June 9, 1959 C. LUZ 2,889,741

PHOTOGRAPHIC ENLARGER WITH AUTOMATIC FOCUS

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Fig. 1

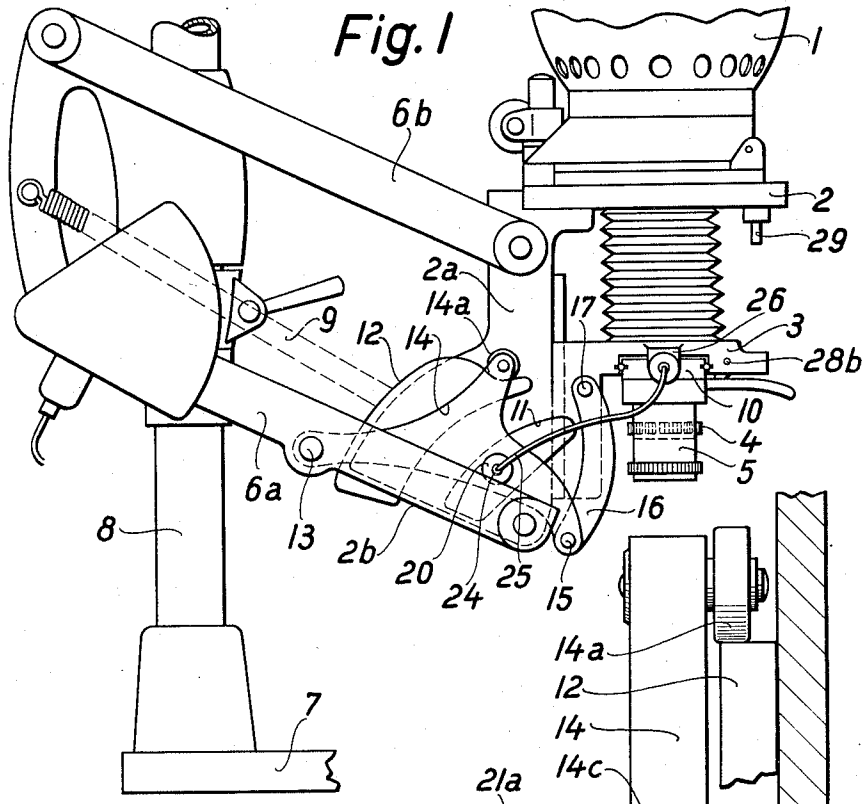
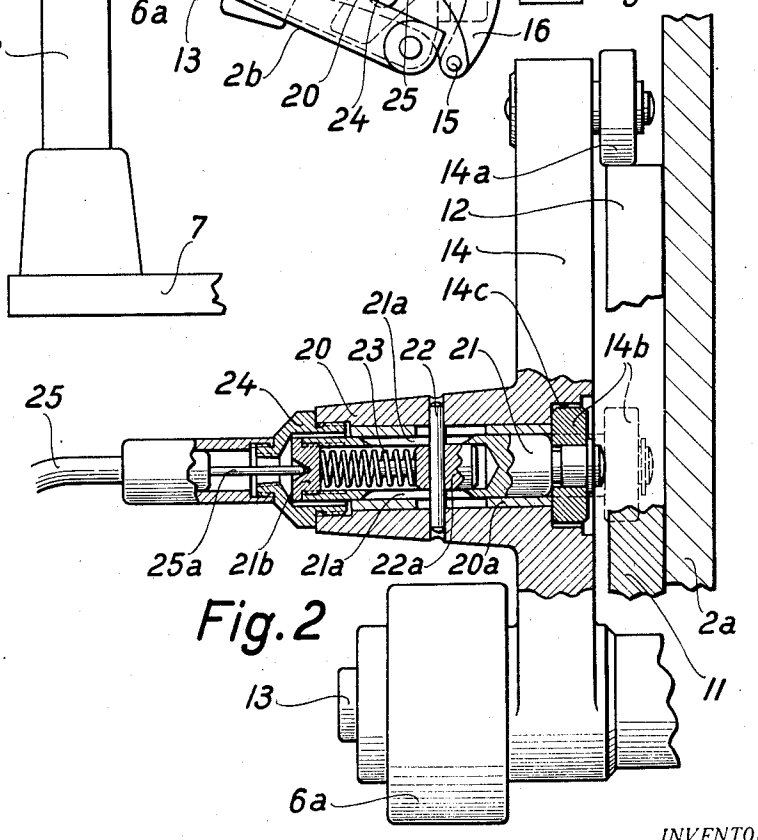



Fig. 2




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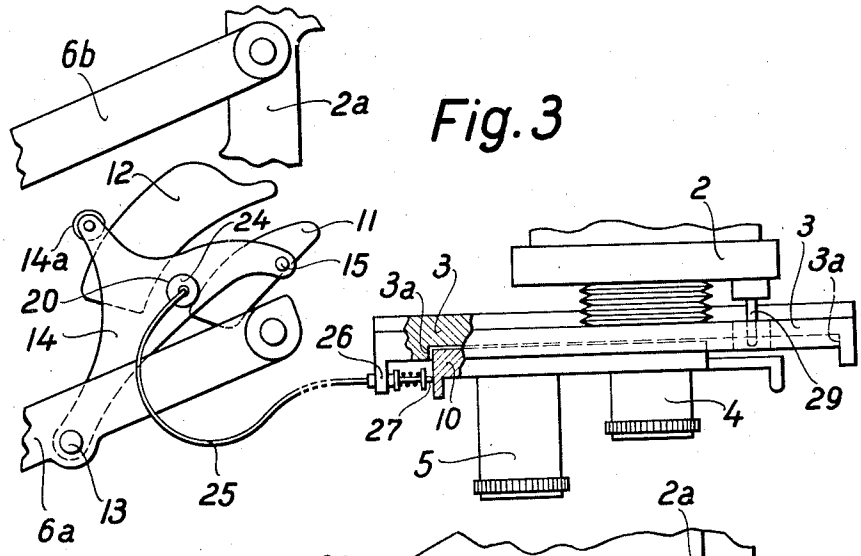



Fig. 3

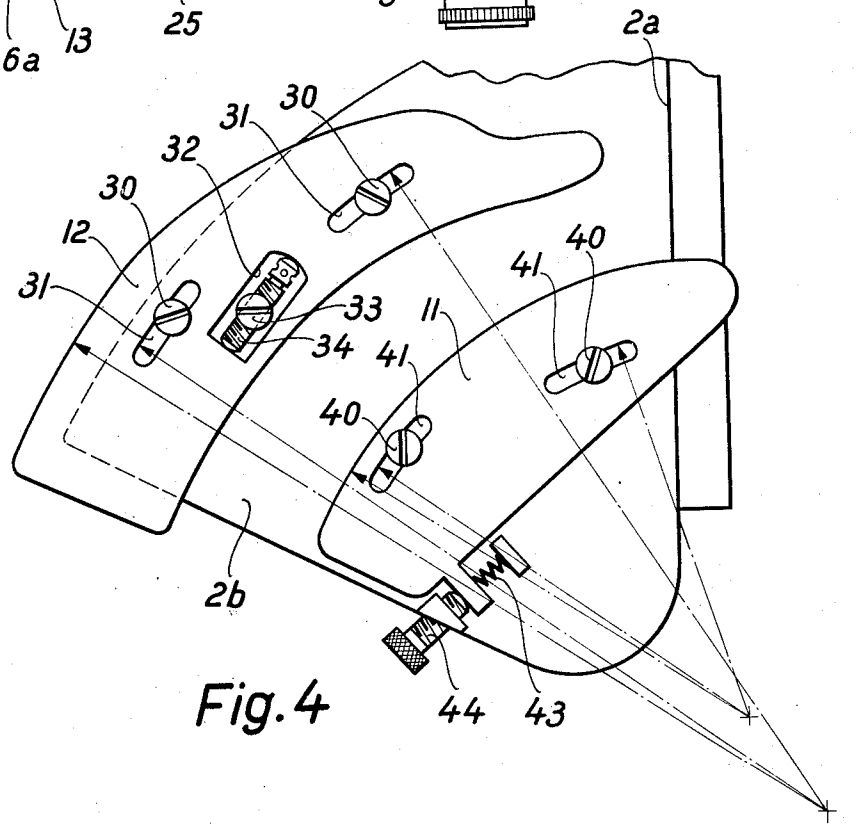



Fig. 4

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PHOTOGRAPHIC ENLARGER WITH AUTOMATIC FOCUS

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Fig. 6

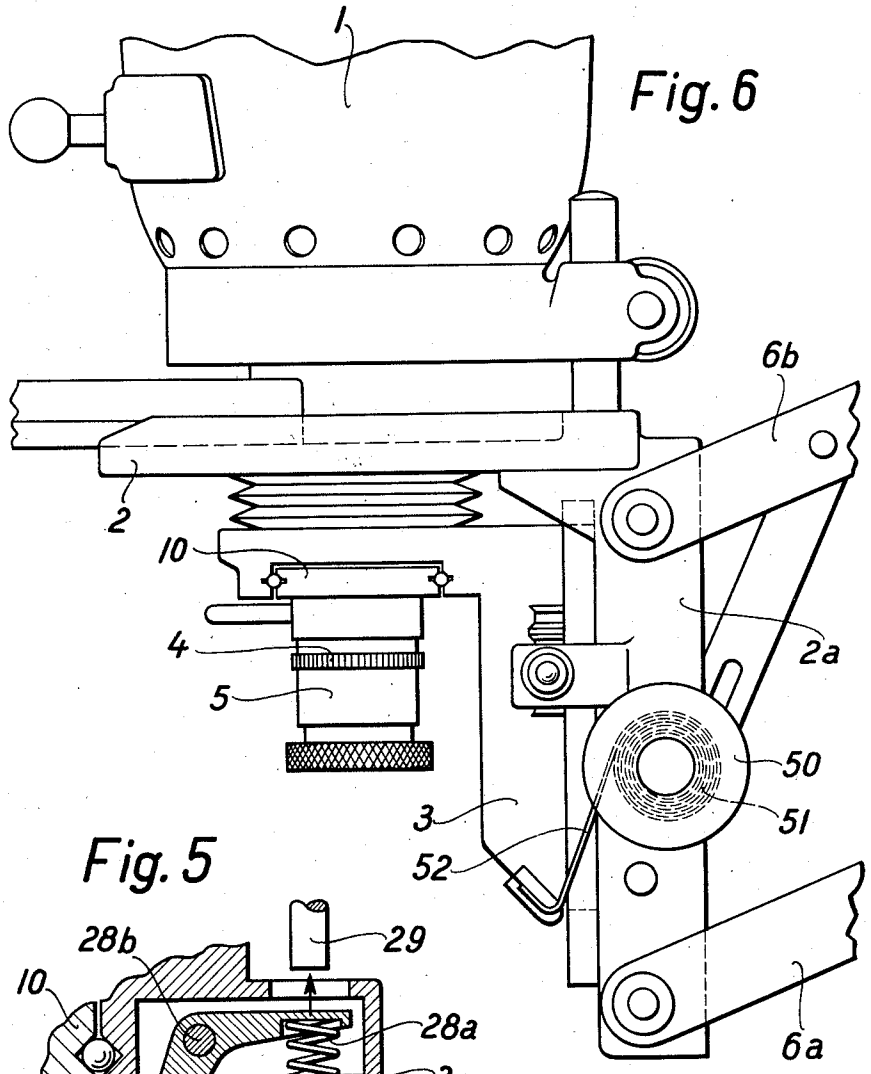



Fig. 5




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United States Patent Office

2,889,741

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2,889,741

# PHOTOGRAPHIC ENLARGER WITH AUTOMATIC FOCUS

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Claims priority, application Germany May 16, 1956

7 Claims. (Cl. 88—24)

This invention relates to photographic enlargers of the type in which the photographic enlarging unit or head is vertically adjustable in relation to the plane of production or to a printing board which is placed upon the base board of the enlarger. The photographic enlarging unit or head is raised or lowered by means of arms which are pivotally connected to and between the enlarging head and a supporting stand, these arms forming opposite sides of a parallelogram. The sharp focusing of the enlarger objectives is accomplished by certain steering cams and cam rollers which are operatively connected with the objectives and one of the arms.

Prior devices of this type are not entirely satisfactory because of unfavorable load and wear conditions at the points where the combined actions of the steering cams and cam rollers are carried over to the objectives for focusing purposes. Again, such prior devices are not suitable for use in enlargers which are provided with exchangeable objectives of different focal lengths where the objectives are focused by automatic operation of the steering cams, the steering cam rollers and associated parts.

The objects of this invention are to improve generally the construction and operation of this type of enlarger, particularly in respect to the operations of the steering cams and the cam rollers and the use of objectives of different focal lengths. Other objects of the invention will appear in the following specification read together with the accompanying drawings in which:

Fig. 1 is a side view of a photographic enlarger embodying this invention, parts being broken away.

Fig. 2 is an enlarged detail view partly in section, showing the mechanism for moving one of steering rollers axially so that it may operatively engage its steering cam when a certain objective is selected for use.

Fig. 3 is a diagrammatic view showing the steering cams, the steering cam rollers and the objectives with associated parts.

Fig. 4 is a detail view showing the steering cams and their support.

Fig. 5 is a detail sectional view of a locking device.

Fig. 6 is a view illustrating a compensating load device.

Referring to Fig.1, the photographic enlarging unit or head includes an illuminating head 1, partly broken away, the negative stage 2 with a downwardly extending arm 2*a* and the objective carrier 3 which carries the objectives 4 and 5. The head is supported on a stand 8 by arms 6*a* and 6*b* and is adjusted vertically in relation to the base board 7 upon which a printing board, not shown, is placed by the operator. The arms 6*a* and 6*b* form opposite sides of a parallelogram.



The objective carrier 3 with the objectives 4 and 5 slides vertically on the fixed arm 2*a* so that either of the objectives may be moved into the correct optical enlarging position below the negative stage 2. In order to move either of the objectives 4 or 5 into optical alinement with the optical axis of the enlarger, the objectives are carried by a transversely movable slide 10 which is supported in the objective carrier 3, Fig. 3. The objectives are locked in enlarging positions by a pawl 28, which is pivoted at 28*b* in the carrier 3 and the pawl extends into a recess 10*a* in the slide 10 and is held there by a spring 28*a*, Fig. 5. When the carrier 3 is moved upwards into contact with the negative stage 2, an abutment 29 on the stage strikes the pawl 28 so that it is lifted out of the recess 10*a*. The slide 10 is then released and may be moved transversely in the carrier 3 whereby to shift the objectives. Stops 3*a* in the carrier limit the movements of the slide in either direction and the objectives are thus automatically alined with the optical axis of the enlarger.

The objective carrier 3 moves vertically on the fixed arm 2*a* by means of a link 16, Fig. 1, which is pivoted on the carrier at 17. The other lower end of the link is pivoted at 15 to a swingable roller arm 14 which, in turn, is pivoted at 13 on one of the arms 6*a* and 6*b*. At the pivot 15 there may be a handle, not shown, for moving the enlarging head vertically. The swingable roller arm 14 carries two cam rollers. One roller 14*a* engages the steering cam 12. The other roller 14*b* is axially movable in a link 20, Fig. 2. The second roller 14*b* is retracted from contact with its steering cam 11 when the objective 5 is selected for use. The roller 14*b* is projected to engage its steering cam 11 when the objective 4 is selected for use.

Fig. 1 shows the roller 14*a* operatively engaging its steering cam 12 whereby to steer the roller arm 14 and the link 16 to focus the objective 5. Fig. 3 shows the one roller 14*b* within the hub of the link 20 operatively engaging its steering cam 11 to steer the roller arm 14 and the line 16 whereby to focus the objective 4. Fig. 1 shows the roller cam 14*b* retracted and out of engagement with the cam 11. In Fig. 3 the roller 14*b* within the hub of the link 20 is projected into operative engagement with its steering cam 11. The means for retracting and projecting the cam roller 14*b* is shown in Fig. 2 to which reference is now made.

The roller arms 14 is formed with a hub 20 having a recess 14*c*. The hub contains a bearing sleeve 20*a*. Within the sleeve there is an axially movable hollow shaft 21. A plug 21*b* closes one end of the shaft 21 which carries the cam roller 14*b* as shown. A pin 22 passes through the hub 20, the sleeve 20*a* and openings 21*a* in the shaft 21 to prevent axial movement of all parts except the shaft 21 and whereby to prevent turning of the parts. The pin carries an abutment 22*a*. Between the abutment and the closing plug 21*b* there is located an expansion spring 23 which, by action against the plug, tends to retract the shaft 21 into the hub and thus tends to keep the cam roller 14*b* within the recess 14*c* and out of engagement with the steering cam 11.

A flexible cable 25, Bowden type, extends between the hub 20 and the slide 10, Fig. 3. The cable carries a pusher pin 25*a* which engages the plug 21*b* to project, i.e. push, the shaft out of the recess 14*c* into

operative engagement with the steering cam **11**. Fig. 3 shows the roller **14***b* in projected position in dotted lines. The other end of the cable **25** ends in a pin **27** adapted to be struck by the slide **10** when the objective **4** is optically alined within the enlarger, Fig. 3. A screw cover **24** closes the end of the hub **20**.

When the objective **4** is selected for use, the slide **10** is moved transversely so as to strike the pin **27** and thus, via the cable **25**, the cam roller **14***b* is projected to engage the cam **11**. The objective carrier **3** is then slightly lowered so that the pawl spring **28***a* may lift the pawl to enter the recess **10***a* and lock the parts in the new position.

The operation is as follows: As shown in Fig. 1 the objective **5** is focused and in enlarging position. In order to achieve this result, the cam roller **14***a* operatively engages its steering cam **12** whereby, via the swingable roller arm **14** and the link **16**, the objective is moved vertically into the correct position below the negative stage **2**.

If the other objective **4** is selected for use, the objective carrier **3** is lifted to contact the negative stage **2** whereby, again via the link **16**, the swingable roller arm **14** is swung so far on its pivot **13** that the cam roller **14***b* can be projected into the space between the two steering cams. In this position the abutment **29** on the stage **2** strikes the pawl **28** and thereby releases the slide **10** which can now be moved transversely to bring the objective **4** into alinement with the optical axis of the enlarger. The cam roller **14***a* will then no longer engage its steering cam **12** whereas the other cam roller **14***b* will engage its steering cam **11**.

If the objective **5** is again selected for use, the above operations take place in reverse order. First, the carrier **3** is lifted and the steering cam roller **14***b* relieved of its load and thereafter, by the reverse movement of the slide **10**, the cam roller **14***b* is retracted and the other cam roller **14***a* again engages the cam **12** operatively to focus the objective **5**.

The cams **11** and **12** are adjustably carried by a segment **2***b* of the fixed arm **2***a* as shown in Fig. 4. The cams are adjusted by means of an adjusting screw **34** located within an opening **32** in engagement with the cam. By rotating the screw **33** the other screw **34** is shifted to adjust the cam on the support. The other cam **11** is adjustably secured in position by screws **40** passing through slots **41**. The cam is adjusted by means of a screw **44** acting against the cam and a spring **43** as shown.

The entire weight of the objective carrier with the two objectives rest upon the steering cams. While this arrangement may suffice to balance the loads, it is desirable to use an additional load balancing device as shown in Fig. 6. A load balancing spring **51** is contained within a housing **50** supported on the arm **2***a*. The outer end of the spring is via a cable **52** connected to the objective carrier **3**. The spring is adapted to be adjusted to balance the weight of the objective carrier and the objectives.

The automatic focusing of the objectives is the result of the combined action of the steering cams and the cam rollers. The position of the cam roller on the steering cam, herein described as operative engagement, focuses the selected objective in that thereby the objective is moved vertically by the link **16** into the required optical distance below the negative stage, the pivot **15** being moved, raised or lowered, when the appropriate steering cam roller operatively engages the steering cam. The change of objectives may be made irrespective of the level of the enlarging unit. The contact between the carrier **3** and the negative stage **2** releases the transverse slide **10** so that the selected objective can be brought into alined position with the optical axis of the enlarger. As the carrier **3** is slightly lowered from the negative stage **2**, the cam rollers, **14***a* or **14***b*, as the case may be, will operatively engage their respective steering cams as shown in Figs. 1 and 3 and the slide **10** is then again locked in the carrier **3**.



I claim:

1. In a photographic enlarger, in combination, a vertically movable enlarger unit, a support therefor, two arms forming opposite sides of a parallelogram pivotally connecting said unit with the said support, steering cams supporting means in said unit, an objective carrier therein engaging said steering cams supporting means in vertically slidable relation thereto, two objectives of different focal lengths supported in said objective carrier, means for moving either of said objectives into operative optical alinement with the optical axis of the enlarger, means for focusing either of said objectives when it has been moved into alined position as aforesaid comprising two steering cams supported on said steering cams supporting means, a swingable cam roller support pivoted on one of the said arms, two cam rollers supported on said swingable support, one of said cam rollers being adapted to operatively engage one of said steering cams when one of the two objectives is moved into optical alinement with the optical axis of the enlarger as aforesaid, the other of said cam rollers being adapted to operatively engage the other of said steering cams when the other objective of the two objectives is brought into alined position as aforesaid, a link pivotally connecting said swingable cam roller support with said objective carrier for moving the cam roller support about its said pivot and causing either one of said cam rollers to operatively engage its steering cam to move the objective carrier vertically in said unit into a position in which the particular objective alined with the optical axis of the enlarger is placed in enlarging position.

2. A photographic enlarger according to claim 1 including a load compensating device supported in said enlarging unit and operatively connected to said slidable objective carrier for relieving the said two steering cams and the cam rollers from the weight of the objective carrier and the objectives thereon.

3. A photographic enlarger according to claim 1 including means for preventing one of the said two cam rollers from operatively engaging its steering cam when a predetermined objective is selected for use and moved into its enlarging position and means for moving the said one cam roller into operative engagement with its steering cam when said predetermined objective is moved out of its enlarging position and replaced by the other selected objective in enlarging position.

4. A photographic enlarger according to claim 1 including means for moving one of said cam rollers axially to operatively engage its steering cam in response to the movement of one of said objectives into optical axial alinement with the optical axis of the enlarger and a spring for retracting the said one cam roller from engagement with its steering cam when the other of said objectives is moved into enlarging position in the enlarger.

5. A photographic enlarger according to claim 1 including means for adjustably supporting the said two steering cams on the said cam supporting means.

6. In a photographic enlarger, in combination, a vertically movable enlarging unit, a support therefor, arms forming opposite sides of a parallelogram pivotally connecting said unit with said support, an objective carrier in said unit to move vertically therewith, a slide transversely movably supported in said carrier, two objectives of different focal lengths supported in said slide to be selectively moved by the slide into optical axial alinement with the optical axis of the enlarger, a spring pressed pawl in said slide for locking the slide to the objective carrier when a particular objective has been moved into alined position as aforesaid and means in the unit for moving said pawl out of locking engagement with the slide and unlock the slide from the objective carrier just prior to the transverse movement of the slide in the carrier in order to bring the other objective into alined enlarging position in the enlarger.

7. A photographic enlarger according to claim 6 in-

cluding a negative stage in the enlarging unit above the said objective carrier with its transverse movable slide, a locking device interposed between the objective carrier and the slide therein for locking the slide to the objective carrier when a selected objective in the slide has been alined with the optical axis of the enlarger and means on said negative stage for operating the said locking device to release the slide so that the slide may be transversely moved only when the other objective is selected for use.



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