

Nov. 15, 1938.

D. W. RAU

2,137,028

PHOTOGRAPHIC ENLARGING MACHINE

Filed Aug. 26, 1936

2 Sheets-Sheet 1

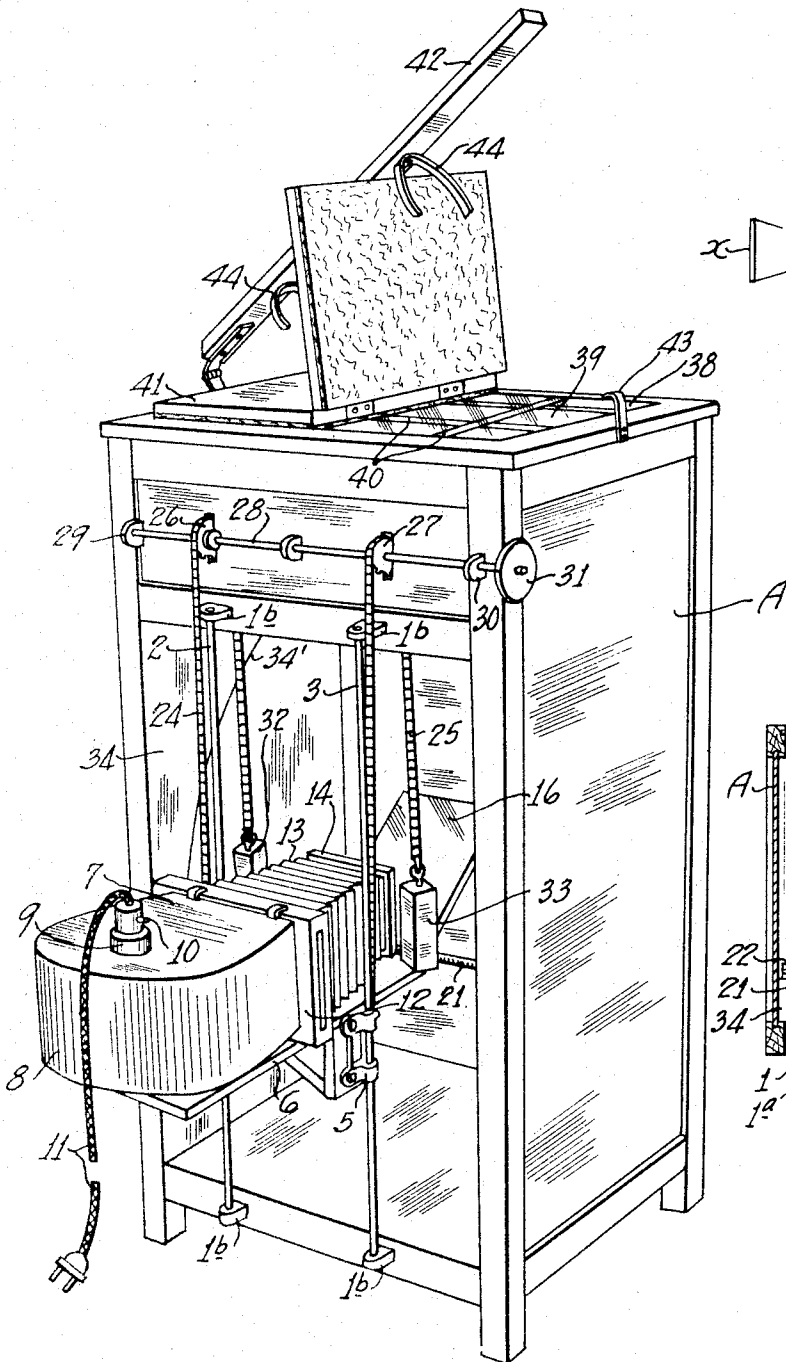


Fig. 1.

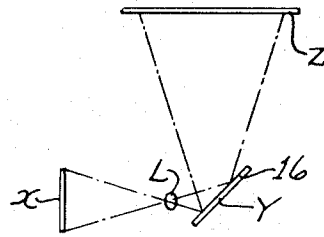


Fig. 3.

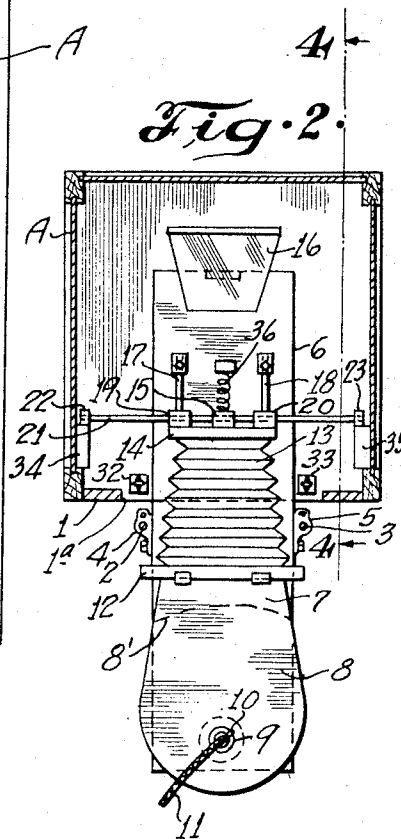


Fig. 2.

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2 Sheets-Sheet 2

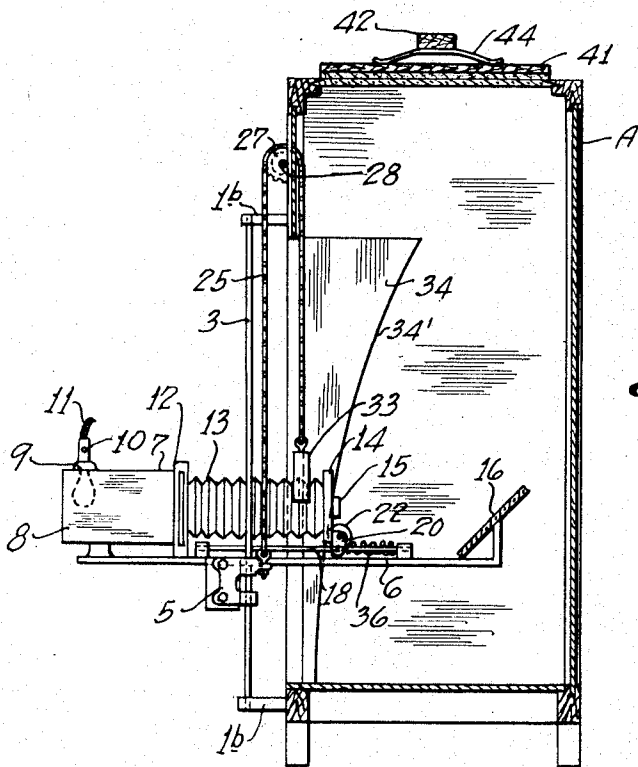


Fig. 4.

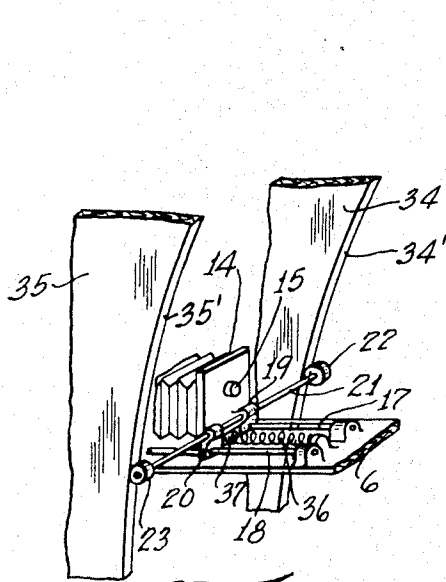


Fig. 5.

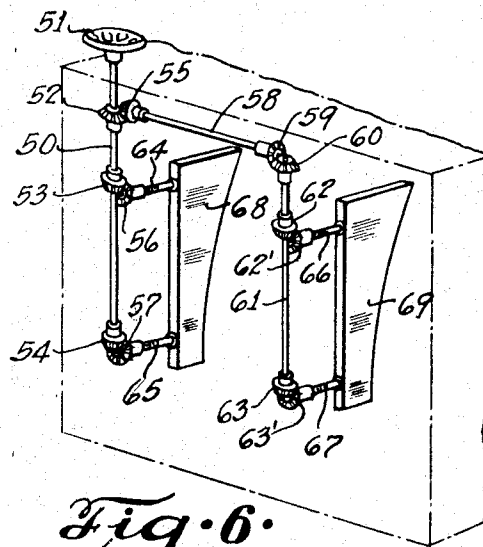


Fig. 6.

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PHOTOGRAPHIC ENLARGING MACHINE

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Application August 26, 1936, Serial No. 97,892

7 Claims. (Cl. 88—24)

This invention relates to a certain new and useful improvement in photographic enlarging machines.

My invention has for its primary object the provision of a machine for the purpose stated, which is of unusually compact character and simple, economical construction.

My invention has for another object the provision of a machine of the type stated so constructed that the enlarged image is directed upon a sensitive surface disposed at an angle to the original print or negative.

My invention has for a further object the provision of a photographic enlarging machine which has a plurality of degrees of enlargement and is self-focusing as the degree of enlargement is varied.

My invention has for an additional object the provision of a photographic enlarging machine in which lenses of comparatively long focal length may be utilized in order to permit enlargement from original prints and negatives of an unusually wide range of sizes.

And with the above and other objects in view, my invention resides in the novel features of form, construction, arrangement, and combination of parts presently described and pointed out in the claims.

In the accompanying drawings (two sheets);—
Figure 1 is a perspective view of a photographic enlarging machine constructed in accordance with and embodying my present invention, a wall of the cabinet or casing of the machine being removed for disclosure of interior parts;

Figure 2 is a cross-sectional plan view of the machine;

Figure 3 is a diagrammatic view of the optical arrangement of parts in the machine;

Figure 4 is an elevational cross-sectional view of the machine, taken approximately on the line 4—4, Figure 3;

Figure 5 is a fragmentary perspective view of the machine, showing in detail the automatic focusing tracks thereof; and

Figure 6 is a fragmentary perspective view of a modified form of automatic focusing track assembly.

Referring now more in detail and by reference characters to the drawings, which illustrate a preferred embodiment of my invention, A designates a preferably rectilinear cabinet, whose inner surfaces are preferably covered in a conventional manner with a customary dead-black non-reflecting material. Formed in the front wall 1 of the cabinet or casing A, is a suitably enlarged longitudinal

opening 1^a, and projecting forwardly from the cabinet A, are brackets 1^b supporting longitudinally extending spaced parallel guide rods 2, 3, in co-operative location relatively to the opening 1^a, all for purposes shortly appearing.

Mounted for movement vertically or longitudinally of the cabinet A between, and slidably engaging, the guide rods 2, 3, by means of suitable brackets 4, 5, is a platform 6, operably mounted at the forward end of which, and extending horizontally inwardly or rearwardly into the cabinet A, is a projector 7 comprising a light-proof compartment 8, in which is disposed a suitable light diffusing screen 8' and a light source 9, the latter being connected in a conventional manner through a switch 10 and a flexible cord 11 with any suitable source of electric current.

Mounted at the rear end of the compartment 8, is a negative holder 12, rigidly mounted on the rear face of which is a camera bellows 13, which is provided at its open rear end with a lens holder 14 for centrally supporting a suitable enlarging lens 15.

Also mounted on the platform 6 at the rear end thereof and disposed at an angle of 45° to the horizontal, is a preferably front silvered, plane reflecting surface or image deflecting means 16.

Horizontally mounted on the platform 6, is a pair of parallel guides 17, 18, slidably engageable with which and preferably integrally formed on the lens holder 14, are bosses or ears 19, 20, in which is mounted, perpendicularly to the axis of the guides 17, 18, for horizontal movement with the lens holder 14, a transverse shaft 21, which extends laterally on both sides of the lens holder 14 and is provided at its outer extremities with freely rotatable rollers 22, 23, respectively.

Extending vertically upwardly from, and having an end fixed to, the brackets 4 and 5, respectively, are sprocket chains 24, 25, which pass over sprockets 26 and 27 mounted on, and rotatable with, a horizontally disposed shaft 28 which extends for rotation through bearings 29, 30, on the cabinet A and is provided at an extremity with an operating hand-wheel 31, the sprocket chains 24, 25, extending downwardly from the sprockets 26, 27, and being provided at their respective lower extremity with counterweights 32, 33, respectively.

Disposed vertically within the cabinet A along opposite vertical walls thereof and adjacent the opening 1^a, is a pair of focusing-tracks 34, 35, having curved or arcuate guide surfaces 34', 35',

on which the rollers 22, 23, ride, the latter being resiliently urged against the tracks under the tension of a compression spring 36, which is disposed on the rear portion of the platform 6 and operatively impinges against an extension 37 formed between the bosses 19, 20 on the lens holder 14, as best seen in Figures 4 and 5.

It should be noted that the curved or arcuate track surfaces 34', 35', are both congruent and parallel and conform in shape to a modified parabola, the exact curve of which may be developed mathematically to correspond to any particular desired dimensions, lens values, and enlargement limits, so that the horizontal movement of the lens 15 will be a direct mathematical function of the vertical movement, thereby automatically maintaining a proper and sharp focal arrangement between the negative and the enlargement. Where the exact optical characteristics of the lens 15 are not known, or where other optical difficulties, such as parallax, may be encountered, it will be found preferable, however, to determine empirically the shape of the curved surfaces 34', 35', by lowering the platform 6 to its lowest point and manually focusing the lens 15 by moving the bellows 13 inwardly or outwardly, as the case may be, to the desired point. When the lens 15 is in focus, the precise position of the roller members 22, 23, is charted. The platform 6 is then moved upwardly a small distance and the lens 15 again focused until a sharp image appears, the precise position of the rollers 22, 23, being again charted to provide a second point in the curve. The platform 6 is successively moved upwardly in small increments, the lens 15 being focused each time to provide an additional point in the curve. When the platform 6 has been moved to its upper limit, the points thus charted will accurately define the exact curve to which the track surfaces 34', 35' must conform.

Formed preferably in the top wall of the cabinet A, is an opening 38, in which is flatwise mounted a flat transparent plate or printing surface 39, slidably movable over the upper surface of which is a plurality of mutually perpendicular and intersecting masking strips 40 shiftable with respect to each other for enclosing a variable rectangular space comparable to the size of the desired enlarged print.

Hingedly mounted preferably on the top of the cabinet A over the opening 38, is a platen 41 adapted for light-proof engagement with the transparent or glass plate or printing surface 39 and the margins of the opening 38, a closing arm 42 being also hingedly mounted on the top wall of the cabinet A and releasably engageable with a hook 43, the arm 42 being provided with a plurality of spring-clips 44 engageable with the upper face of the platen 41 for resiliently forcing the platen 41 down over the transparent plate 39 for holding an inserted sheet of sensitized printing paper Z in tight flatwise contact therewith.

It will be noted that, as shown diagrammatically in Figure 3, the negative X from which the enlargement is to be made is held in a fixed vertical plane, and the plane reflecting surface Y, which corresponds to the member 16, is disposed at an angle of 45° from the horizontal and is perpendicular to the vertical focal plane of the projector 7, the center of the reflecting surface Y being preferably located along the optical axis of the projector 7. The sensitized paper Z upon which the enlargement is to be printed is dis-

posed in a horizontal plane, which is at right angles to the plane of the negative X and is also preferably centered about the vertical optical plane of the projector 7. The reflecting surface Y, as has been stated, moves vertically with the negative X. The lens L, which corresponds to the member 15, is automatically shifted horizontally along its optical axis toward or away from the negative X in such manner that, as the distance between the paper Z and the optical axis increases, thereby increasing the size of the enlargement, the distance between the optical center of the lens L or 15 and the negative X will correspondingly decrease, thus automatically maintaining a sharp focus for any desired degree of enlargement.

In use and operation, the negative X is placed in the holder 12 and the switch 10 turned to "on" position, thereby energizing the light source. The image is projected by the lens L onto the reflecting surface Y or 16, which, in turn, directs the image upwardly to the glass plate or printing surface 39. An auxiliary ground glass plate or ground celluloid sheet (not shown) of the type conventionally used for such purpose in photographic work, may be placed over the upper surface of the glass plate 39, whereupon the enlarged image will become visible. The hand-wheel 31 is then actuated to raise or lower the platform 6 until the desired size of enlargement is obtained, as may be observed directly by reference to the image on the ground glass plate. The masking strips 40 are then moved into position so as to enclose either the entire image or any selected part of the enlarged image, whereupon the switch 10 is turned to "off" position.

A sensitized printing paper Z is then placed, sensitive side down, on the glass plate 39 in such manner that its edges will overlie the masking strips 40. The platen 41 is then placed on top of the paper Z and the closing arm 42 brought down into locking engagement with the hook 43, whereupon the spring-clips 44 will engage the top of the platen 41, urging the same downwardly and thereby forcing the sensitized paper Z tightly into position.

The switch 10 is thereupon again turned to "on" position for an interval of time, which will vary in accordance with the proper exposure time of the particular negative and sensitized paper being employed for the enlargement.

Under some circumstances, it may be desirable to alter the focus of the enlargement to produce, for instance, from a sharp focus negative a print having a soft focus appearance. Since the curves of the track surfaces 34', 35', have been designed to provide a sharp focusing relationship between the plane of the negative and the plane of the print, variations in the focus may be readily obtained, as illustrated in the modified embodiment in Figure 6, which comprises a vertical shaft 50 rotatively disposed in some suitable manner in the cabinet A and extending through the top wall thereof, having at its upper end a suitable hand-wheel 51. A plurality of bevel-gears 52, 53, and 54 are disposed along the shaft 50 for rotation therewith and respectively engage bevel-gears 55, 56, and 57. The gear 55 is mounted on a horizontal shaft 58, which is provided at its other extremity with a bevel-gear 59, operatively meshing with which is a bevel-gear 60 rigidly mounted on the upper extremity of a vertical shaft 61, the latter being, in turn, provided with bevel-gears 62, 63, meshing with 62' and 63'. The bevel-gears 56, 57, 75

62', and 63' are each suitably formed with internally threaded collars, which threadedly engage rods 64, 65, 66, and 67, respectively. Focusing track members 68, 69, are mounted on the ends of the rods 64, 65, 66, and 67, respectively, as shown, for slidable movement in a vertical plane. Thus, when the machine has been adjusted to obtain the desired size of enlargement, the hand-wheel 51 may be turned, thereby simultaneously moving the two focusing track members 68, 69, horizontally inwardly or outwardly, as the case may be, thereby permitting a sharpening or softening of the focus.

The machine is simple in structure, conveniently and readily operable, and efficient in the performance of its intended functions.

And it is to be understood that changes and modifications in the form, construction, arrangement, and combination of the several parts of the machine may be made and substituted for those herein shown and described without departing from the nature and principle of my invention.

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

1. A photographic enlarger comprising a cabinet, a projector movable in the cabinet, a printing surface disposed in the cabinet in a plane angularly disposed to the path of movement of the projector, image reflecting means movable with the projector toward and away from the printing surface along a single predetermined line at right angles to the printing surface for directing a projected image upon the printing surface, longitudinally shiftable lens means operably mounted on the projector in juxtaposition to the image reflecting means, focusing means co-operable with the lens means for shifting the lens means toward and away from the image reflecting means responsive to movement of the projector means, and manually operable means for laterally shifting the focusing means to vary the focusing position thereof.

2. A photographic enlarger comprising a box-like cabinet having a horizontal top wall, an open-faced front vertical wall, opposed parallel vertical side walls, and a rear wall, said top wall being provided with an aperture having disposed thereacross a flat transparent plate, a cover hingedly mounted on the cabinet for swingably fitting over the plate, a pair of spaced parallel vertical slide rods rigidly disposed across the face-opening of the cabinet, a support member mounted horizontally between, and for vertical movement upon, the slide rods, a photographic projector mounted rigidly upon the support and having a horizontally shiftable focusing lens, a flat reflector mounted rigidly upon the support inwardly within the cabinet with respect to the focusing lens, a pair of curved track members respectively mounted flatwise upon the side walls, lens adjusting means operatively connected to the focusing lens engageable with the tracks for moving the lens toward the reflector responsive to upward movement of the support, and spring means for normally urging the lens adjusting means into track-engagement.

3. A photographic enlarger comprising a box-like cabinet having a horizontal top wall, an open-faced front vertical wall, opposed parallel vertical side walls, and a rear wall, said top wall being provided with an aperture having disposed thereacross a flat transparent plate, a cover hingedly mounted on the cabinet for swingably fitting over the plate, a pair of spaced par-

allel vertical slide rods rigidly disposed across the face-opening of the cabinet, a support member mounted horizontally between, and for vertical movement upon, the slide rods, a photographic projector mounted rigidly upon the support and having a horizontally shiftable focusing lens, a flat reflector mounted rigidly upon the support inwardly within the cabinet with respect to the focusing lens, a pair of curved track members respectively mounted flatwise upon the side walls, lens adjusting means operatively connected to the focusing lens engageable with the tracks for moving the lens toward the reflector responsive to upward movement of the support, spring means for normally urging the lens adjusting means into track-engagement, and manually controllable counter-balancing means operatively connected with the support for adjustably moving the support to any desired position vertically of the face-opening.

4. A photographic enlarger comprising a cabinet, a projector movable in the cabinet, a printing surface disposed in the cabinet in a plane angularly disposed to the path of movement of the projector, image reflecting means movable with the projector for directing a projected image upon the printing surface, longitudinally shiftable lens means operably mounted on the projector in juxtaposition to the image reflecting means, a curved focusing track, a rotatively mounted threaded rod operatively engageable with the track, a first bevel gear mounted on the rod, a second bevel gear mounted for meshing engagement with the first gear, a crank handle mounted exteriorly of the cabinet and operatively connected to the second gear for rotatively actuating the latter to produce corresponding translative movement of the track, and means slidably engageable with the track for shifting the lens means toward and away from the image reflecting means responsive to movement of the projector.

5. A photographic enlarger comprising a cabinet having a plurality of walls, one of said walls being substantially open-faced and another of said walls being disposed substantially at right angles to the open-faced wall and having mounted rigidly thereon means for supporting a sensitized photographic film, a pair of spaced parallel slide rods rigidly disposed across the face-opening of the cabinet, a support member mounted at right angles to and between the slide rods for shiftable movement therealong, a photographic projector mounted rigidly upon the support and having a focusing lens mounted for shiftable movement along the support, a reflector mounted rigidly upon the support interiorly of the cabinet with respect to the focusing lens, a pair of curved track members respectively mounted flatwise upon opposed parallel walls of the cabinet, lens adjusting means operatively connected to the focusing lens and being engageable with the tracks for moving the lens toward the reflector responsive to movement of the support along the slide rods, and means for normally urging the lens adjusting means into track engagement.

6. A photographic enlarger comprising a cabinet having a plurality of walls, one of said walls being substantially open-faced and another of said walls being disposed substantially at right angles to the open-faced wall and having mounted rigidly thereon means for supporting a sensitized photographic film, a pair of spaced parallel slide rods rigidly disposed across the face-opening of the cabinet, a support member mount-

ed at right angles to and between the slide rods for shiftable movement therealong, a photographic projector mounted rigidly upon the support and having a focusing lens mounted for shiftable movement along the support, a reflector mounted rigidly upon the support interiorly of the cabinet with respect to the focusing lens, a pair of curved track members respectively mounted flatwise upon opposed parallel walls of the cabinet, lens adjusting means operatively connected to the focusing lens and being engageable with the tracks for moving the lens toward the reflector responsive to movement of the support along the slide rods, means for normally urging the lens adjusting means into track engagement, and counter-balancing means operatively connected with the support for adjustably moving the support to any desired position along the slide rods.

7. A photographic enlarger comprising a cabinet having a plurality of walls, one of said walls being substantially open-faced and another of

said walls being disposed substantially at right angles to the open-faced wall and having mounted rigidly thereon means for supporting a sensitized photographic film, a pair of spaced parallel slide rods rigidly disposed across the face-opening of the cabinet, a support member mounted at right angles to and between the slide rods for shiftable movement therealong, a photographic projector mounted rigidly upon the support and having a focusing lens mounted for shiftable movement along the support, a reflector mounted rigidly upon the support interiorly of the cabinet with respect to the focusing lens, a curved track member mounted within the cabinet, lens adjusting means operatively connected to the focusing lens and being engageable with the track for moving the lens toward the reflector responsive to movement of the support along the slide rods, and means for normally urging the lens adjusting means into track engagement.

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