K. LEHTO.

PHOTOGRAPHIC COPYING AND ENLARGING APPARATUS.

APPLICATION FILED APR. 5, 1921.

1,406,041. Patented Feb. 7, 1922.

3 SHEETS—SHEET 1.

Fig. 3.

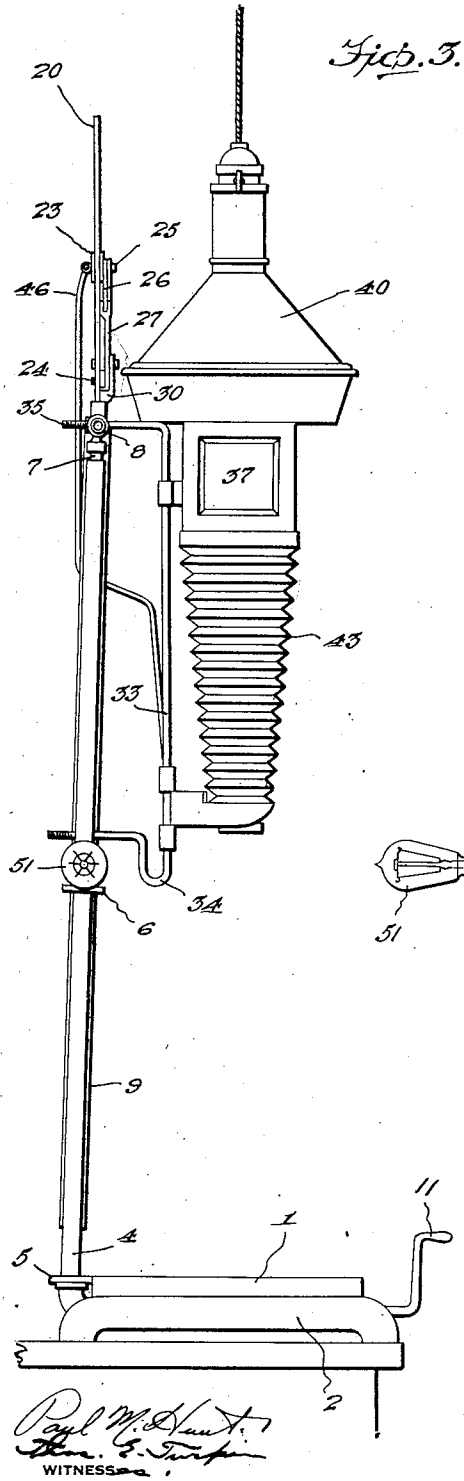
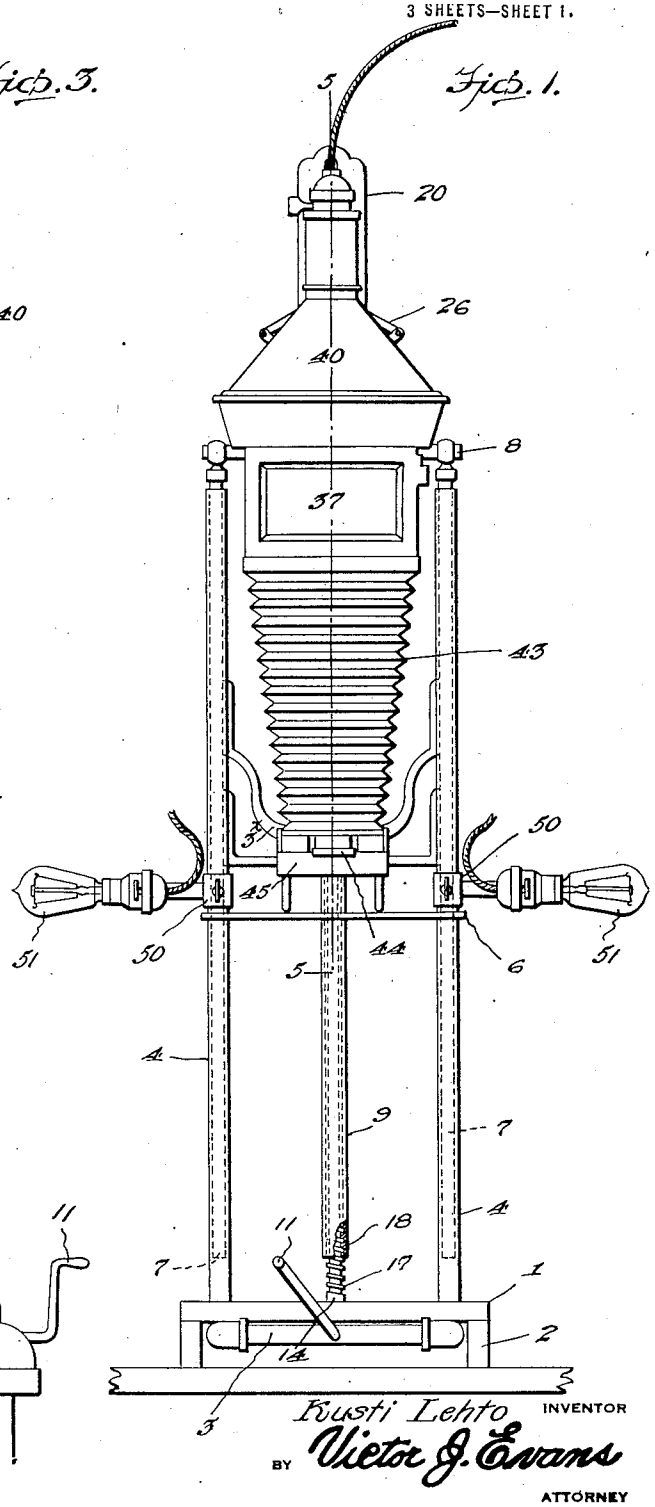


Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2.

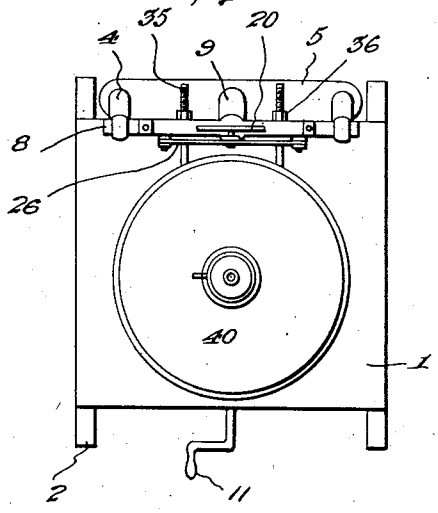
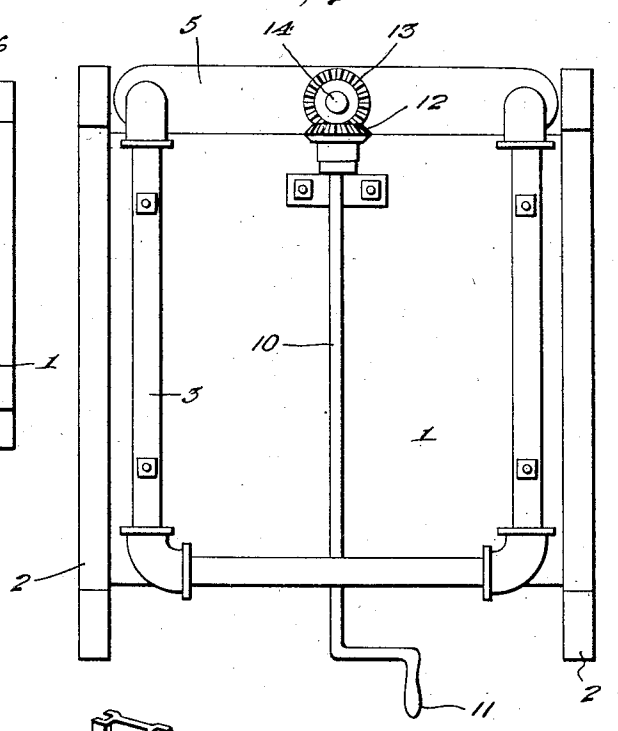


Fig. 7.



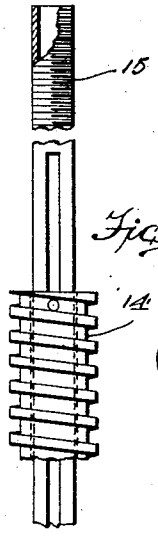


Fig. 8.

Fig. 6.

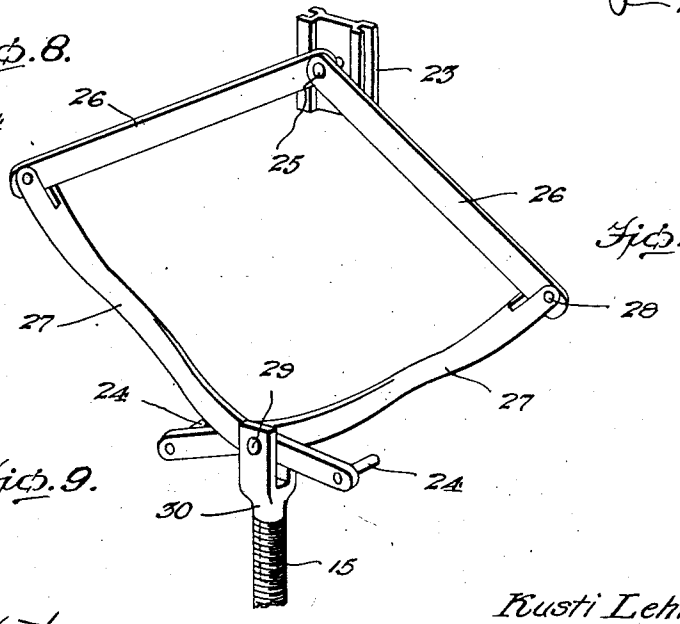


Fig. 9.

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3 SHEETS—SHEET 3.

Fig. 4.

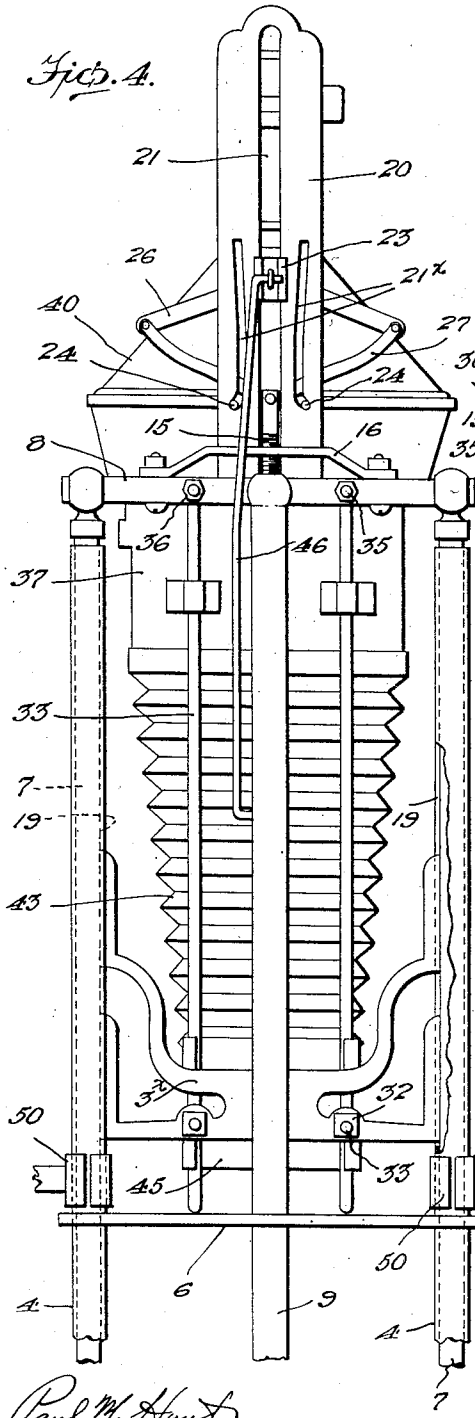
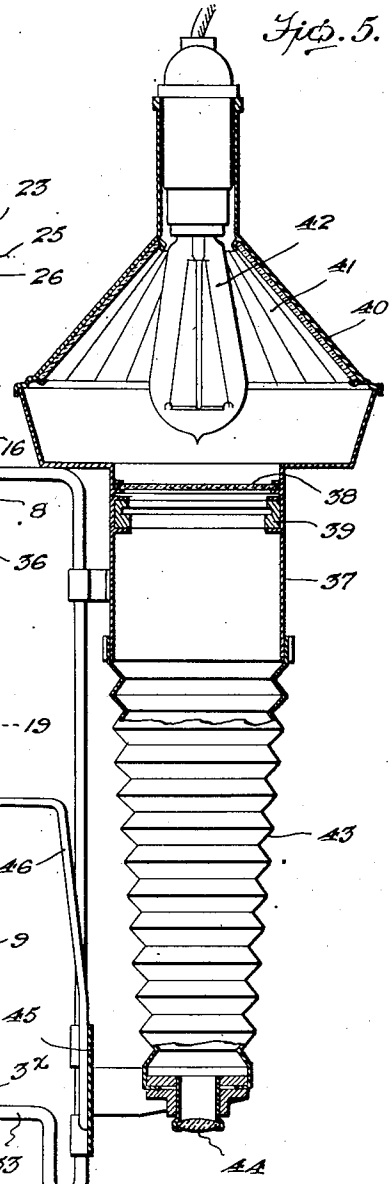


Fig. 5.



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UNITED STATES PATENT OFFICE.

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PHOTOGRAPHIC COPYING AND ENLARGING APPARATUS.

1,406,041. Specification of Letters Patent. Patented Feb. 7, 1922.

Application filed April 5, 1921. Serial No. 458,785.

To all whom it may concern:

Be it known that I, KUSTI LEHTO, a citizen of Finland, residing at Maynard, in the county of Middlesex and State of Massachusetts, have invented new and useful Improvements in Photographic Copying and Enlarging Apparatus, of which the following is a specification.

The object of my present invention is the provision of an apparatus susceptible of ready and nice adjustment and adapted to be used to advantage in the copying and enlarging of photographs.

To the attainment of the foregoing, the invention consists in the improvement as hereinafter described and definitely claimed.

In the accompanying drawings, forming part hereof:—

Figure 1 is a front elevation of the apparatus constituting the best practical embodiment of my invention that I have as yet devised.

Figure 2 is a plan view of the same.

Figure 3 is a side elevation.

Figure 4 is an enlarged detail rear elevation.

Figure 5 is a vertical central section on the line 5—5 of Figure 1.

Figure 6 is a detail perspective illustrative of the connection for expanding and contracting the accordion-like casing to position the lens.

Figure 7 is an enlarged inverted plan view of the apparatus.

Figures 8 and 9 are enlarged detail views showing the connection between the coarse-threaded lower section and the fine-threaded lower section of the operating shaft.

Similar numerals of reference designate corresponding parts in all of the views of the drawings.

For the sake of clearness I will describe my novel apparatus in detail, but I desire it understood that it is within the purview of my invention to make various structural changes such as clearly fall within the scope of my appended claims.

In the present and preferred embodiment of the invention the apparatus includes among other elements a base made up of a platform 1 and side bars 2 on which the platform 1 is superimposed and to which it is fixed.

Arranged under and appropriately fixed to the platform 1 is a base portion 3 of the fixed main frame, which frame also comprises two tubular uprights 4 arranged in spaced and parallel relation and connected together through the medium of a lower cross bar 5 and an upper cross bar 6.

Guided in the tubular uprights 4 are the upright rods 7 of a vertically movable frame, which vertically movable frame also comprises a crown bar 8 and a vertical central tubular bar 9 that depends from the crown bar 8.

Journaled in the base portion 3 of the fixed frame is a shaft 10 which is provided at one end with a crank 11 and at its opposite end with a miter gear 12. The said miter gear 12 is intermeshed with a miter gear 13 at the lower end of a vertical sectional shaft 14 which is adapted to turn about its axis in the lower cross bar 5 and in the central tubular bar 9 of the vertically movable frame, and is provided on its upper section with a threaded portion 15 that extends through and engages a nut 16 fixed on the crown bar 8. On its lower section the shaft 14 is provided with a comparatively coarse and fast thread 17, which is engaged with a complementary thread 18 in the lower portion of the central bar 9. It will also be noticed that the tubular side uprights of the fixed main frame are provided in their inner sides with vertical slots 19. The spline connection between the lower and upper sections of the shaft 14 is shown in Figures 8 and 9.

Fixed to and superimposed on the crown bar 8 of the vertically movable frame is an auxiliary frame 20 having a vertical central slot 21 and auxiliary slots $21^{\times}$. Movable vertically in the slot 21 is a slide 23, and movable vertically in the slots $21^{\times}$ are pins 24. Pivotally connected at 25 to the slide 23 are the upper members 26 of toggle levers, the lower members 27 of which are pivotally connected at 28 to the upper members and are pivotally connected at 29 together and to a swivel head 30. At their lower ends said members 27 are appropriately connected to the pins 24. The swivel head 30 as its name imports is swivelled on the upper end of the shaft 14 so that expansion and contraction of the toggle levers will attend rotation of the shaft 14. In other words when the shaft 14 is turned in one direction the slide 23 will be raised and when the shaft is turned in the opposite direction the slide 23 will be lowered.

Fixed to the vertical central tubular bar

9 and the upright rods 7 of the vertically movable frame and movable in the slots 19 of the tubular uprights 4 is a cross frame 3^{x}.

Adjustably connected at 32 to the said cross frame 3^{x} are rods 33 which are extended forwardly from the cross frame and are looped at 34 and then extended upwardly. At their upper ends the said rods 33 are provided with angularly disposed arms 35 which are adjustably connected at 36 to the crown bar 8 of the vertically movable frame. By virtue of the adjustable connections of the rods 33 it will be manifest that the said rods may be adjusted relatively to the vertically movable frame so as to make the apparatus perfectly level.

Fixed to the upper portions of the rods 33 is a casing 37 adapted to receive a ground glass plate 38 and a plate or negative holder 39, the latter being mounted to slide into and out of the casing 37 in a horizontal plane slightly below the plate 38.

Superimposed on and removable from the casing 37 is a hood 40 having a reflector 41 at its underside and adapted to receive and hold an incandescent electric lamp bulb 42, the latter being designed to be electrically connected through wires with a source of electric energy. Connected to and extending downwardly from the casing 37 is an accordion-like casing 43 adapted at its lower end to carry a lens 44. The lower end portion of the said accordion-like casing 43 is fixed to a slide 45 movable vertically on the rods 33.

Interposed between and connecting the said slide 45 and the before mentioned slide 23 is a rod 46. By virtue of this provision it will be apparent that upward movement of the slide 45 and contraction of the accordion-like casing 43 will attend upward movement of the slide 23 while downward movement of the slide 23 will bring about downward movement of the slide 45 and downward extension of the accordion-like casing 43. Also that upward movement of the slide 45 will attend upward movement of the vertically movable frame while downward movement of the slide 45 will attend downward movement of the vertically movable frame, the said movement of the slide 45 being relative to the vertically movable frame though at a less rate of speed than the corresponding movements of said vertically movable frame. At 50 and movable vertically on the tubular uprights 4 are brackets by which are carried incandescent electric lamp bulbs 51 which obviously can be moved horizontally and vertically for copying when the apparatus is used for that purpose. It will also be understood that ruby bulbs can be used for developing.

In the practical use of my novel apparatus for copying purposes the plate is placed in the holder 39 and the object to be copied is placed on the platform 1, and the filaments of the incandescent lamps are caused to glow.

When the apparatus is to be used for enlarging purposes, the bromide paper is superimposed on the platform 1, and the negative is placed on the holder 39.

The adaptability of the hood 40 to be lifted off the casing 37 is advantageous inasmuch as it permits of ready inspection of the interior of said casing 37.

It will be apparent from the foregoing that when the vertically movable frame is raised in the manner described, the focus will be lengthened for the enlargement of an object on the platform 1; also, that in concert with the raising of the vertically movable frame the lens is moved nearer to the negative thereby assuring a sharp focus at different heights. In other words the focus is automatically corrected.

Manifestly the hereinbefore described spline connection between the lower and upper sections of the shaft 14 will provide for the endwise movement of one shaft section relatively to the other, necessary in view of the fact that the thread 17 is a coarse thread and the thread 15 is a fine thread.

Having described my invention, what I claim and desire to secure by Letters-Patent, is:—

1. Apparatus for the purpose described comprising a fixed frame, a movable frame, a casing connected to the movable frame, an accordion-like casing carried by said casing and adapted to carry a lens, a slide connected with the accordion-like casing, means carried by the movable frame on which means the slide is movable, means to move the movable frame, and means to move the slide relatively to the movable frame and in concert with the movement of said frame; the said means for moving the frame comprising a shaft having a thread engaging a complementary thread of the frame and also having a finer thread engaging a complementary fine thread of the frame, toggle levers connected with the shaft, a slide connected with and movable by said toggle levers, and a connection between said slide and the first-named slide.

2. An apparatus for the purpose described comprising a platform, means to support the same, a fixed frame having a portion arranged under and fixed to the platform and also having spaced and parallel tubular uprights vertically slotted at their inner sides, a shaft journaled in the said frame portion and having a crank and miter gear, a vertical shaft having a lower coarse thread and an upper finer thread and also having a miter gear intermeshed with that of the first-named shaft, a vertically movable frame having upright portions guided in the tubular uprights and a crown bar connecting said portions and also having a central vertical

portion receiving the second-named shaft and threads for the engagement of the threads of said shaft and further having a cross frame interposed between the upright portions and movable in the slots of the frame uprights, a slotted frame on the crown bar of the movable frame, upright rods adjustably connected with the crown bar and said cross frame, a slide movable on said rods, a slide movable in the slot of the frame on the crown bar and connected with the first-named slide, a swivel head on the second-named shaft, toggle levers connected with the frame on the crown bar and also with the swivel head and the second-named slide, a casing connected to the said rods and open at its upper side and adapted to contain a ground glass plate, an accordion-like casing connected to the first-named casing and also connected to the first-named slide and adapted to carry a lens at its lower end, a hood removably arranged on the casing and adapted to receive an incandescent electric lamp bulb and having a reflector at its underside, and a bracket adjustable on one of the tubular uprights of the main frame and adapted to carry an incandescent electric lamp bulb.

In testimony whereof I affix my signature.

KUSTI LEHTO.