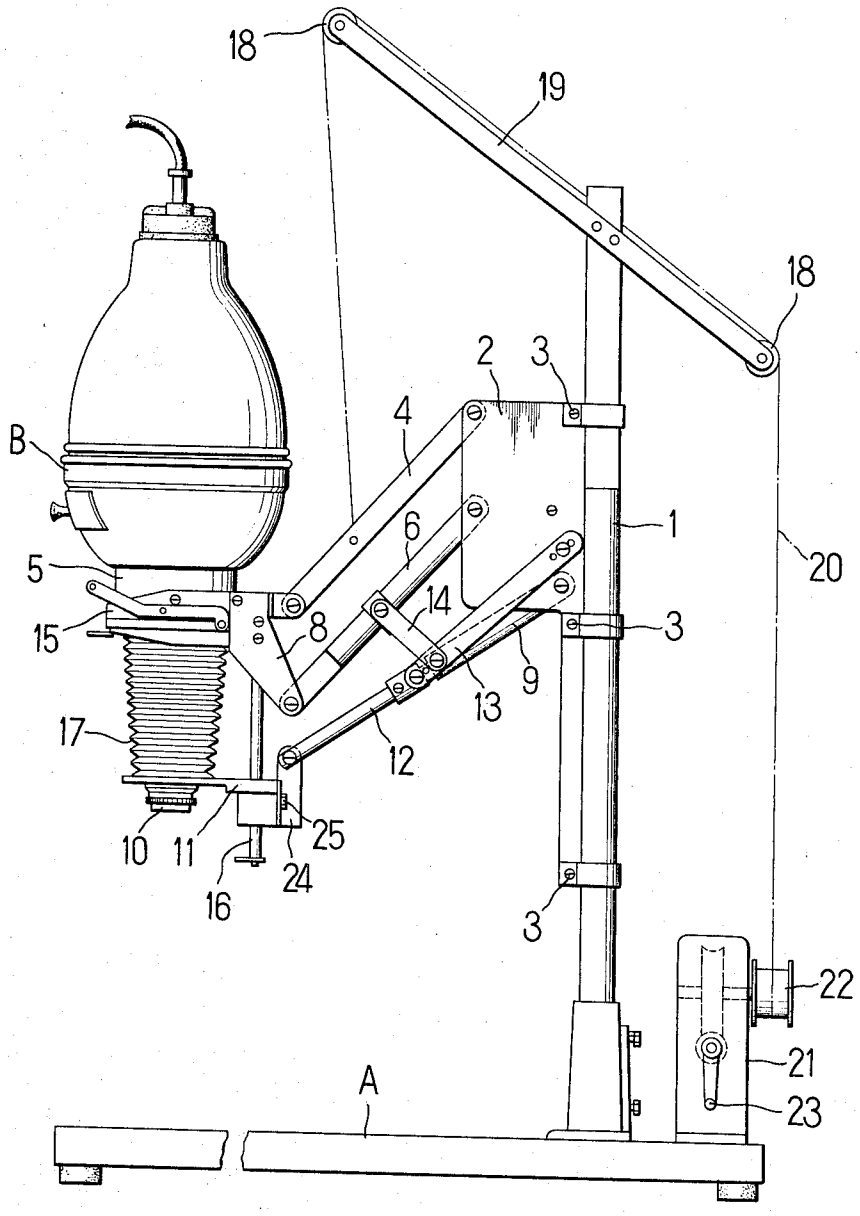
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AUTOFOCUS ENLARGER

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Fig. 1



INVENTOR.

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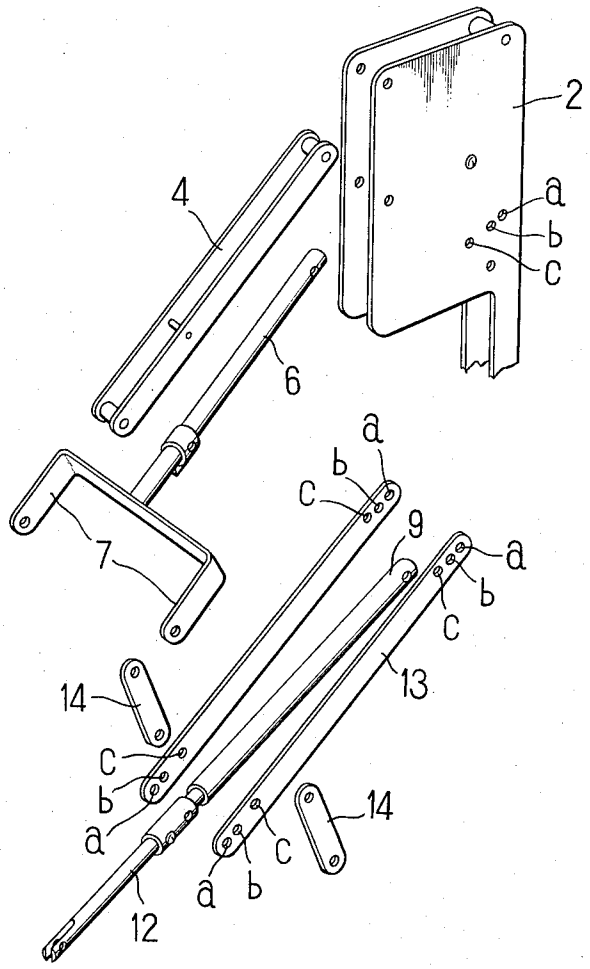
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Fig. 2



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AUTOFOCUS ENLARGER

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ABSTRACT OF THE DISCLOSURE

An automatic focus adjusting enlarger apparatus, comprising a supporting member, a standing column along which said supporting member is movable in a vertical direction and to which said member can be fixed, an enlarger head, an enlarging lens holder for holding an enlarging lens and mounted on the lower part of the enlarger head and movable relative thereto along the enlarger axis, a parallel motion means connected between said supporting member and said enlarger head for moving said enlarger head along an axis parallel to the standing column, and a lens holder adjusting linkage connected between said supporting member and said lens holder and also connected to said parallel motion means for moving said lens holder relative to said enlarger head when said parallel motion means moves said enlarger head.

In the automatic focusing adjusting apparatus for an enlarger according to the present invention, the photographic images are focused automatically with movement up and down of the enlarging lens, and the magnification and the focusing of images are adjusted mutually according to the rising and falling action of the parallel link system.

For a more detailed description of the invention, reference will be made to the accompanying drawings in which:

FIG. 1 is a side view illustrating the enlarger of the present invention; and

FIG. 2 is an exploded view of the automatic focusing adjusting apparatus of the present invention.

A concrete example of the present invention is illustrated in FIGS. 1 and 2. A supporting plate **2** is fixed on a column **1** so that the vertical position can be fixed by bolts and nuts **3**.

One end of a connecting lever **4** is rotatably mounted on the upper part of the supporting plate **2**, and the other end of the connecting lever **4** is connected rotatably to the head of the enlarger **5**. One end of connecting rod **6** is rotatably mounted on the middle of the supporting plate **2**, and the other end has a U-shaped supporting yoke **7** the legs of which are rotatably connected to the side plates **8** which are fixed to the both sides of the enlarger head **5**.

The enlarger head **5** is supported by the connecting lever **4** and rod **6** which perform parallel motion to each other during the rising and falling of the head **5**.

An outside tube **9** has one end rotatably connected to the lower part of the supporting plate **2** and an inside tube **12** has one end connected rotatably to the lens holder **11** carrying the enlarging lens **10**, the tubes **9** and **12** being telescopically engaged. A group of three bearing holes *a*, *b* and *c* is provided at each end of the connecting lever **13**. At one end one of two bearing holes *a* or *b* receives a pin mounted on the inside tube **12**. At the other end, one of the three holes *a*, *b* or *c* receives a pin mounted on the lower part of the supporting plate **2**. Interlocking levers **14** are rotatably connected to the bearing hole *c* in the one end of the connection levers **13** and the central point of the connection rod **6**.

When a film clip **15** is sealed in the lower part of the enlarger head, and a lens holder **11** in which an enlarging lens is mounted freely moves by sliding along a guide rod **16**, a bellows **17** is expanded and contracted.

A supporting lever **19** at both ends of which are mounted pulleys **18** is fixed at the top of the standing column **1**. One end of a cord **20** which is used in order to move the enlarger head **5**, is tied to one part of the connecting lever **4**, and the other end of the cord is fixed to a pulley **22** arranged on gearing **21** which includes a worm-gear and a worm-wheel on the base plate A, so the enlarger head **5** can be moved upwards and downwards with the handle **23**.

In the automatic focusing adjusting apparatus according to the present invention, the standing column **1** and the gearing **21** by which the height of the enlarger head can be controlled, are mounted on the base plate A, and the supporting plate **2** is positioned on the upper part of the standing column by the bolt and nut **3**, while the enlarger B including the enlarger head **5**, the bellows **17** and the enlarging lens **10** is supported by the parallel linkage system having the connecting levers **4** and **6**.

The focus of the photographic image is adpjusted freely by sliding the lens holder **11** carrying the enlarging lens **10** along the guide rod **16** fixed vertically beside the bellows **17**.

The said lens holder **11** is rotatably connected to the inside tube **12** which slides freely in the outside tube **9** one end of which is rotatably connected to the supporting plate **2**, and the inside tube **12** is rotatably connected to the connecting levers **13** which are rotatably connected to the supporting plate **2**. Moreover the lens holder **11** carrying the enlarging lens is supported by the interlocking levers **14** which are rotatably connected between connecting levers **13** and the central point of the connecting lever **6**. The lens holder **11** is connected to the inside tube **12** through a slide plate **24**. The distance error between the enlarging lens **10** and the bellows **17** during the rising and falling of the enlarger B is adjusted through the sliding plate **24** which is fixed to the lens holder **11** by the setscrew **25**.

The construction of the automatic focusing adjusting apparatus of the present invention is as described above, and therefore the distance between the enlarging lens **10** and the film clip **15** affects the focusing of the image as shown in FIG. 1.

When the connecting lever **4** is raised to the horizontal position from that shown in FIG. 1 by the gearing **21**, the connecting lever **4** and rod **6** are elevated while remaining parallel. Accordingly, the enlarger B is raised and the interlocking levers **14** having one end rotatably connected to a suitable position on the connecting rod **6**, draw the connecting levers **13** upwardly and as the inside tube **12** rotatably connected to the end of the connecting levers **13** slides into the outside tube **9** in response to the action of the connecting levers **13**, the upward deflection of the said outside tube **9** occurs. Consequently, the lens holder **11** fixed on the end of the inside tube **12** slides along the guide rod **16** during the rising of inside tube **12** and draws up the bellows the required distance. Then the difference between the rise distance of the said enlarger B and the guide rod **16** of the enlarging lens is observed with the trigonometrical principle.

Generally, if the distance between the enlarging lens **10** and the film clip is constant, magnification of the image increases, but defocusing of image is observed.

In order to compensate such phenomena the objective distance must be decreased. The compensating distance is able to be obtained easily by the principle of geometrical optics. Such compensating distance coincides with the difference in distance in the present invention as described above. Since such difference in distance is estimated previously and the rise distance compensated for, enlarging by the lens is obtained. The focusing is ad-

justed automatically according to the distance the enlarger B rises and therefore the troubles caused in the manual adjustment of the focusing are eliminated.

On the other hand, when the connecting lever 4 and rod 6 are brought down from their horizontal positions by the rising and lowering gearing 21, the focusing for the enlarging lens is adjusted automatically according to the distance the enlarger B is lowered in the reverse manner to that described above.

Hence, the adjustment of the focusing is obtained easily and correctly by the position of the interlocking levers 14 rotatably connected to the connecting levers 13. Since the inside tube 12 connected rotatably to the connecting levers 13 is freely slidable into the outside tube 9 and is connected therethrough to the interlocking levers 14, the axis of the rising and falling action of the enlarger B always agrees with that of the enlarging lens, because the later deflection of the lens holder does not occur owing to the sliding of inside tube 12. As the distance between the enlarging lens and the film clip is controlled by changing the angle of inclination of the connecting lever 4 and rod 6 for the inside tube 12 excellent accuracy is obtainable in the operation of the enlarger, as well as simplicity of operation and improvement of the enlarging techniques.

Both ends of the connecting levers 13 have the bearing holes *a*, *b* and *c* therein. For example, when the focal lengths of the enlarging lens are 75 mm., 90 mm., and 50 mm., respectively, the bearing holes in the connecting levers 31 which are connected with the supporting plate 2 are the holes *a*, *b* and *c* respectively. The inside tube 12 is rotatably connected at the bearing hole *a* or *b* at the end of the connecting levers 13.

The selection of the bearing holes is according to the difference of the focal length of the enlarging lens; that is the bearing hole *a* is for 75 mm. and 90 mm., and *b* for 50 mm., respectively. In FIG. 1 the enlarging lens 10 having a focal length of 90 mm. is used.

As described above, the bearing holes of the connecting levers 13 and the interlocking levers 14 are selected according to the different focal lengths of the enlarging lens, and the focusing discrepancy caused by the rising and falling action of the enlarger B is compensated automatically.

What I claim is:

1. An automatic focus adjusting enlarger apparatus, comprising a supporting member, a standing column along which said supporting member is movable in a vertical direction and to which said member can be fixed, an enlarger head, an enlarging lens holder for holding an enlarging lens and mounted on the lower part of the enlarger head and movable relative thereto along the enlarger axis, a parallel motion means connected between said supporting member and said enlarger head for moving said enlarger head along an axis parallel to the standing column, and a lens holder adjusting linkage connected between said supporting member and said lens holder and also connected to said parallel motion means for moving said lens holder relative to said enlarger head when said parallel motion means moves said enlarger head.

2. An automatic focus adjusting enlarger apparatus as claimed in claim 1 in which said lens holder adjusting linkage comprises an outside tube pivoted on said supporting member, an inside tube telescopically slidable in said outside tube and having the lens holder on the free end thereof, and connecting levers pivotally mounted on said supporting member and pivotally connected to said inside tube, and interlocking levers connected between the connecting levers and said parallel motion means for connecting the lens holder adjusting linkage and the parallel motion means.

3. An automatic focus adjusting enlarger apparatus as claimed in claim 2 in which the connection of the ends of the connecting levers to both the supporting member and the inside tube are adjustable, whereby the lens holder adjusting linkage can be adjusted for lenses of different focal lengths held in the lens holder.

4. An automatic focus adjusting enlarger apparatus as claimed in claim 3 in which said connecting levers have a plurality of holes in the ends thereof and said supporting members has a plurality of holes in the lower portion thereof, and pivot members extending through one hole on each end of the connecting levers and secured on the inside tube and in one of the holes in the supporting member respectively.

5. An automatic focus adjusting enlarger apparatus as claimed in claim 1 in which said lens holder adjusting linkage further includes a guide rod fixed to said enlarger head and extending parallel to the direction of movement of the lens holder relative to the enlarger head, said lens holder being slidable along said guide rod during movement by said adjusting linkage.

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