United States Patent [19]

Ludwig

[11] **3,816,656**

[45] **June 11, 1974**

[54] **TELEPRINTER HAVING A TYPE CYLINDER WHICH IS ADJUSTABLE BY MEANS OF A STEPPING MOTOR**

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[73] Assignee: **Siemens Aktiengesellschaft,** Berlin and Munich, Germany

[22] Filed: **Oct. 31, 1972**

[21] Appl. No.: **302,569**

[30] **Foreign Application Priority Data**

Nov. 4, 1971 Germany 2154899

[52] **U.S. Cl.** **178/34,** 318/685, 197/48

[51] **Int. Cl.** **H04l 15/34**

[58] **Field of Search** 178/34, 35, 38; 197/48, 197/6.6; 318/467, 685

[56] **References Cited**

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Assistant Examiner—Gerald Brigance
Attorney, Agent, or Firm—Hill, Gross, Simpson, Van Santen, Steadman, Chiara & Simpson

[57] **ABSTRACT**

A teleprinter for *n*-step codes having a type cylinder which can be adjusted by a stepping motor by means of rotating the type cylinder in both directions comprises a position comparing device and an *n*-digit electronic binary counter for counting marks arranged in a row at the circumference of a timing disk carried for rotation with the type cylinder. The position of the timing disk is compared electronically with the received code combination associated with the type to be positioned and the type carrier is operated to the next circumferential position in accordance with the lesser distance of travel in the advance or reset direction of rotation of the type carrier.

2 Claims, 4 Drawing Figures

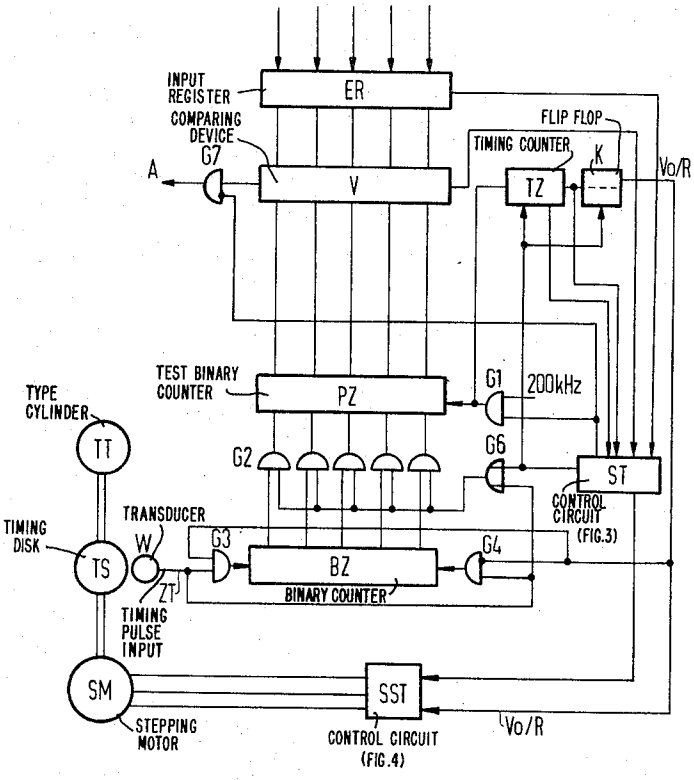


Fig.1

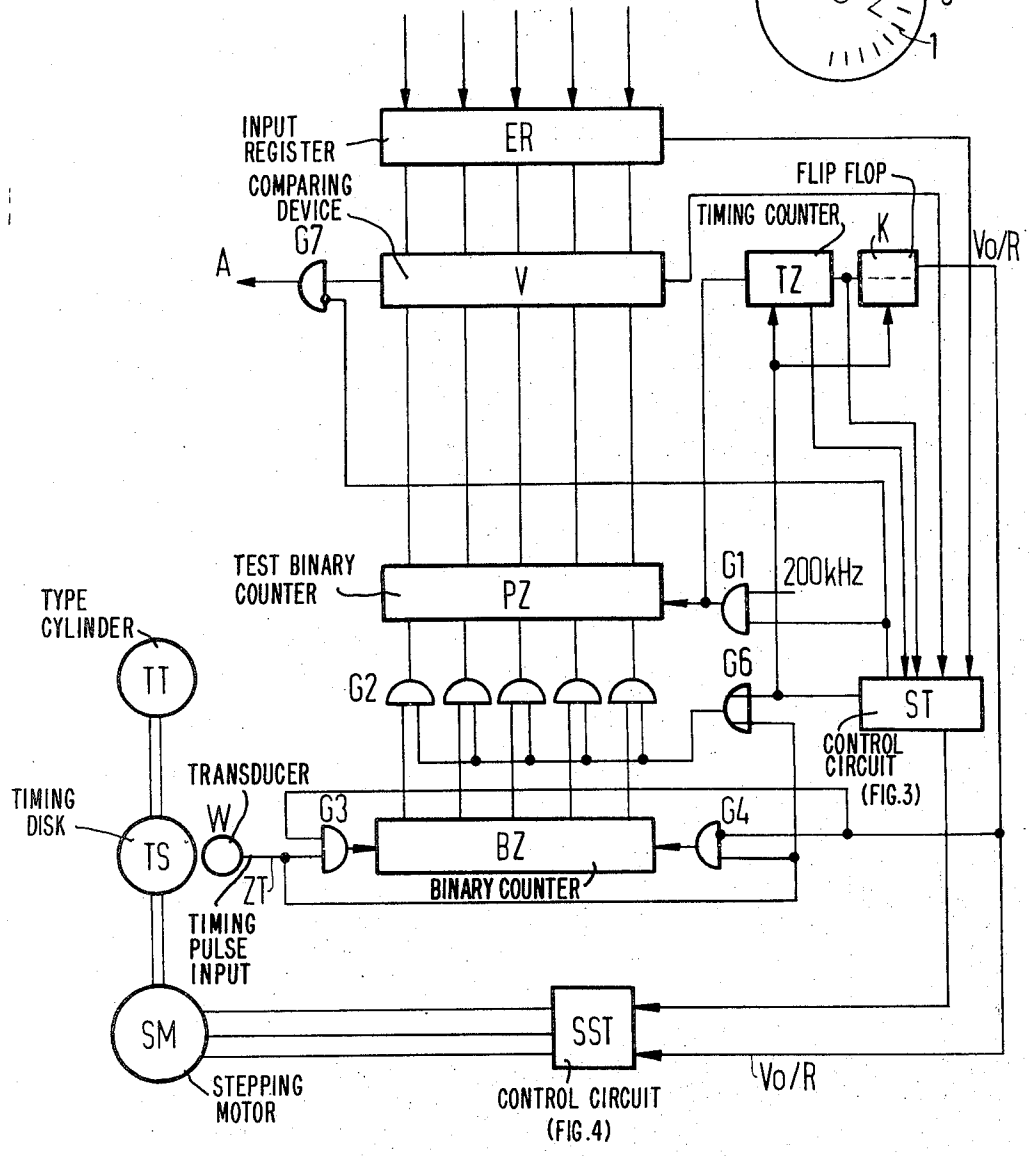

INPUT REGISTER
ER
COMPARING DEVICE
G7
A
V
FLIP FLOP
TIMING COUNTER
K
TZ
Vo/R
TEST BINARY COUNTER
PZ
G1
200kHz
TYPE CYLINDER
TT
G2
G6
ST
CONTROL CIRCUIT (FIG.3)
TRANSDUCER
TIMING DISK
W
G3
G4
TS
BZ
BINARY COUNTER
ZT
TIMING PULSE INPUT
SM
SST
STEPPING MOTOR
CONTROL CIRCUIT (FIG.4)
Vo/R

Fig.2

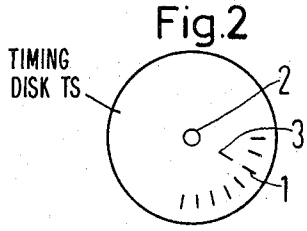

TIMING DISK TS
1
2
3

Fig.4

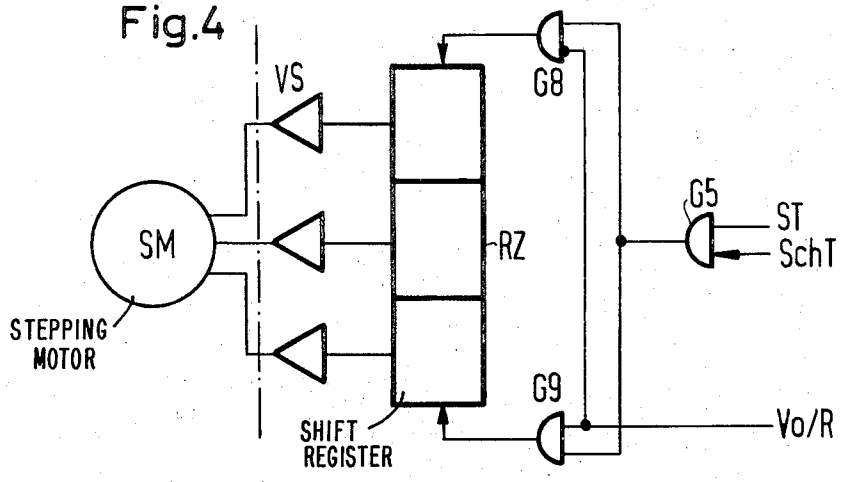
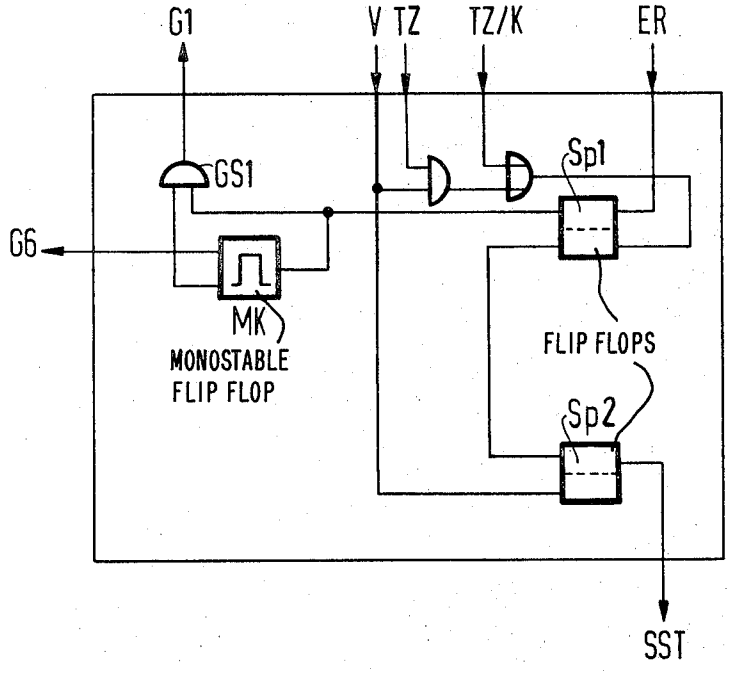

VS
G8
SM
RZ
G5
ST
SchT
STEPPING MOTOR
G9
SHIFT REGISTER
Vo/R

Fig.3


G1
V TZ
TZ/K
ER
GS1
Sp1
G6
MK
MONOSTABLE FLIP FLOP
FLIP FLOPS
Sp2
SST

TELEPRINTER HAVING A TYPE CYLINDER WHICH IS ADJUSTABLE BY MEANS OF A STEPPING MOTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a teleprinter, and more particularly to a teleprinter having a *n*-stepping code comprising a type cylinder which can be adjusted by a stepping motor by means of rotating the type cylinder in both directions and comprising a code-comparing device having marks upon a disk or roller which can be scanned and which are rotated along with the type carrier.

2. Description of the Prior Art

The prior art recognizes the application of an n-digit electronic binary counter with a teleprinter having a constantly rotating type number, which electronic binary counter can be controlled by way of stepping marks arranged in a row at the circumference of a timing disk and means for scanning the comparing marks whereby the position of the type cylinder is electronically compared with respective code combinations associated with the type cylinder which is to be adjusted.

SUMMARY OF THE INVENTION

The primary object of the present invention is to provide a teleprinter of the type mentioned above comprising a comparing system having a binary counter, as described above, and a simple system by which it can easily be decided whether the next printing location can be reached on the shortest path of travel by means of advancing or resetting the type carrier.

The foregoing object is realized, according to this invention, in such a way that a test binary counter with a much higher timing frequency, for example, with a 200 kHz timing frequency, which can be permutated in the advance direction, is provided for simulating the demanded adjustment of the binary counter. A timing counter which can be controlled by way of the test binary counter is controlled when half of the number of printing positions or less along the circumference are counted before the end position is reached to effect an adjustment of the stepping motor in the advance direction and if half of the number of printing positions or more is exceeded, will effect an adjustment of the stepping motor in the reverse direction.

According to a further development of the invention, a solution which can be realized simply and inexpensively, for example, in accordance with the prior art MOS technique, is provided in that a flip-flop stage is connected to the timing counter which, after a teleprinter symbol has been stored, is effective in the sense of influencing a control circuit which reacts according to logical switching states in one or the other sense and influences the stepping motor, first of all, in the advance direction. The timing counter influences a control circuit, possibly while reaching a position corresponding to half the passed-through printing positions, in such a way that the stimulation is completed and thus the reset of the stepping motor is caused while the advance control of the stepping motor becomes effective when lower timing numbers are detected before reaching the next printing position.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the invention, its organization, construction and operation will be best understood from the following detailed description of an embodiment thereof taken on conjunction with the accompanying drawings, on which:

FIG. **1** is a schematic logic diagram of the system according to the invention;

FIG. **2** is a plan view of the timing disk TS employed in FIG. **1**;

FIG. **3** is a more detailed logic diagram of a control circuit employed in FIG. **1**; and

FIG. **4** is a schematic logic diagram of a circuit for controlling the stepping motor.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. **1** and **2**, five steps of a teleprinter symbol are received in a register ER in a teleprinter in accordance with a five code and **100** Baud printing speed. The register ER comprises an electronic series/-parallel converter. The type carrier of the printing system is embodied as a type cylinder TT which is adjustable in either direction by means of a stepping motor SM. A timing Disk TS, which is illustrated in a plan view in FIG. **2**, is attached upon a shaft **2** which defines the axis of rotation of the type cylinder TT. The timing Disk TS comprises marks **1** at a predetermined radial distance from the shaft **2**, which marks are scanned by a transducer W. A mark **3** is carried on the disk TS at a different radius and appears only once per revolution and serves for producing a synchronizing pulse which is not essential for the invention and is therefore not further treated herein.

The contents of a five-digit binary counter BZ which is provided in the circuit respectively correspond to the binary numbers by which the code combination can be expressed which is associated with the instantaneous position of the type cylinder TT. The construction of the binary counter may, for example, correspond to that disclosed in the German Letters Pat. No. 1,055,047. A comparing device V compares the symbols stored in the input register ER (with the bits in parallel form) with the contents of the binary counter BZ, on the one hand, and on the other hand compares with the contents of a test binary counter PZ. Both counters are switched further over one digit in the five-digit dual system when an individual timing pulse arises.

More specifically, the development when the counters are switched is as follows. When the contents applied to the comparing device V from the input register ER and from the test binary counter PZ coincide, a character printing process is effected directly by way of an output A. In the case of non-coincidence, the adjusting movement is stimulated in the test binary counter PZ before the adjusting movement of the type carrier TT at a 200 kHz frequency as follows. Since a maximum of **16** steps are required for adjusting in an advance or reset motion in the example as selected, **80** microseconds are required. This time is negligible compared with the mechanical adjustment time (**65** miliseconds with **100** Bd).

After a symbol has been stored in the input register ER, a signal is produced and further processed in a control circuit ST, as illustrated in FIG. **3**. A bistable flip-flop circuit Sp1 is connected into this control circuit ST

and is therefore activated by way of a monostable flip-flop circuit MK, or an OR gate G6 and the AND gates G2, so that the information stored in the binary counter BZ reflecting the position of the type carrier TT is transferred by the test binary counter PZ. Simultaneously, a timing counter TZ and a flip-flop stage K are reset. The position of the flip-flop stage K obtained in this manner contains the direction that the stepping motor SM must be driven in a direction herein called the advance direction for a control circuit SST for the stepping motor SM. After the contents of the binary counter BZ has been transferred over into the test counter PZ, the monostable flip-flop circuit MK will flip back and activate a 200 Khz timing pulse generator for the test binary counter TZ, by way of a gate G1, after which the test binary counter PZ is switched further in accordance with this timing frequency. The comparing device V thereby compares the information stored in the input register ER with that of the further switched test binary counter PZ. The timing counter TZ is switched further in accordance with the same timing frequency. If the comparing device V detects coincidence with the contents of the input register ER and the test binary counter PZ, then the simulated adjustment is ended in the test binary counter PZ and the adjustment of the type carrier TT is initiated by the stepping motor SM by way of the bistable flip-flop stages Sp1 and Sp2. If the timing counter PZ has not reached the counting value **16** in the meantime, the flip-flop stage K which is connected to the timing counter TZ is reset. As was mentioned before, this means that the stepping motor SM is driven in an advance direction. If the timing counter has reached the position **16** again before the comparing device V finds coincidence between the contents of the input register ER and the contents of the test binary counter PZ, then a pulse will be emitted from the timing counter TZ which, and in the same manner as the comparing device V in the other case, will initiate the adjusting process of the type carrier TT by means of the stepping motor SM by way of the bistable flip-flop stages Sp1 and Sp2. However, the circuit ST will simultaneously place the flip-flop K in a position which announces a reset motion of the stepping motor SM to the control circuit SST for the stepping motor SM. Timing pulses ZT are generated due to the rotation of the timing disk TS pass the transducer W as the type carrier TT is adjusted and reach the binary counter BZ whereby the latter is selectively switched further forward or backward—the flip-flop stage K either activates the AND gate G3 or the AND gate G4—due to the symbol pulses ZT by way of one of the gates G3 or G4, respectively. Simultaneously, the contents of the binary counter BZ are further processed and applied to the test binary counter PZ by way of the gates G2, and the test binary counter PZ makes this information available for the comparing device V.

During the simulated adjustment of the test binary counter PZ by the 200 kHz timing pulses, a gate G7 is blocked so that the comparing device V cannot further process any information to the type printing device by way of the output A if the contents of the input register ER and the contents of the test binary counter PZ coincide. Only after the adjusting process of the type carrier TT by way of the stepping motor SM has been completed will this printing order be further processed.

Referring to FIG. 4 there is illustrated a stepping motor and the control circuit SST required for controlling the stepping motor. The stepping motor SM in the selected example has three poles, i.e., it comprises three excitation windings. Corresponding to these three excitation windings, a three-stage shift register RZ is provided in the control circuit. Depending on the position of the shift register, one of the excitation windings of the stepping motor SM will be excited by way of a corresponding amplifier circuit VS. The stepping frequency is supplied to the shift register by a timing generator SchT (not illustrated in detail) by way of an AND gate G5 when the corresponding information concerning the adjusting movement is provided by way of the bistable flip-flop stage ST. The direction of the pulse supply for the shift register RZ is predetermined, depending on the position of the flip-flop stage K by way of the gates G8 and G9.

Although I have described my invention by reference to a specific illustrated embodiment thereof, many changes and modifications of the invention may become apparent to those skilled in the art without departing from the spirit and scope of the invention. I therefore intend to include within the patent warranted hereon all such changes and modifications as may reasonably and properly be included within the scope of my contribution to the art.

I claim:

1. A teleprinter for *n*-step codes comprising: a rotatable type cylinder, a stepping motor connected to said type cylinder for rotating said type cylinder in both directions, a position comparing device comprising a timing disk mutually rotatable with said type cylinder and carrying thereon a plurality of marks, means for reading said marks as said type cylinder is rotated, an *n*-digit electronic binary counter connected to said reading means for storing the position of said type cylinder, means for receiving an *n*-digit code corresponding to a symbol to be typed, means for comparing the contents of said receiving means and the contents of said *n*-digit electronic binary counter and producing a printing pulse in response to coincidence, and means for controlling the rotation of the type carrier over the shortest path for the next circumferential position thereof including a test binary counter interposed between said *n*-digit electronic binary counter and said comparing means, means for advancing said test binary counter to simulate advancement of said *n*-digit electronic binary counter to produce a simulated demanded adjustment of said biary counter for the next circumferential position of said type cylinder, a timing counter controlled by said test binary counter for controlling the operation of said stepping motor in the advance direction if half the number of printing positions or less along the circumference of said type cylinder are counted before the end position is reached and in the opposite direction if half the number of printing positions is exceeded.

2. A teleprinter according to claim **1** comprising a flip-flop stage and a control circuit, said flip-flop stage connected to said timing counter and responsive to receipt of a symbol to be typed to cause said control circuit to effect operation of said stepping motor in the advance direction, said timing counter connected to said control circuit and operable to cause said control circuit to effect operation of said stepping motor in the opposite direction when a position is reached corresponding to half the printing positions.

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