(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 538 800 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **92117938.8**

(51) Int. Cl.^{5}: **G03G 15/04**

(22) Date of filing: **20.10.92**

(30) Priority: **21.10.91 JP 272394/91**

(43) Date of publication of application: **28.04.93 Bulletin 93/17**

(84) Designated Contracting States: **DE FR GB IT**

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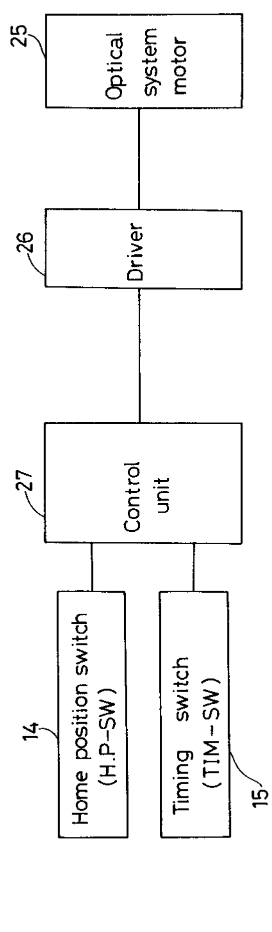
(54) Drive device for optical system.

(57) A drive device for reciprocating an optical system within an area, with a specified position being made a reference position, said drive device comprising
actual measuring means for actually measuring the reference traveling amount from the specified position to a return position on a forward movement of the optical system;
memory means for memorizing the braked travel amount which is necessary to make the optical system operate at a specified traveling speed at the specified position on a returning movement of the optical system;
computation means for computing the travel moving amount by subtracting the braked travel amount from the reference traveling amount; and
braking means for starting braking of the optical system from the position where the optical system starts returning action from the return position and has returned by the travel moving amount.

Fig. 2



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BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to a drive device for reciprocating an optical system within an area making a specified position as reference, for example, in an image forming equipment such as a document copying machine, etc..

Description of the Prior Art

Conventionally, a device disclosed for example in the Japanese Laid Open Patent No. Sho-61-59321 gazette has been known as this kind of drive device.

As in a device disclosed in the above gazette it is detected by the number of pulses from a rotary encoder that the optical system goes beyond the point of termination of an image area through moving on a going path, a motor for driving the optical system is controlled for reversal braking, whereby the travelling speed of the optical system is quickly slowed down, and the period of pulse row outputted from the rotary encoder according thereto becomes greater. When the period reaches a certain fixed level, it is then detected that the optical system has started reverse movement. The optical system is driven for movement at a high speed from this return position, and as this optical system moves only by a fixed distance, it is next controlled for speed deceleration. Thereafter, as the optical system reaches the position of reference, the motor is immediately controlled for reversed braking. And at the point of time when the motor rotation speed is further decelerated, the motor is turned OFF, and the optical system comes to a stop at its stop position.

Hereupon, since the traveling speed of the optical system is generally different in the image area according to the ratio of magnification for the same size of document, the return position of the optical system may is made different according to the traveling speed. Therefore, as shown above, in the technology disclosed in the above Gazette wherein speed is controlled so that it is changed to a low speed from the position where the optical system has returned by a fixed distance as making the return position as reference, the braking distance may be made uneven, it is impossible to secure the stop accuracy of the optical system always in high precision under a stabilized status at a so-called home position (stop position) as an original position.

SUMMARY OF THE INVENTION

So, in view of the above situation, the present invention has been created, and it is an object of the invention to provide a drive device for the optical system which is equipped with control function securing stop accuracy in a high precision under a stabilized status at the stop position of the optical system.

In order to achieve the object, principal means adopted in the present invention is as gist that in a drive device for reciprocating an optical system within an area with a specified position made as reference, a drive device for optical system comprises; actual measuring means for actually measuring the reference traveling amount from the specified position to a return position on a going path of the optical system; memory means for memorizing the braked travel amount which is necessary to make the optical system operate at a specified traveling speed at the specified position on a returning path of the optical system; computation means for computing the travel moving amount by subtracting the braked travel amount from the reference traveling amount; and braking means for starting braking of the optical system from the position where the optical system starts returning action from the return position and has returned by the travel moving amount.

In a drive device according to the above construction, when the optical system travels on the going path, the reference traveling amount from a specified position (for example, the timing position made as reference for scanning by the optical system) to the return position is actually measured, for example, by the number of pulses or time corresponding to the distance. Subsequently, the braked travel amount which is necessary to make the optical system operate at a specified speed at the specified position on the returning path of the optical system (as the relationship between influence by inertia and travel speed in the optical system has been already known, the amount of travel which is required for braking at the travel speed can be made clear) is subtracted from this reference traveling amount, the travel moving amount supplied for scanning by the optical system is computed. Also, in this case, the braked travel amount is memorized in the memory means in advance.

And braking control for the optical system is started from the position where the optical system starts returning from the return position and has returned by the travel moving amount.

Thus, based upon the distance (position) along which the optical system actually has moved, it is controlled so that the distance necessary for braking in returning of the optical system can be secured. Therefore, even though the traveling speed of the optical system varies, for example, according to the magnification of copying, the stop position accuracy in returning of the optical system is remarkably good (well stabilized and high precision).

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a construction view of essential parts of an image forming equipment equipped with a drive device for optical system according to a preferred embodiment of the present invention,

Fig. 2 is a block diagram showing the outline construction of the essential parts of the drive device,

Fig. 3 is a view for explaining the outline of control in the drive device,

Fig. 4 is a flow chart showing the sequence of control of the essential parts by the drive device, and

Fig. 5 is a flow chart showing the sequence of control according to another preferred embodiment of the essential parts by the drive device,

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the drawings attached hereto, preferred embodiments in which the present invention is embodied is described for understanding of the invention. Furthermore, the following preferred embodiments are merely examples of the embodiments and do not intend to limit the technical scope of the invention.

As shown in Fig. 1 and Fig. 2, in an image forming equipment equipped with a drive device according to a preferred embodiment, an optical system unit 3 is provided below a document table 2 within the box-like body 1, and the optical system unit 3 is reciprocatably supported by rails now shown but arranged in parallelism with the document table 2 within a specified area between an original position 4 (home position) and a return position 5 on the rails.

The optical system unit 3 comprises a first traveling frame 6 and a second traveling frame 7, and the first traveling frame 6 and the second traveling frame 7 are mutually related with intervention of a wire so that they can travel at a speed ratio of 2:1.

The first traveling frame 6 compreses reflection plates 8, 9, a halogen lamp 10 and a mirror 11, etc., and the second traveling frame 7 is provided with mirrors 12, 13, etc..

And the position of the optical system unit 3 on the rails is detected by turning ON and OFF a home position switch 14 and timing switch 15 by means of an actuator (not shown) attached to the first traveling frame 6, further based upon the traveling amount which is actually measured with these positions made as reference. In this case, the home position switch 14 is for detecting the optical system unit 3 at the original position 4, and the timing switch 15 is for taking timing when a document image is scanned by the optical system unit 3. Also, the travelling amount of the first traveling frame 6 of the optical system unit 3 is detected by counting the number of pulse signals outputted from an encoder not shown connected to the motor 25 which drives the optical system unit 3. The motor 25 is driven and stopped by availability and unavailability of the power supply and is controlled by a control unit 27 via a driver 26.

A lens 20 for magnification which constitutes a lens unit 19 is provided on an optical path 18 from the optical system unit 3 to a photosensitive body 17, and the lens 20 is promptly moved and adjusted along the optical path 18 according to the ratio of image forming magnification. Mirrors 21, 22, 23 and a filter 24, etc. are provided in the above lens unit 19 as well as the lens 20.

In the image forming equipment according to the above construction, the lens 20 is firstly moved and adjusted in a prompt direction according to a specified magnification during action of image forming.

And as the motor 25 is turned ON, the photosensitive body 17 begins rotating, and at the same time the optical system unit 3 begins to scan at a traveling speed according to the magnification ratio, thereby causing exposure to be carried out by a halogen lamp 10.

Namely, the first traveling frame 6 of the optical system unit 3 which began to travel from the original position 4 detected by the home position switch 14 turns ON the timing switch 15. Thereafter, the corresponding optical system unit 3 enters scanning according to the size of paper (copying paper, original document) and magnification ratio.

This scanning direction (normal rotation direction) is shown with an arrow mark 31.

Scanning is thus carried out for a document, and when the first travelling frame 6 of the optical system unit 3 reaches the return position 5, the above motor 25 is controlled for reversed drive, and the traveling direction of the optical system unit 3 is reversed. The traveling direction caused thereby is shown with an arrow mark 32.

The optical system unit 3 which has been reversed and moved as shown above moves toward the stop position. Then, the motor 25 is turned OFF by turning-ON of the timing switch 15, the optical system unit 3 is made to stop at the original position 4.

A document image which has been light-irradiated by the halogen lamp 10 for scanning is formed in the mirrors 11, 12, 13, the lens 20, the mirrors 21, 22, and 23 in the order and is irradiated on the photosensitive body 17 through penetrating the filter 24.

Thereby, electrostatic latent image is formed on the surface of the photosensitive body 17 and is turned into visible image by developing this electrostatic latent image.

The visible image on the photosensitive body 17 is transferred onto a sheet of paper and treated for fixation, and the fixation-treated paper is delivered outside the machine.

Subsequently, the processings related to actions especially of the optical system unit 3 in a series of image forming processing as shown above are described with reference to Fig. 3 and Fig. 4.

Also, in Fig. 4, S1, S2, ... means steps of respective processings.

Firstly, the optical system unit 3 starts normal rotation, that is begins traveling in the direction of the arrow mark 31. Then, if passage of the first traveling frame 6 of the corresponding optical system unit 3 is detected by the timing switch 15 (TIM-SW) (S1, S2, S3), counting of the output pulses from the encoder connected to the motor 25 (S4). The optical system unit 3 starts scanning in the direction of the arrow mark 31 at a speed according to the magnification ratio.

As scanning responsive to the image area by the optical system unit 3 is completed and the first traveling frame 6 reaches the return position 5, the motor 25 is controlled for reversed braking, and the traveling direction of the optical system unit 3 is reversed. Thereby, the reference traveling distance from the position of the timing switch 15 to the return position 5 is actually measured as the number of pulses corresponding to the distance while the first traveling frame 6 of the optical system unit 3 is moving on the going path. The count value of that time is regarded as L_1 (reference traveling amount).

As shown above, when the traveling direction of the optical system unit 3 is reversed, the value of L_2 is subtracted from the value of L_1 to obtain the value of L_3.

In this case, the L_2 represents the braked travel amount which is required to make the first traveling frame 6 of the optical system unit 3 operate at a specified traveling speed R_5 at the position of the timing switch 15 on the return path of the optical system unit 3 and is memorized in a memory (not shown) which constitutes the control unit 27. And the amount braked traveling L_2 is found clear in advance as value necessary for braking at the traveling speed since the relationship between influence of inertia in the optical system unit 3 and the traveling speed.

Also, the L_3 represents the travel moving amount at which the first traveling frame 6 of the optical system unit 3 can be made to travel when it is returned at a high speed R_4.

Therefore, the travel moving amount L_3 can be calculated by subtracting the braked travel amount L_2 from the reference traveling amount L_1.

Thereby, in order to secure the braked travel amount L_2 necessary to obtain the speed which makes the optical system unit 3 stop positively at the original position 4, that is, the traveling speed R_5, it is determined how long distance the optical system unit 3 can be traveled.

Under the above premise, travel of the optical system unit 3 on the returning path is started, and at the same time subtraction for the count value (L_1) of which computation is finished at the S5 is started (S6, S7, and S8).

As described above, subtraction of the count value is carried out as well as travel of the optical system unit 3, and when this count value is made equal the travel moving amount L_3 (S10), control for reversed braking related to the optical system unit 3 is started (S11).

And at the position of the timing switch 15 where the optical system unit 3 has traveled (been spaced) by the braked travel amount L_2 from the position where the reverse braking control has been started, the first traveling frame 6 of the optical system unit 3 is controlled so that its traveling speed can become the value of R_5.

Thereafter, as the passage of the first traveling frame 6 is detected by the timing switch 15, the motor 25 is turned OFF, and the first traveling frame 6 is stopped at the original position 4 without fail.

As described above, in the device according to the present preferred embodiment, as control is made so that the distance necessary for braking on return can be secured according to the distance along which the optical system unit 3 has actually traveled on the going path, the stop position accuracy on returning of the corresponding optical system unit 3 is remarkably good even the traveling speed of the optical system unit 3 changes according to the ratio of magnification.

Also, in the above preferred embodiment, an example of the case that each traveling amount of the first traveling frame 6 of the optical system unit 3 is expressed by count values (L_1, L_2, L_3) of pulse is described. Instead of the pulse count value, the values obtained through measurement of time by a timer may be used as this traveling amount.

In this case, the sequence of control of the corresponding drive device is shown in Fig. 5.

And, in this sequence, the count value T_1 by the timer corresponds to the above L_1, T_2 to L_2, and T_3 to L_3, respectively.

Claims

1. In a drive device for reciprocating an optical system within an area with a specified position made as reference, a drive device for optical system comprising;

actual measuring means for actually measuring the reference traveling amount from the specified position to a return position on a going path of the optical system;

memory means for memorizing the braked travel amount which is necessary to make the optical system operate at a specified traveling speed at the specified position on a returning path of the optical system;

computation means for computing the travel moving amount by subtracting the braked travel amount from the reference traveling amount; and

braking means for starting braking of the optical system from the position where the optical system starts returning action from the return position and has returned by the travel moving amount.

2. A drive device for optical system defined in Claim 1, wherein the reference traveling amount, the braked travel amount, and the travel moving amount are expressed by the count values of pulse signal outputted in accompanying with travel of the optical system.

3. A drive device for optical system defined in Claim 1, wherein the reference traveling amount, the braked travel amount, and the travel moving amount are expressed by the time required for travel of the optical system.

Fig.1

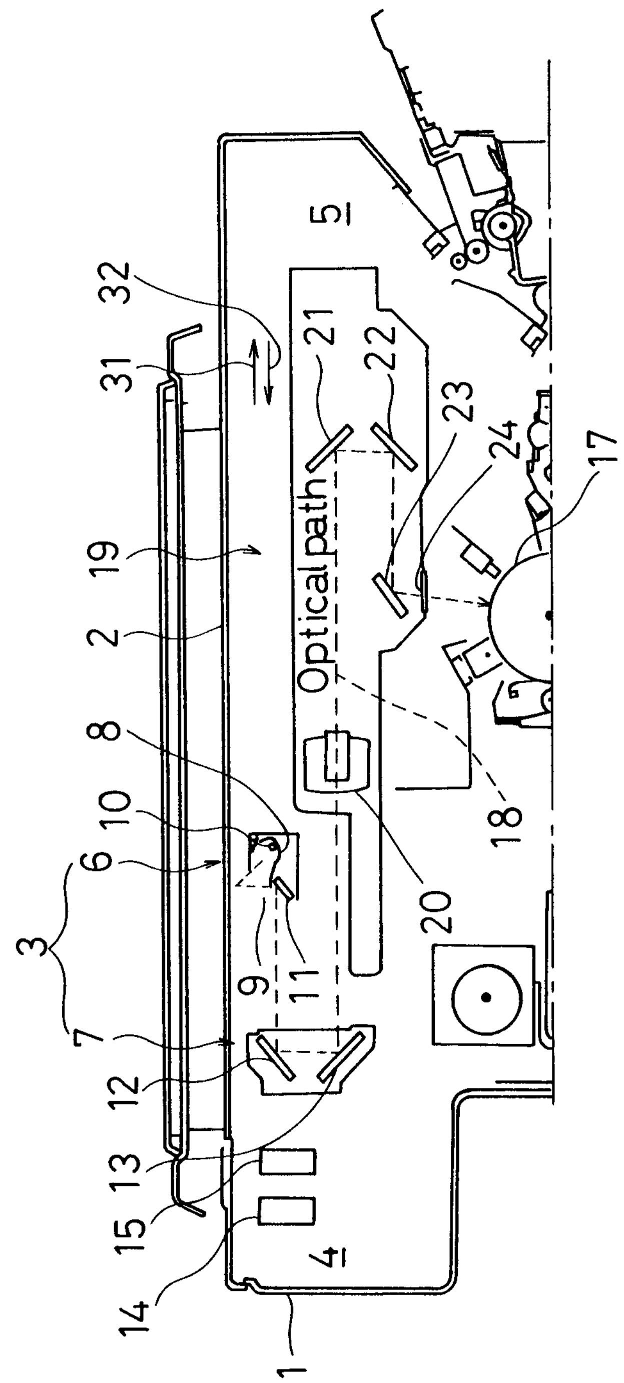

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
17
18
19
20
21
22
23
24
31
32
Optical path

Fig. 2

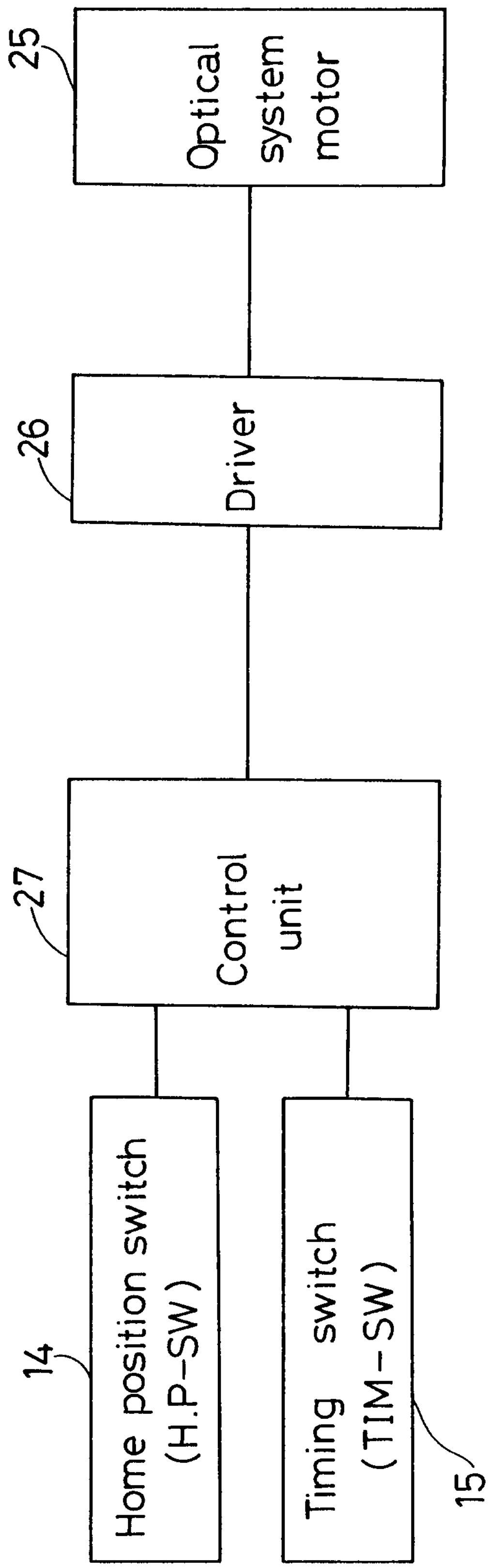

25
Optical system motor
26
Driver
27
Control unit
14
Home position switch (H.P-SW)
15
Timing switch (TIM-SW)

Fig.3

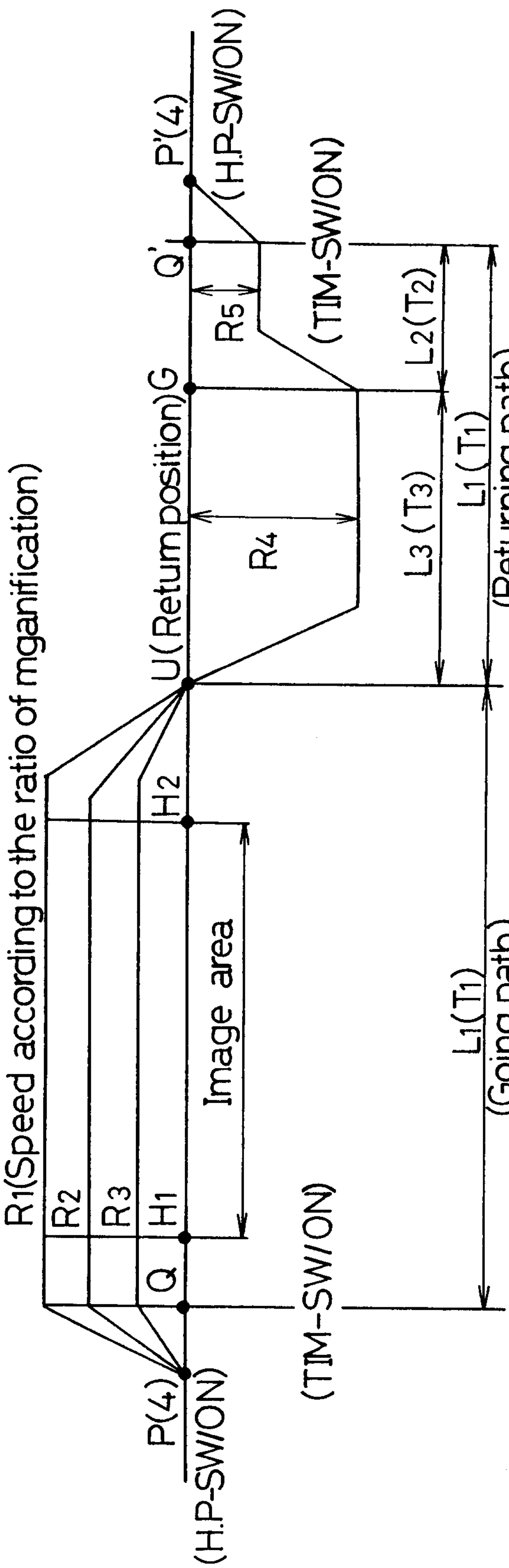

R_1(Speed according to the ratio of mganification)
R_2
R_3
H_1
H_2
Q
P(4)
(H.P-SW/ON)
(TIM-SW/ON)
Image area
L_1(T_1)
(Going path)
U(Return position)G
R_4
L_3(T_3)
L_1(T_1)
(Returning path)
R_5
L_2(T_2)
(TIM-SW/ON)
Q'
P'(4)
(H.P-SW/ON)

Fig.4

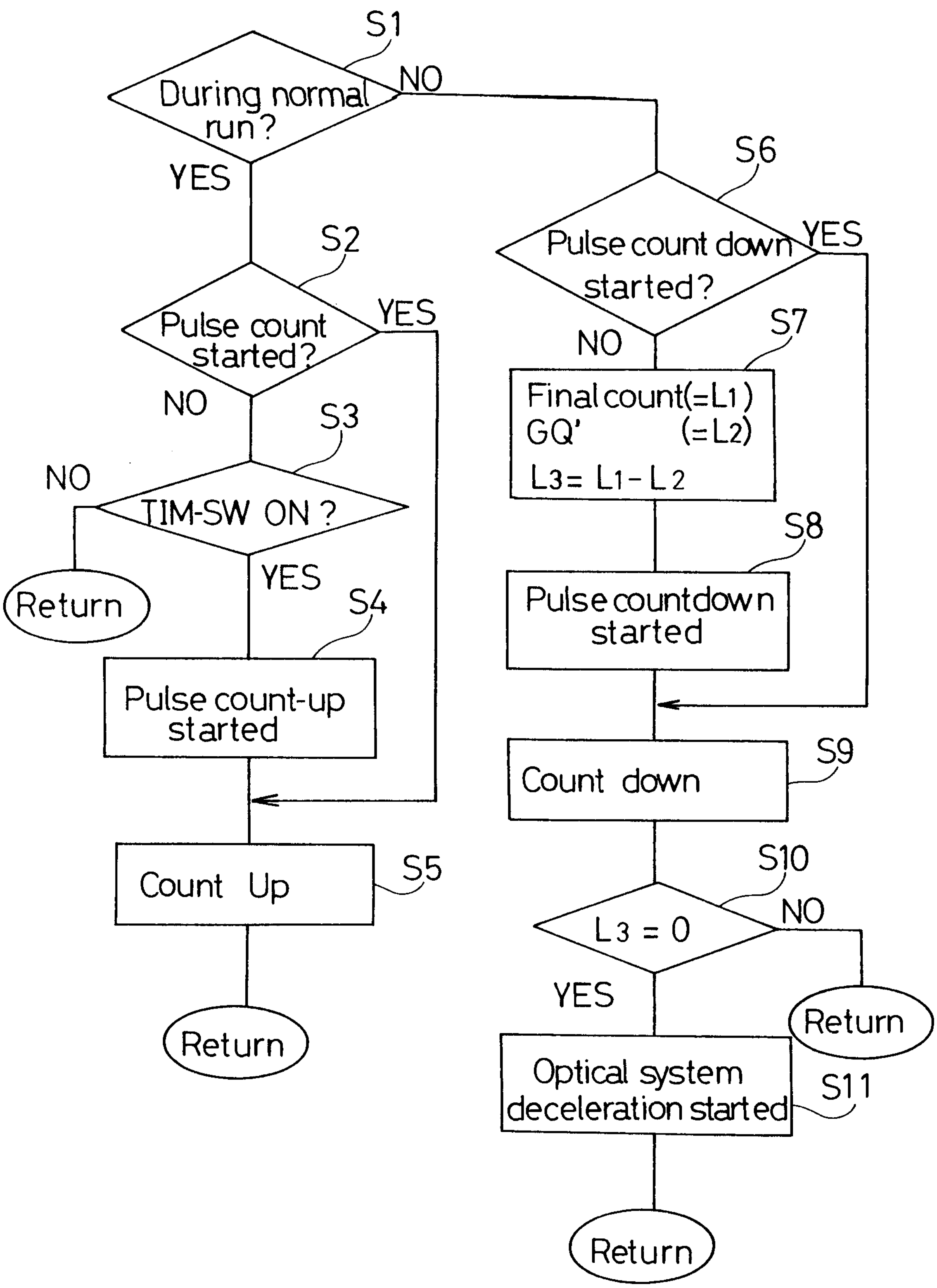
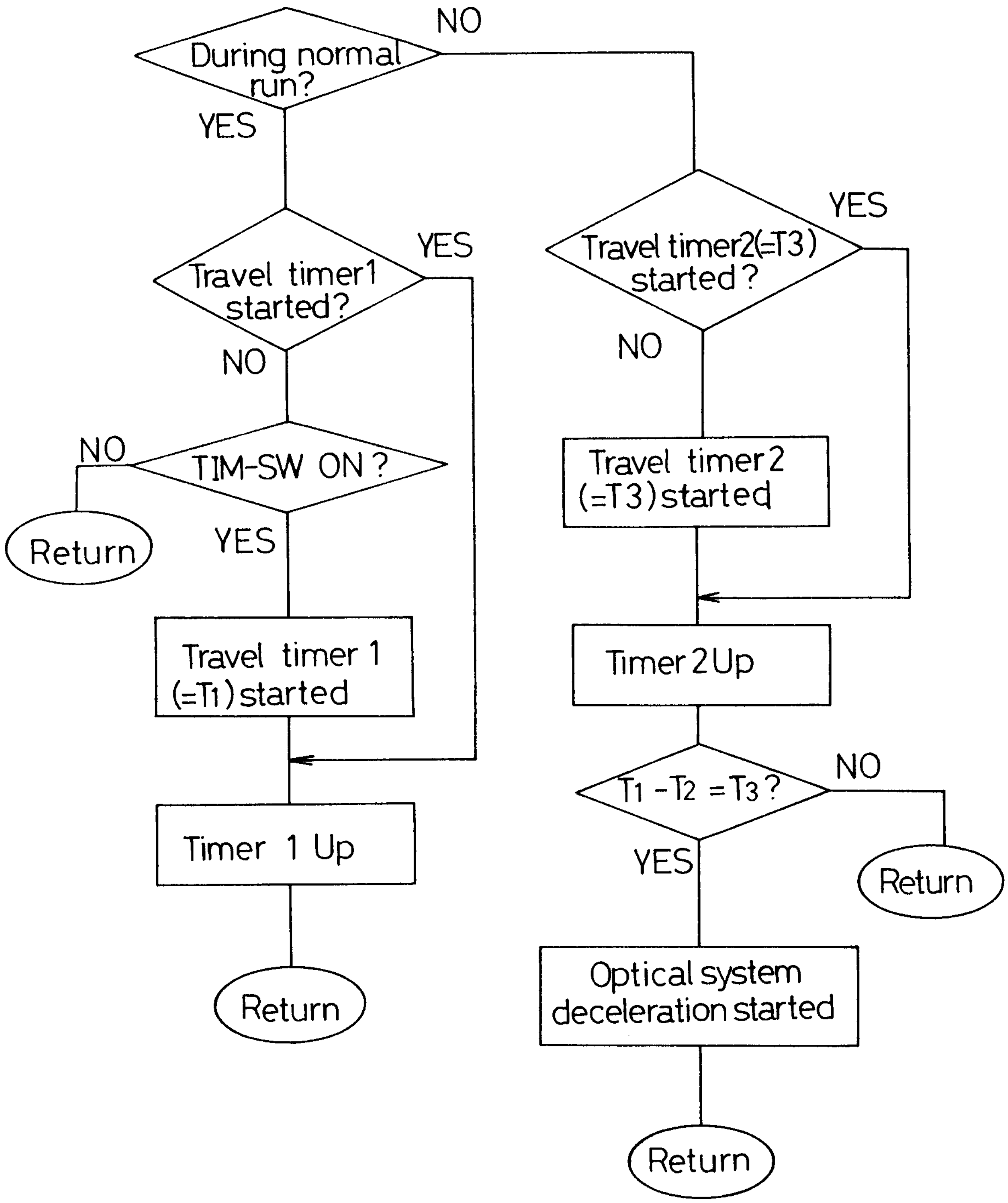

S1
During normal run?
NO
YES
S6
Pulse count down started?
YES
S2
Pulse count started?
YES
NO
S7
Final count(=L1)
GQ' (=L2)
L3= L1-L2
NO
S3
NO
TIM-SW ON ?
YES
Return
S4
Pulse count-up started
S8
Pulse countdown started
S9
Count down
S5
Count Up
S10
L3 = 0
NO
YES
Return
Return
Optical system deceleration started
S11
Return

Fig. 5


During normal run?
NO
YES
Travel timer1 started?
YES
NO
TIM-SW ON ?
NO
Return
YES
Travel timer 1 (=T1) started
Timer 1 Up
Return
Travel timer2(=T3) started?
YES
NO
Travel timer2 (=T3) started
Timer 2 Up
T1 - T2 = T3 ?
NO
Return
YES
Optical system deceleration started
Return