LINEAR DRIVING ARRANGEMENT FOR USE IN A COPYING APPARATUS.

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References cited:
EP-A-0 322 704
US-A-4 509 001
US-A-4 585 331


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Description

BACKGROUND OF THE INVENTION

The present invention relates to a linear driving arrangement for use in a copying apparatus, for displacing optical mechanisms incorporated in the apparatus.

A linear driving arrangement having the features of the preamble of claim 1 as enclosed is known from the document US-A-4,585,331. This prior art arrangement comprises a driving control section which stores start or initial position data to control the driving sections to start their movements from initial positions based on preliminarily stored initial position data.

Prior art linear driving arrangements, also such ones of the kind as just discussed, have to be assembled with high accuracy to achieve good optical properties. When the adjustment is lost during longtime use of the arrangement, it is difficult to readjust the prior art arrangements.

SUMMARY OF THE INVENTION

Accordingly, an essential object of the present invention is to provide a linear driving arrangement for use in a copying apparatus and the like, which is capable of readily effecting positional adjustments of a drum projection optical mechanism and an original document scanning optical mechanism employed therein.

Another object of the present invention is to provide a linear driving arrangement of the above described type which is simple in construction and stable in functioning, and can be readily incorporated into a copying apparatus and the like at low cost.

In accomplishing these and other objects, according to one preferred embodiment of the present invention, there is provided a linear driving arrangement for use in a copying apparatus, which includes first and second linear driving sections adapted to displace a drum projection optical mechanism and an original document scanning optical mechanism from respective initial positions alternately in an original document scanning direction, a driving control section which imparts speed pattern for the drum projection optical mechanism and the original document scanning optical mechanism whose speed ratio is at 2 to 1, controls said first and second linear driving sections according to the speed pattern, and independently controls the initial positions of the respective first and second linear driving sections based on preliminarily stored initial position data; characterized by a memory means for storing externally settable initial position adjusting data for determining the initial positions of the first and second linear driving sections, respectively.

In the above arrangement according to the present invention, when information related to the positional deviation of the drum projection optical mechanism and the original document scanning optical mechanism is applied to the initial position adjusting section as an instruction from outside, the first and second linear driving sections are independently driven according to said instruction, whereby respective initial positions for the drum projection optical mechanism and the original document scanning optical mechanism are adjusted. When the driving control section is actuated after the adjustments of the drum projection optical mechanism and the original document scanning optical mechanism have been effected, these mechanisms are displaced according to the speed pattern.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and features of the present invention will become apparent from the following description taken in conjunction with the preferred embodiment thereof with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view showing a general construction of a linear driving arrangement according to one preferred embodiment of the present invention;

Fig. 2 is a schematic side sectional view showing a drum projection optical mechanism and an original document scanning optical mechanism to be driven by the arrangement of Fig. 1;

Fig. 3 is an electrical block diagram showing a circuit construction of the linear driving arrangement of Fig. 1; and

Fig. 4 is a flow-chart for a program related to an initial position adjusting section of a microcomputer.

DETAILED DESCRIPTION OF THE INVENTION

Before the description of the present invention proceeds, it is to be noted that like parts are designated by like reference numerals throughout the accompanying drawings.

Referring now to the drawings, there is shown in Fig. 1, a general construction of a linear driving arrangement according to one preferred embodiment of the present invention.

In the first place, general constructions of linear motors 10 and 20 for displacing a drum projection optical mechanism 30 and an original document scanning optical mechanism 40 provided within a copying apparatus, will be described with reference to Fig. 1.
The linear motor 10 equivalent to a first linear

driving section is constituted by movable members
12 and 12 respectively disposed at opposite sides
of the drum projection optical mechanism 30, and
stators 11 and 11 perpendicularly disposed to con-
front the corresponding movable members 12 and
12 as shown, and by restricting sliding movement
of the movable members 12 and 12 with a rod-like
guide member 50 disposed along the stator 11 at
one side to extend therethrough, the drum projec-
tion optical mechanism 30 is adapted to be dis-
placed in an original document scanning direction.
Similarly, with respect to the linear motor 20 equi-
vant to the second linear driving section, movable
members 22 are respectively disposed at opposite
sides of the original document scanning optical
mechanism 40, with the stators 11 and 11 and the
guide member 50 extending therethrough being
commonly used therefor also so as to displace said
mechanism 40 in the similar manner as in the
linear motor 10. Thus, it is so arranged to displace
the drum projection optical mechanism 30 and the
original document scanning optical mechanism 40
at a speed ratio of 2 to 1 by independently control-
ing the linear motors 10 and 20. Moreover, en-
coders 13 and 23 are respectively provided on the
linear motors 10 and 20 for detecting respective
displaced positions of the drum projection optical
mechanism 30 and the original document scanning
optical mechanism 40. Although not particularly
shown, at a central portion of each of the movable
members 12 and 22, a hall effect element (not parti-
cularly shown here) is provided to detect the
magnetic pole of the confronting stator 11.

Subsequently, referring to Fig. 2, general con-
structions of the drum projection optical mecha-
nism 30 and the original document scanning optical
mechanism 40 will be described.

For the drum projection optical mechanism 30,
there may be employed, for example, a mirror
base 31 provided with a halogen lamp 311 and a
reflecting mirror 312 thereon, while for the original
document scanning optical mechanism 40, for ex-
ample, another mirror base 41 provided with re-
reflecting mirrors 411 and 412 may be adopted.
Moreover, in positions which are out of contact with
the optical mechanism 30 to be displaced in the
original document scanning direction, there are
fixedly provided a zoom lens assembly 71, and a
mirror base 72 provided with a reflecting mirror
721, etc.

More specifically, it is so arranged that light
emitted from the halogen lamp 311 and reflected
by surface of an original document "a" is adapted
to be projected onto a photosensitive surface 70a
of a photoreceptor drum 70 successively through
the reflecting mirrors 312, 411 and 412, and the
zoom lens assembly 71, and the reflecting mirror
721, and owing to the arrangement that the speed
ratio between the drum projection optical mecha-
nism 30 and the original document scanning optical
mechanism 40 is maintained at 2 to 1, an optical
path length from the surface of the original docu-
ment "a" to the surface 70a of the photoreceptor
drum 70 can be held constant irrespective of the
scanning positions.

Hereinbelow, a linear motor control circuit 60
for controlling the linear motors 10 and 20 will be
described with reference to Fig. 3.

The linear motor control circuit 60 mainly in-
cludes a micro-computer 61, i.e. so-called software
servo, and is arranged to produce three-phase ex-
citing current to be applied to the movable mem-
bers 12 and 22 of the linear motors 10 and 20 so
as to displace the drum projection optical mecha-
nism 30 and the original document scanning optical
mechanism 40 according to the predetermined pat-
ters.

More specifically, data for respective displaced
positions of the drum projection optical mechanism
30 and the original document scanning optical
mechanism 40 are successively introduced, through
encoders 13 and 23 of the linear motors 10
and 20 connected thereto, into the microcomputer
61, where said data are compared with the speed
pattern data preliminarily stored therein, and PWM
(Pulse Width Modulation) signals 613 and 614 are
produced according to the result of the compari-
son. The PWM signals 613 and 614 are respec-
tively applied to three-phase driver circuits 62 and
63 which are coupled with the hall effect elements
15 and 25 of the movable members 12 and 22 to
receive signals therefrom, while said three-phase
driver circuits 62 and 63 produce three-phase ex-
citing current for subjecting the movable members
12 and 22 to the three-phase excitation.

The micro-computer 61 also includes an initial
position adjusting section 612 having the function
for respectively adjusting the initial positions of the
drum projection optical mechanism 30 and the
original document scanning optical mechanism 40,
in addition to a driving control section 611 having
the function to control the linear motors 10 and 20.

Subsequently, by way of example, one pro-
gram related to the initial position adjusting section
612 in the programs preliminarily stored in the
micro-computer 61 will be described with reference
to Fig. 4.

It is to be noted here that, in Fig. 4, the linear
motor 10 is represented as a motor A, while the
linear motor 20 is denoted as a motor B for the
convenience of explanation.

In the first place, the linear motors 10 and 20
are respectively driven until count data SA and SB
of the counters A and B which give the respective
displaced positions of the drum projection optical
mechanism 30 and the original document scanning optical system 40, i.e. the respective displaced positions of the linear motors 10 and 20, become equal to the preliminarily set hold-position data for the linear motors 10 and 20, and thus, the optical mechanisms 30 and 40 are respectively returned to the initial positions. Subsequently, initial setting is effected so that counters A and B are respectively preset at such timing that ZA phase of the encoder 13 and ZB phase of the encoder 23 become active (Step S1).

Then, after driving the linear motor 10 until ZA phase of the encoder 13 becomes active, the linear motor 20 is driven until ZB phase of the encoder 23 becomes active (Step S2).

Thereafter, position adjusting data PA and PB related to the displacing amounts required for positional adjustments of the optical mechanisms 30 and 40 from the initial positions thereof are stored in a predetermined register (Step S3). It is to be noted that these position adjusting data PA and PB are arranged to be respectively set through switches or the like (not shown) connected to input ports of said micro-computer 61.

Subsequently, the linear motor 10 is driven until the count data SA and the position adjusting data PA become equal to each other, and thereafter, the linear motor 20 is driven until the count data SB and the position adjusting data PB become equal to each other. Thus, the optical mechanisms 30 and 40 are to be respectively positionally adjusted by the displacing amounts corresponding to the position adjusting data PA and PB (Step S4).

Accordingly, in the linear driving arrangement of the embodiment according to the present invention as described so far, even when the positional relation between the drum projection optical mechanism 30 and the original document scanning optical mechanism 40 is deviated due to assembling errors, variation with time etc., thus resulting in the variation of the optical path length, correction may be readily effected by merely setting the position adjusting data PA and PB from outside. Therefore, not only clear and definite images may be obtained, but a high assembling accuracy is not particularly required for the manufacture of the arrangement. Moreover, owing to the construction which employs the linear motors, the arrangement can be applied to operations at higher speeds, thus contributing to improvement of performance in the copying apparatus on the whole.

It should be noted here that the concept of the present invention is not limited in its application, to the foregoing embodiment alone, but may be applied, for example, to such a modification, in which two units of wire/pulley mechanisms, etc., are employed for the first and second linear driving sections so as to independently displace the drum projecting optical mechanism and the original document scanning optical mechanism in the original document scanning direction.

As is clear from the foregoing description, according to the linear driving arrangement of the present invention, since it is so arranged that the first and second linear driving sections can be independently driven by external instructions, even when deviation or variation is taking place due to assembling errors or variation with time, etc., respective positional adjustments for the optical mechanisms may be readily effected for correction of the optical path length to a proper value, which is very significant for improving the performance of the copying apparatus on the whole.

Although the present invention has been fully described by way of example with reference to the accompanying drawings, it is to be noted here that various changes and modifications will be apparent to those skilled in the art.

Claims

1. A linear driving arrangement for use in a copying apparatus, which comprises first and second linear driving sections (10,20) adapted to displace a drum projection optical mechanism (30) and an original document scanning optical mechanism (40) from respective initial positions alternately in an original document scanning direction, a driving control section (60) which imparts speed pattern for said drum projection optical mechanism (30) and said original document scanning optical mechanism (40) whose speed ratio is at 2 to 1, controls said first and second linear driving sections (10,20) according to said speed pattern, and independently controls the initial positions of the respective first and second linear driving sections (10,20) based on preliminarily stored initial position data; characterized by a memory means for storing externally settable initial position adjusting data (PA, PB) for determining said initial positions of the first and second linear driving sections (10, 20), respectively.

2. A linear driving arrangement as claimed in Claim 1, wherein said first and second linear driving sections are constituted by linear motors (10,20).

3. A linear driving arrangement as claimed in Claim 1, wherein said first and second linear driving sections include two sets of wire/pulley driving mechanisms arranged to displace said drum projection optical mechanism (30) and said original document scanning optical
mechanism (40) independently in the original document scanning direction.

4. A linear driving arrangement as claimed in any of the preceding claims, characterized by switches for inputting said initial position adjusting data (PA, PB) into said memory means.

Patentansprüche

1. Linearantriebsanordnung zur Verwendung in einem Kopiergerät, die einen ersten und einen zweiten Linearantriebsabschnitt (10, 20), die zum abwechselnden Verschieben eines optischen Trommelprojektionsmechanismus (30) und eines optischen Vorlagenabtastmechanismus (40) ausgehend von jeweiligen Anfangspositionen in Abtastrichtung einer Vorlage ausgebildet sind und einen Antriebssteuerabschnitt (60) aufweist, der Geschwindigkeitsmuster für den optischen Trommelprojektionsmechanismus (30) und den optischen Vorlagenabtastmechanismus (40) vorgibt, deren Geschwindigkeitsverhältnis 2 zu 1 beträgt, der den ersten und zweiten Linearantriebsabschnitt (10, 20) abhängig vom Geschwindigkeitsmuster steuert, und der die Anfangspositionen des ersten bzw. zweiten Linearantriebsabschnitts (10, 20) auf Grundlage vorab abgespeicherter Anfangspositionsdaten unabhängig voneinander steuert; gekennzeichnet durch eine Speichereinrichtung zum Abspeichern extern einstellbarer Anfangsposition-Einstelldaten (PA, PB) zum Festlegen der Anfangspositionen des ersten bzw. zweiten Linearantriebsabschnitts (10, 20).

2. Linearantriebsanordnung nach Anspruch 1, bei der der erste und zweite Linearantriebsabschnitt durch Linearmotoren (10, 20) gebildet sind.

3. Linearantriebsanordnung nach Anspruch 1, bei der der erste und zweite Linearantriebsabschnitt zwei Sätze von Draht/Rolle-Antriebsmechanismen aufweisen, die so ausgebildet sind, daß sie den optischen Trommelprojektionsmechanismus (30) und den optischen Vorlagenabtastmechanismus (40) unabhängig voneinander in Abtastrichtung der Vorlage verschieben.

4. Linearantriebsanordnung nach einem der vorstehenden Ansprüche, gekennzeichnet durch Schalter zum Eingeben der Anfangsposition-Einstelldaten (PA, PB) in die Speichereinrichtung.

Revendications

1. Un dispositif d’entraînement linéaire pour un appareil à copier, comprenant des première et deuxième sections d’entraînement linéaire (10, 20), adaptées pour déplacer un mécanisme optique de projection à tambour (30) et un mécanisme optique d’exploration de document original (40), pour les faire se déplacer alternativement, à partir de leurs positions initiales respectives, dans une direction d’exploration du document original, une section de contrôle d’entraînement (60) qui attribue des modèles de vitesses audit mécanisme optique de projection à tambour (30) et audit mécanisme optique d’exploration de document original (40), dont le rapport de vitesses est de 2 à 1, en commandant lesdites première et deuxième sections d’entraînement linéaire (10, 20) en fonction desdits modèles de vitesses, et en commandant indépendamment les positions initiales, respectivement, des première et deuxième sections d’entraînement linéaire (10, 20), sur la base de données de positionnement initial stockées au préalable, caractérisé par un moyen de mémoire destiné à stocker des données de réglage de position initiale (PA, PB), réglables depuis l’extérieur, en vue de déterminer respectivement lesdites positions initiales des première et seconde sections d’entraînement linéaire (10, 20).

2. Un dispositif d’entraînement linéaire selon la revendication 1 dans lequel lesdites première et deuxième sections d’entraînement linéaire sont constituées de moteurs linéaires (10, 20).

3. Un dispositif d’entraînement linéaire selon la revendication 1, dans lequel lesdites première et deuxième sections d’entraînement linéaire comprennent deux jeux de mécanismes d’entraînement à câbles/poulies disposés de façon à déplacer ledit mécanisme optique de projection à tambour (30) et ledit mécanisme optique d’exploration de document original (40), indépendamment, dans la direction d’exploration de document original.

4. Un dispositif d’entraînement linéaire selon l’une quelconque des revendications précédentes, caractérisé par des commutateurs destinés à introduire lesdites données de réglage de position initiale (PA, PB) dans lesdits moyens de mémoire.
Fig. 3
Fig. 4

1. ORIG. P. HOLD.
2. SET HOLD. P. OF MO. A, B TO S_A, S_B
3. SET PRES. T. OF CTR. A, B TO Z_A, Z_B PHASE
   (S1)
   - Z_A = H? N
     - A MO. OFF
     - Z_B = H? N
       - B MO. OFF
       - Z_A = H? N
       - Z_B = H? Y
     - A MO. DISP.
   - Y
4. SUB. PRES. VAL. P_A, P_B
   (S3)
   - P_A = S_A? N
     - A MO. OFF
     - P_B = S_B? N
       - B MO. OFF
       - P_A = S_A? N
       - P_B = S_B? Y
   - Y
   - A MO. DISP.
   - Y
5. MO. A, B, HOLD. COMPL.