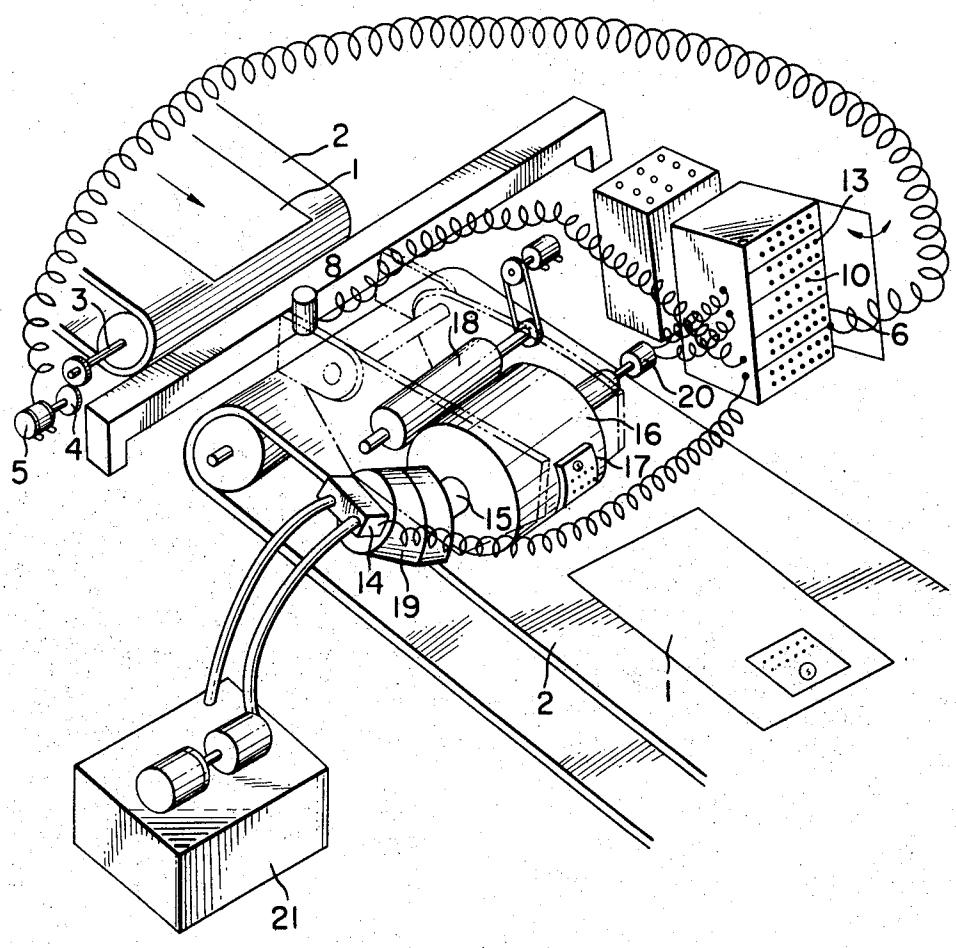
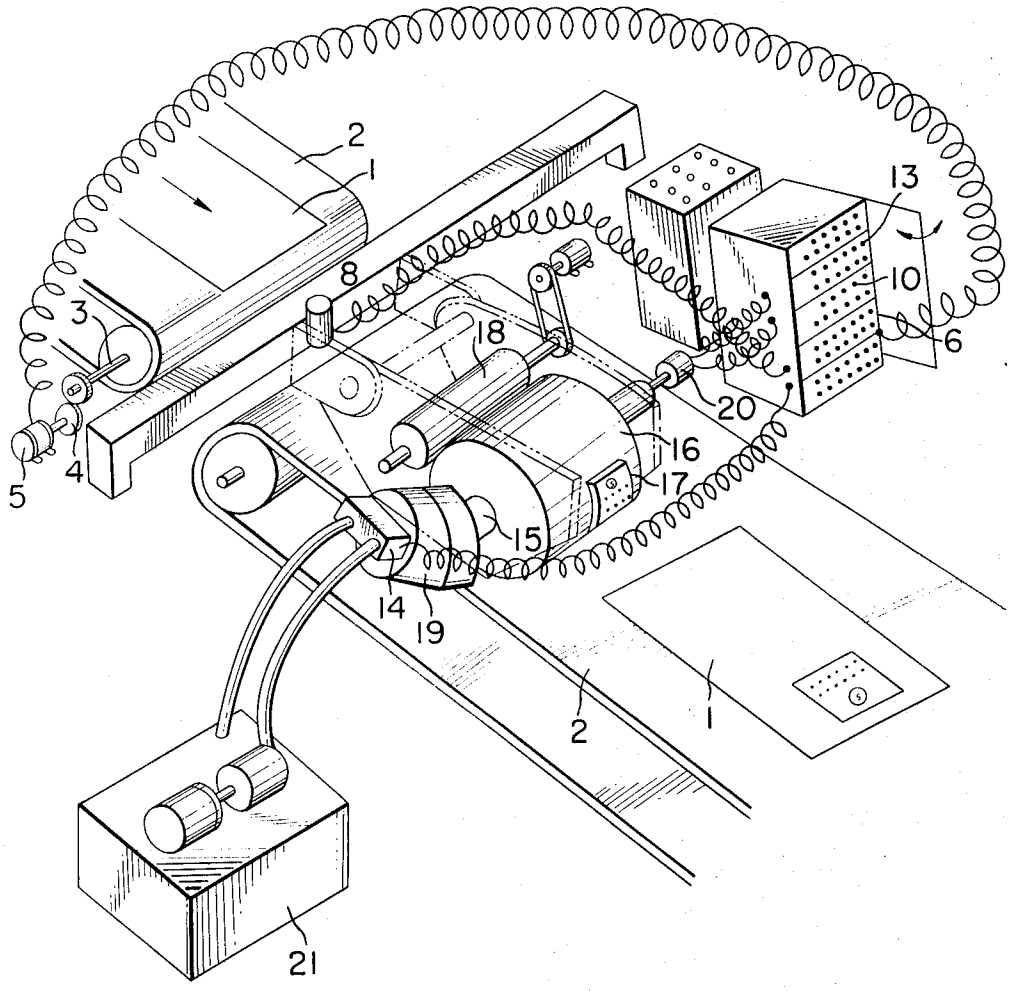


FIG. 1



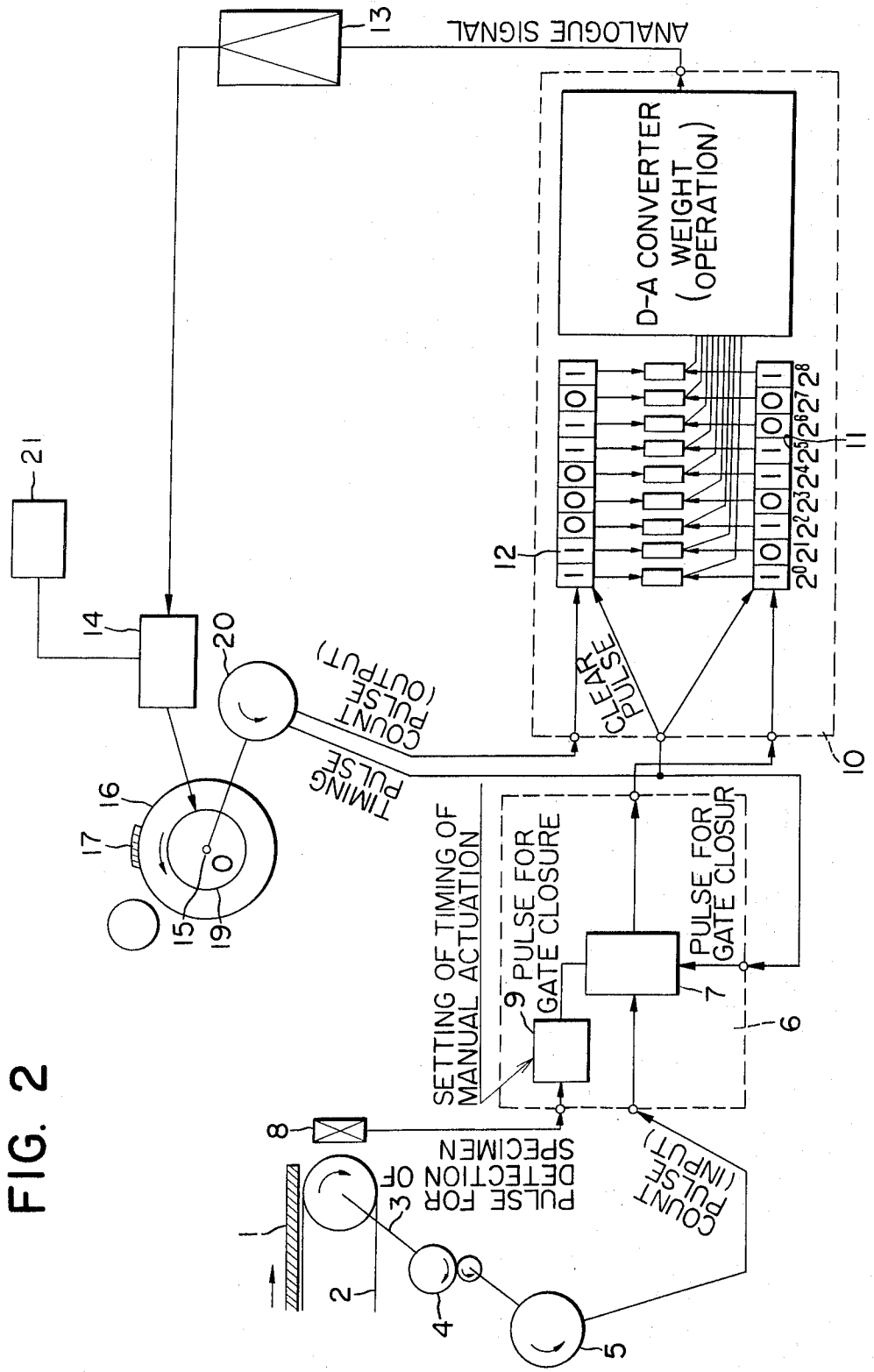

ANALOGUE SIGNAL
13
D-A CONVERTER
WEIGHT
(OPERATION)
2^0 2^1 2^2 2^3 2^4 2^5 2^6 2^7 2^8
11
12
10
CLEAR PULSE
COUNT PULSE (OUTPUT)
TIMING PULSE
20
21
14
16
17
15
19
SETTING OF TIMING OF MANUAL ACTUATION
9 PULSE FOR GATE CLOSURE
7 PULSE FOR GATE CLOSUR
6
8
PULSE FOR DETECTION OF SPECIMEN
COUNT PULSE (INPUT)
1
2
3
4
5

FIG. 2

HIGH-SPEED PRINTER

BACKGROUND OF THE INVENTION

Up to now, most printing of marks or identifications, such as trademarks and product specifications on steel sheets, veneers, etc. have been done manually, and this manual printing can attain a line speed only up to 140m/min. at highest.

Mechanically actuated printing has been developed and the manual printing line speed attained has been increased by it. Such mechanical printing has already been adopted in mass-production plants. However, increased printing speed has been eagerly desired.

Speed-up of an automatic printer has not been attained to the present time and the conventional automatic printer can achieve only a printing speed of about 140 – 260m/min. because friction clutches, claw clutches or the like are used for starting and stopping a printing drum. In a friction clutch system, slipping of the clutches occurs more often as the printing speed is increased, thus causing slips of prints, and in a claw clutch system, excessive load is imposed on the claws and troubles are caused thereby.

An object of the present invention is to provide a high-speed speed printer which overcomes the above defects.

According to the high-speed printer of the present invention, a printing drum is rotated one time for each sheet of the materials to be printed, using a hydraulic system instead of the friction clutch or claw clutch system, and the hydraulic system is controlled by detection of the feed speed of the material to be printed and the speed of the printing drum, so as to make the speed of rotation of the drum correspond to the speed of the material to be printed.

BRIEF DESCRIPTION OF THE DRAWINGS

One embodiment of the present invention will be described by referring to the attached drawings.

FIG. 1 is a schematic view of the printer of the present invention and

FIG. 2 is a schematic diagram of the systems used in the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

In FIGS. 1 and 2, 1 a material such as steel sheets or veneers to be printed, 2 is a belt-conveyor for carrying the material, 3 is a drive shaft for driving the belt-conveyor 2. A transmission gear 4 responds to the speed of the belt-conveyor 2 through the drive shaft 3. A pulse generator 5 responds to the moving speed of the belt-conveyor 2 through the transmission gear 4 and produces pulses whose rate corresponds to the speed print-positioning device 6 includes a gate circuit 7 for passing the pulses from the pulse generator 5 and a mono-stable vibrator 9 for opening and closing the gate circuit 7.

Element 8 is a detector for responding to the presence of the material to be printed. The arrival of the material is detected by this detector and its output signals are transmitted to mono-stable vibrator 9 to close the gate circuit 7 so as ultimately to vary the printing position. The pulse-generator 5, responds to the speed of the belt-conveyor 2 and applies the resulting signals to the gate circuit 7 in the print positioning device 6.

The gate circuit 7 is closed by the mono-stable vibrator 9 responds to detection of the arrival of the material to be printed at the detector 8 so that the signals from the pulse generator 5 are passed through the gate circuit 7. Element 10 is a speed signal operating device. A counter receives the signal of the moving speed of the material to be printed, through the gate circuit 7. A reversible counter 12 receives the signals of the moving speed (position) of the printing drum described later and operates error between signals of the counter 11 and the reversible counter 12. The counters 11 and 12 are housed in the speed signal operating device 10.

A servo-amplifier 13 amplifies the error signals produced the counter 11 and the reversible counter 12. A servo-valve 14 receives electric current proportional to the error signals supplied by the servo-amplifier 13. Element 15 is a shaft of the printing drm 16, 19 is a hydraulic motor for driving the printing drum, and the printing drum 16 is associated with the hydraulic motor 19 by means of the drum shaft 15.

A pulse generator 20 produces pulses whose rate corresponds to the rotation speed (position) of the printing drum 16. The generator 20 is provided at the other end of the drum shaft 15 and has its output connected to the speed signal operating device 10 and the gate circuit 7 of the print positioning device 6. Element 17 is a printing plate fixed on the circumference of the printing drum 16, 18 is an ink-roll for supplying printing ink to the printing plate 17, and 21 is a hydraulic unit for starting and stopping the printing drum. In this embodiment an oil-pressure unit is used for the hydraulic unit, but other hydraulic units may be used.

Next, the operations of the printer of the present invention will be explained.

When the material to be printed is fed by the conveyor 2, the time when the material is detected by the detector 8 provided along the path of the material and the detected signal is transmitted to the mono-stable vibrator 9 in the print positioning device 6 and closes the gate circuit 7 so as to change the position of the printing plate 17 on the printing drum in correspondence to the speed of the material 1.

Meanwhile, the moving speed of the belt-conveyor 2 is detected by the pulse generator 5 from the driving shaft of the belt-conveyor 2 through the transmission gear 4, and the thus detected signal is sent to the gate circuit 7 contained in the print positioning device 6. The signal from the pulse generator 5 is allowed to pass the gate circuit 7 only when the latter is rendered conductive by the detected signal of the material from the mono-stable vibrator 9 in the print positioning device 6, and then the signal which has passed the gate circuit is sent to the counter 11.

On the other hand, the signal of the moving speed (position of the printing plate) is transmitted to the reversible counter 12 by the pulse generator 20 and between the reversible counter 12 an error signal indicating the difference and the counter 11 is produced. A signal proportional to the error signal is applied to the servo-amplifier 13 and the amplifier 13 supplies electric current amplified from the error signal to the servo-valve 14. The pressure of oil supplied from the hydraulic unit 21 to the hydraulic motor 19 is adjusted by the degree to which the servo-valve 14 is opened. The rotary condition of the printing drum 16 obtained by this adjustment is sent by the pulse generator 20 to the reversible counter 12, while the running speed of the ma-

terial to be printed is signaled to the counter **11** from the gate circuit **7** and an error signal between the counter **11** and the reversible counter is operated, and when the both speeds become equal the material **1** is printed. Furthermore the signal from the pulse generator **20** is sent to the reversible counter **12** and a pulse signal for one rotation is directed to the gate circuit **7** in the print positioning device **6** so as to direct completion of one rotation of the printing drum **16** to open the gate, hold the printing drum **16** at a predetermined position and adjust the printing drum **16** in accordance with the speed of the material **1** to be printed. These operations are effected in a continuous manner.

As above described, according to the highspeed printer of the present invention, as the feed-back is effected by the speed signal operating device and the printing is effected by the hydraulic servo-mechanism, it is possible completely to synchronize the feed speed of the material to be printed with the rotation of the printing drum even at a high reverse rotation and to set the printing plate at a predetermined position so that high efficiency is attained in printing the materials such as steel sheets and veneers and yet clear and accurate printings are obtained.

What is claimed is:

1. A printer, comprising a normally non-rotating printing drum, conveying means for conveying materials to be printed toward the drum, first pulse generator means coupled to said conveying means for responding to said conveying means and producing pulses indicative of the speed of said conveying means, detecting means along the path of the material on the input side of the drum for indicating the presence of the material, said drum having print positioned on the periphery thereof, regulating means for rotating the drum and thereby changing the position of the print on the drum, second pulse generator means coupled to the regulating means for responding to the speed of the drum and producing pulses indicative of the speed of the drum,

print control means responsive to said first and second pulse generator means and said detecting means and coupled to said regulating means for comparing the speeds of the conveying means and the print when the material passes said detecting means and for controlling the speed of said regulating means on the basis of the comparison, said control means including, in combination, a first counter rendered effective upon the generation of an indication by the detecting means for responding to the pulse output of said first generator means and producing an output indicative of the speed of the conveying means after the material has passed said detecting means, a second counter responsive to said second generator means for responding to the position of said drum, and comparison means responsive to said counters for producing error signals indicative of the comparison in said counters and coupled to said regulating means for varying the position of said drum.

2. A printer as in claim **1,** wherein said regulating means includes a hydraulic motor and valve means, said control means controlling said valve means.

3. A printer as in claim **1,** wherein said first and second pulse generator means produce pulses at a rate corresponding to the respective speeds of said conveying means and said regulating means.

4. A system as in claim **3,** wherein said control means includes a gate, said gate being rendered effective for passing pulses in response to the material passing said detecting means, said gate passing pulses from said first pulse generator means to said first counter means.

5. A printer as in claim **4,** wherein said regulating means includes a hydraulic motor and valve means, said control means controlling said valve means.

6. A printer as in claim **5,** wherein said control means includes digital-to-analog converter means responsive to said comparison means.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,830,154 Dated August 20, 1974

Inventor(s) Nobumitsu Hegi and Sueo Matsubara

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading of the patent, insert:

--[30] Foreign Application Priority Data

June 11, 1971 Japan.....46-41932--.

Signed and sealed this 19th day of November 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,830,154 Dated August 20, 1974

Inventor(s) Nobumitsu Hegi and Sueo Matsubara

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading of the patent, insert:

--[30] Foreign Application Priority Data

June 11, 1971 Japan.....46-41932--.

Signed and sealed this 19th day of November 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.