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United States Patent [19]

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Kokubo et al.

[45] Date of Patent: **Dec. 17, 1996**

[54] **IMAGE READING DEVICE FOR PRECISELY MOVING OPTICAL COMPONENTS TO PROVIDE RELATIVELY REDUCED AND MAGNIFIED IMAGES**

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[57] ABSTRACT

[21] Appl. No.: **229,715**

A reading unit for an image reading device includes a lens tube for forming an image of an object and a line sensor for converting the formed image into an electrical signal. A reducing/magnifying mechanism is included for changing the magnification of the image detected by the line sensor. The lens tube is movable such that the optical path length between the lens tube and the line sensor is adjustable to thereby vary magnification of the image. Further, in response to the movement of the lens tube, a movable mirror is adjusted. The mirror is set in a first predetermined position and directs reflected light from the object to the lens tube to shorten the optical path length between the object and the lens tube and thus relatively increase magnification, in response to the lens tube being in a predetermined normal position with a relatively long optical path length between the lens tube and the line sensor. Then, the mirror is set in a second predetermined position and does not direct reflected light from the object to the lens tube to lengthen the optical path between the object and the lens tube and thus relatively decrease magnification, in response to the lens tube being in a predetermined reducing position with a relatively short optical path length between the lens tube and the line sensor. Movement of both the movable mirror and the lens tube are therefore linked together and are each displaced between predetermined positions so as to vary magnification of the image and to prevent distortion in the image read by the line sensor.

[22] Filed: **Apr. 19, 1994**

[30] Foreign Application Priority Data

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Nov. 16, 1993 [JP] Japan 5-311142
Dec. 6, 1993 [JP] Japan 5-340145

[51] Int. Cl.⁶ **H04N 1/04; H04N 1/393; G02B 7/04; G02B 15/14; G02B 27/02**

[52] U.S. Cl. **358/451; 358/474; 358/494; 359/676; 359/806; 359/823; 359/861; 359/862; 359/872**

[58] Field of Search 358/487, 474, 358/471, 497, 494, 451, 474, 494, 496, 497; 355/243, 57, 51, 55, 60, 66; 359/861, 862, 872, 806, 807, 676, 677, 823, 824, 850, 857

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18 Claims, 39 Drawing Sheets

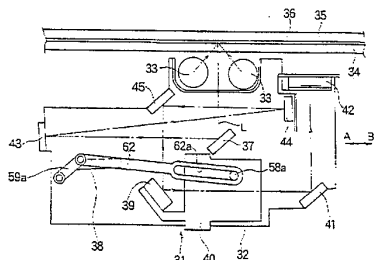
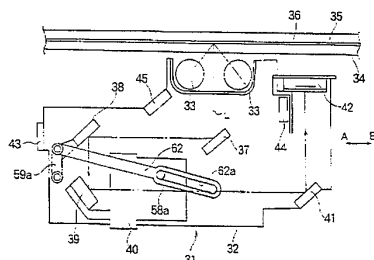


FIG. 1

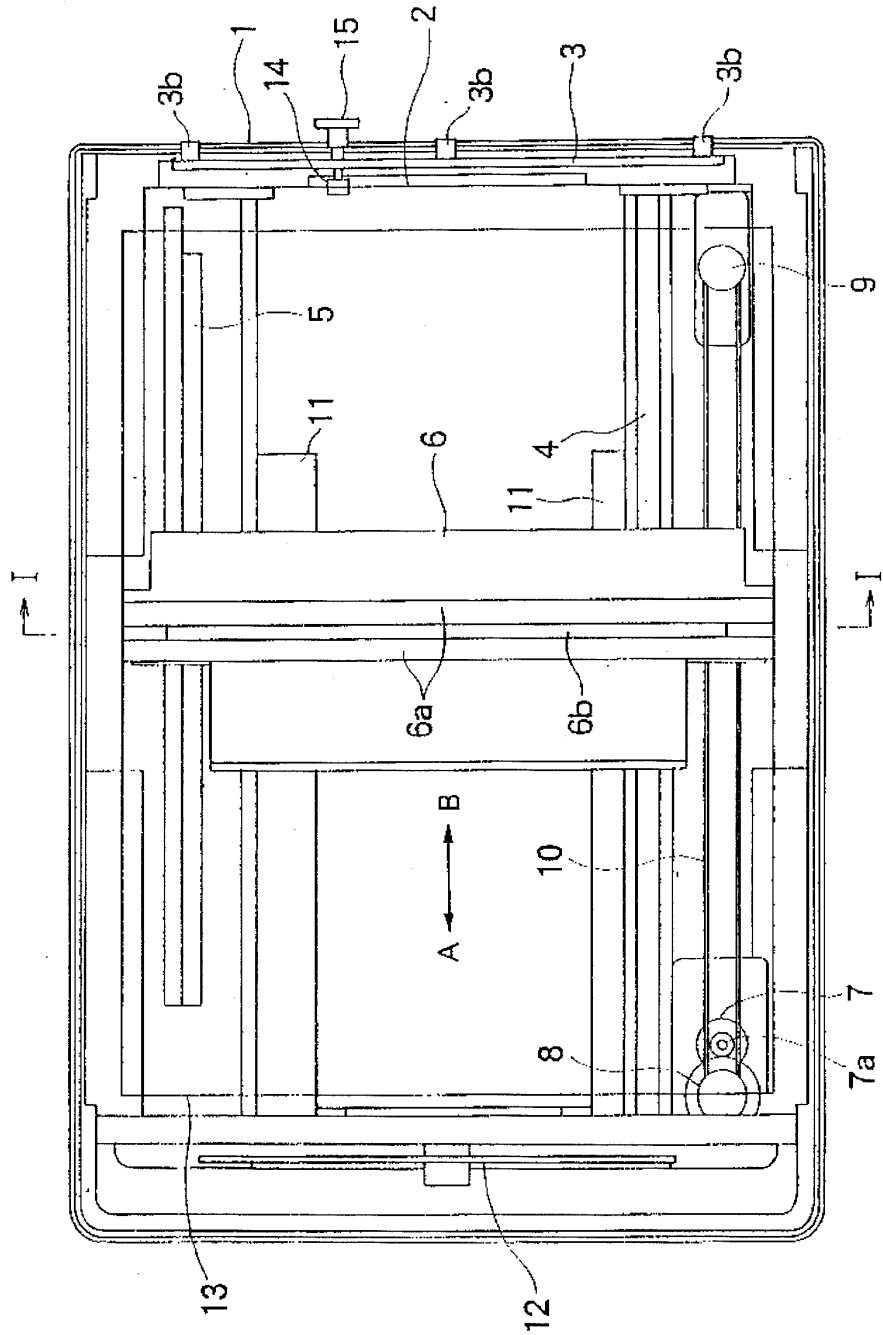


FIG. 2

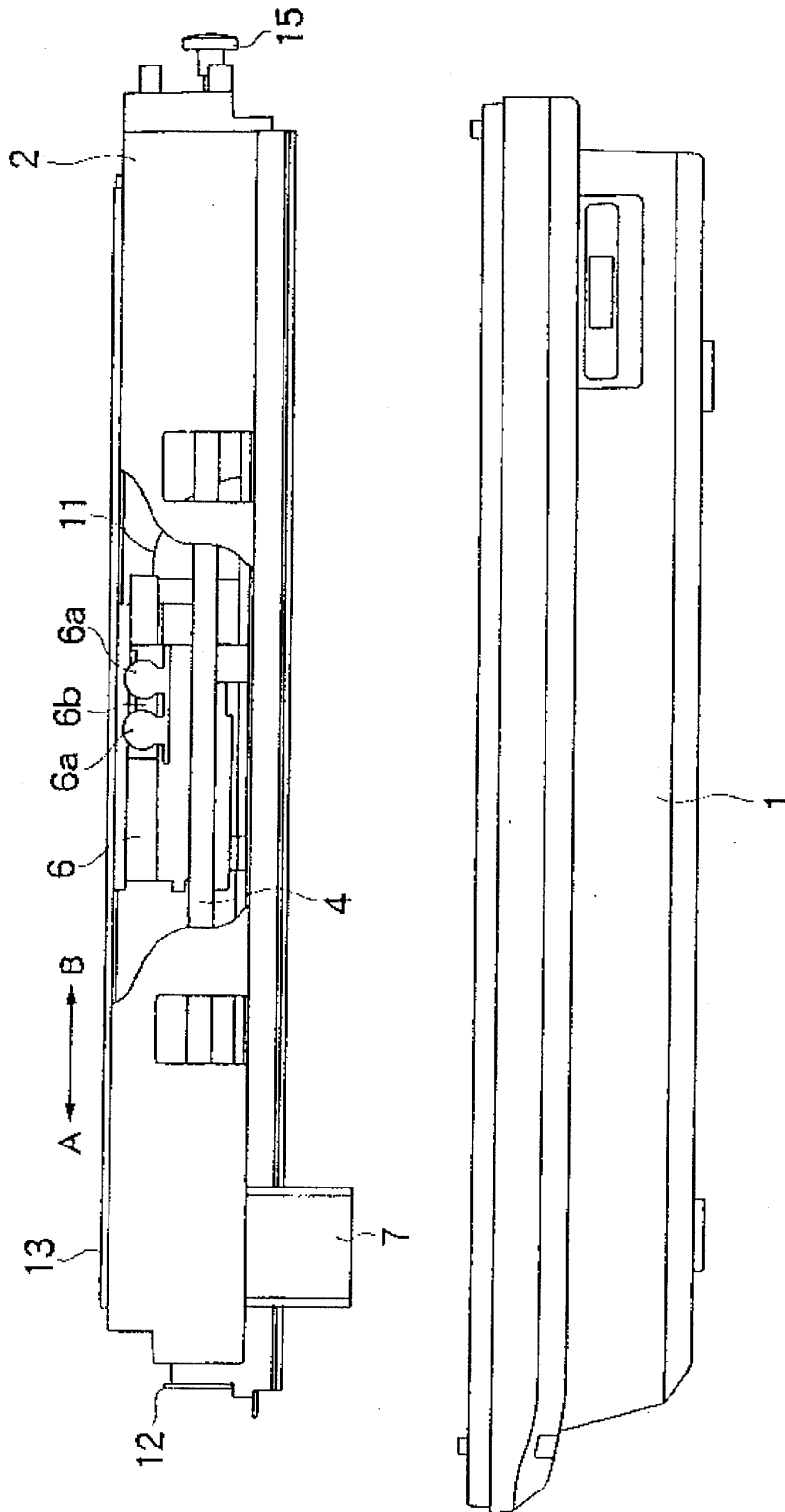


FIG. 3

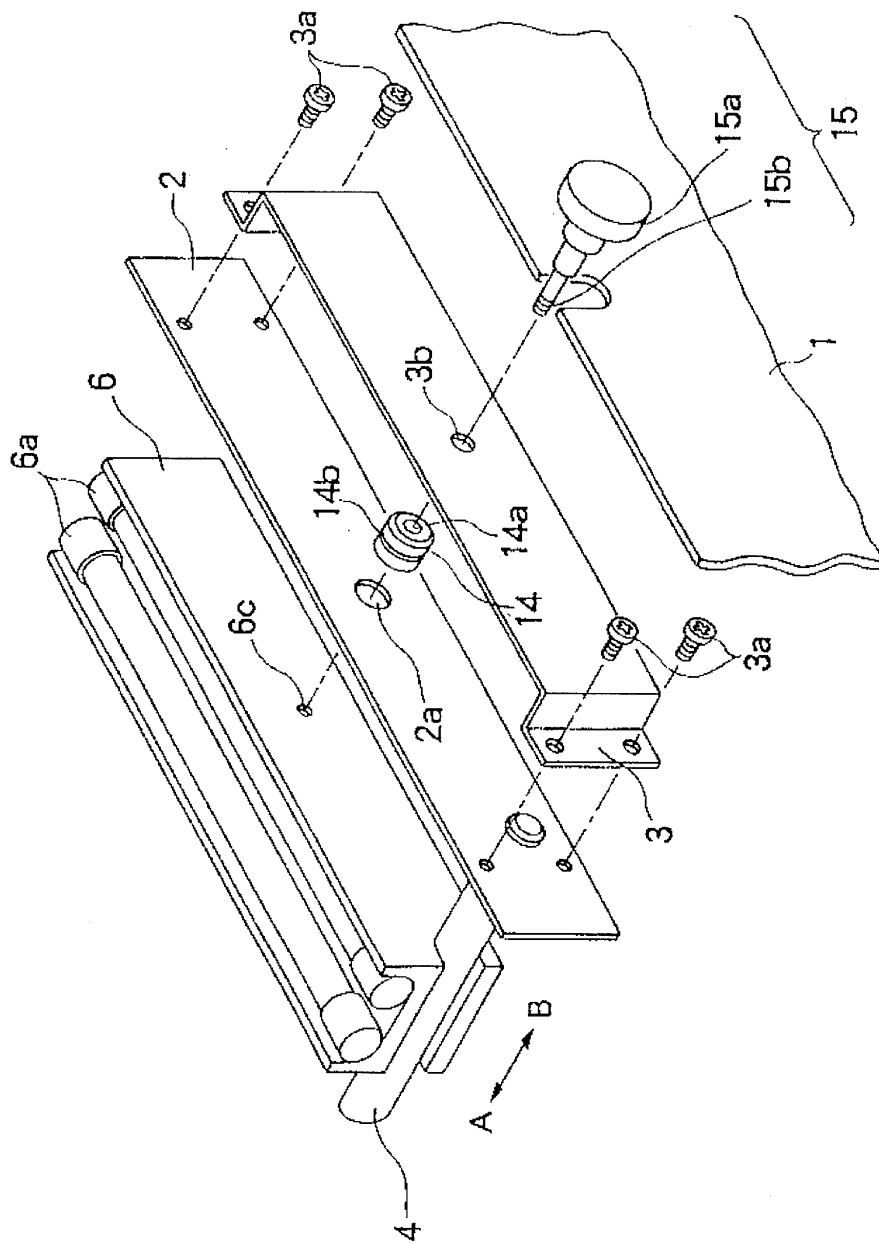
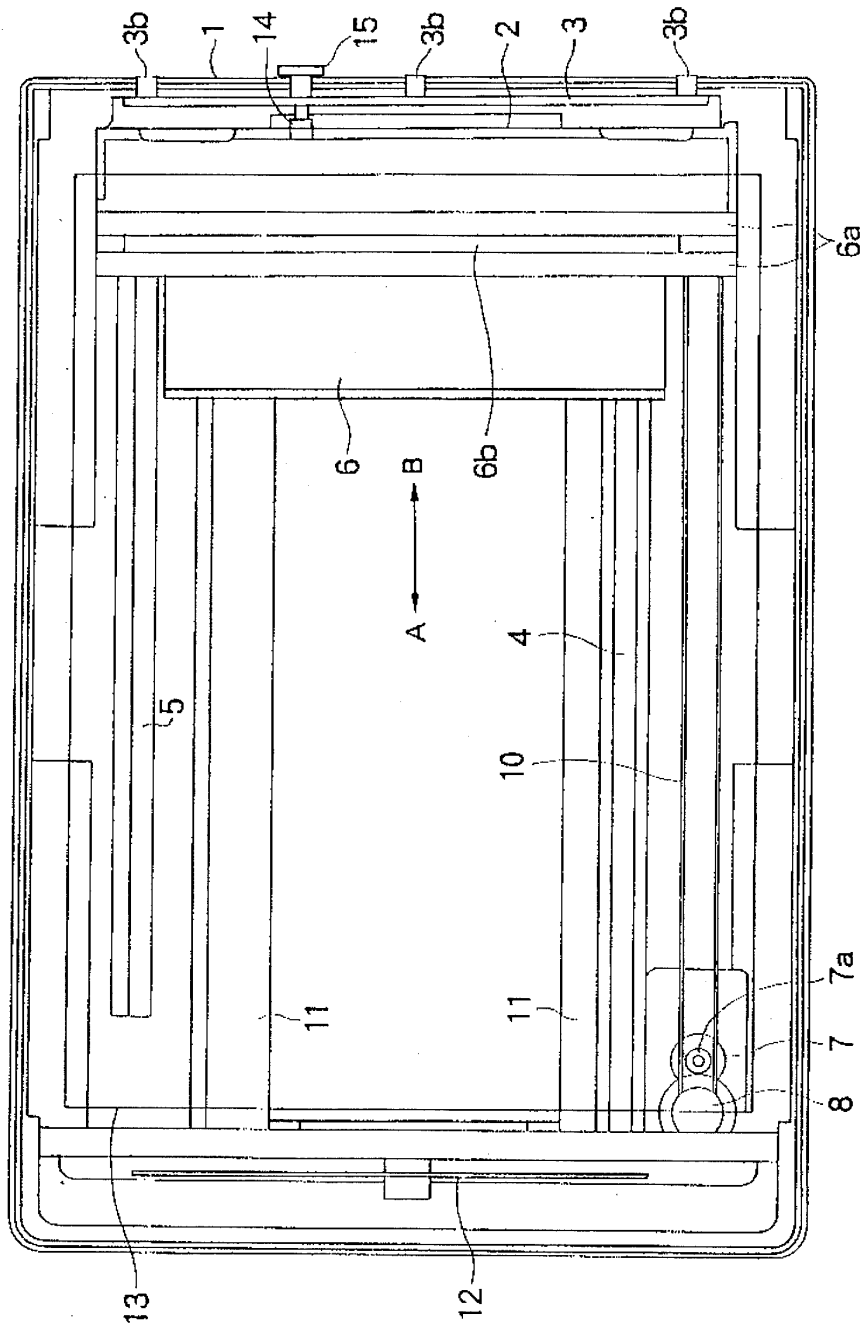


FIG. 4



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