

Aug. 26, 1969

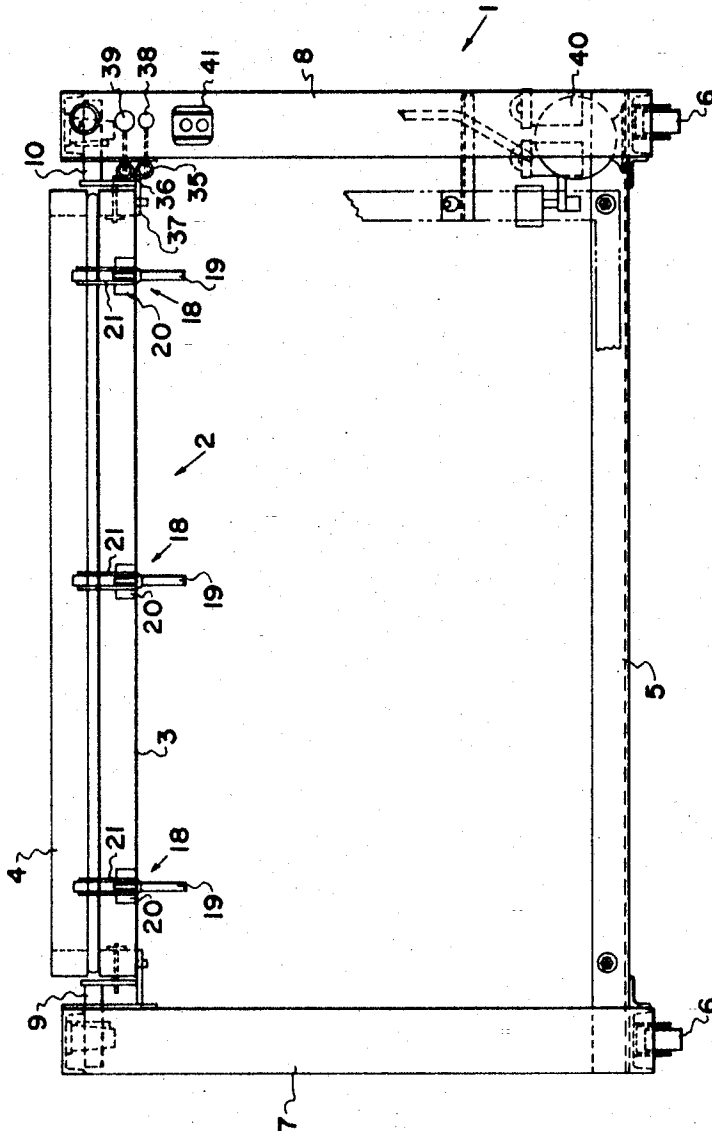
C. H. OLTRA ETAL

3,463,587

VACUUM FRAME FOR SILK SCREEN STENCILS

Filed June 19, 1967

3 Sheets-Sheet 1



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VACUUM FRAME FOR SILK SCREEN STENCILS

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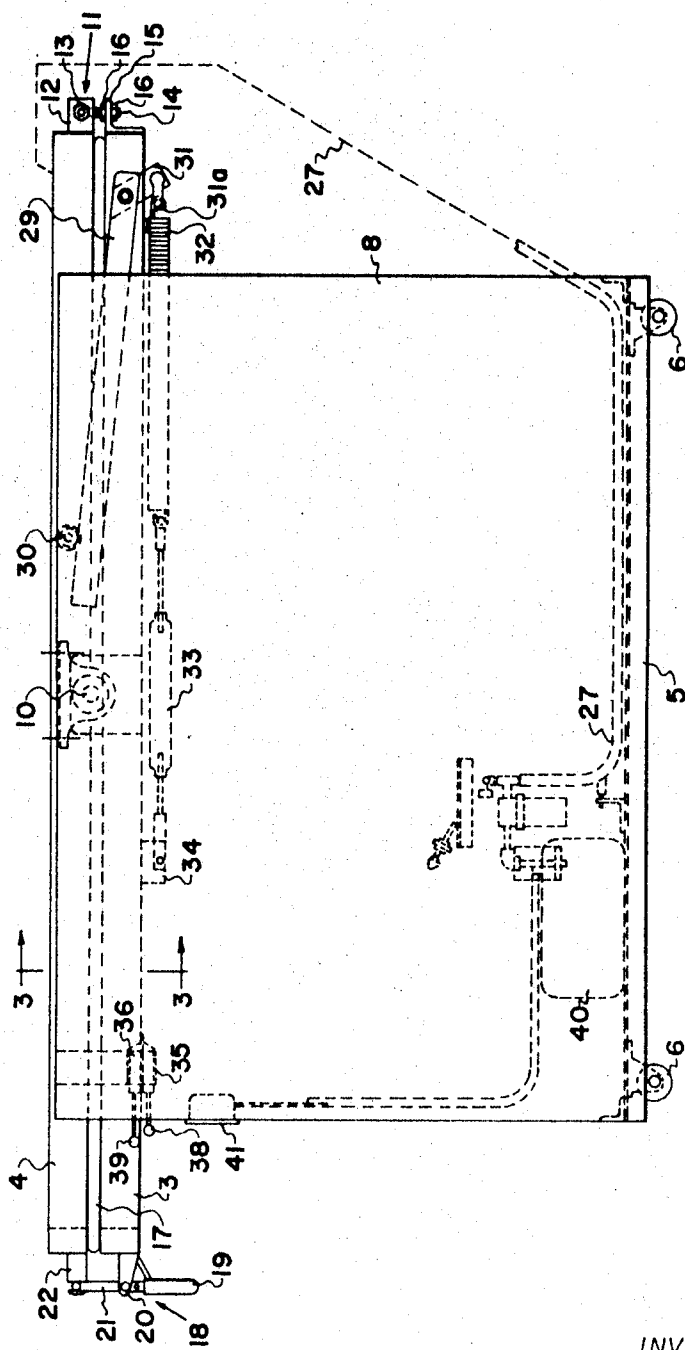


FIG. 2

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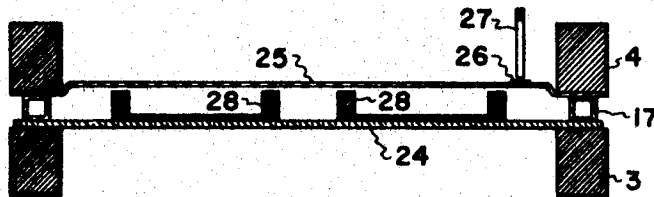


FIG. 3

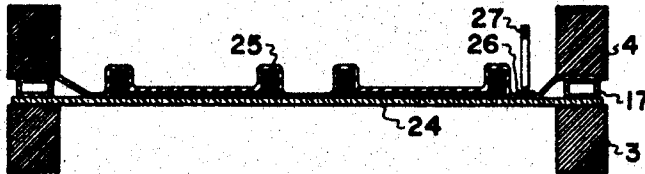


FIG. 4

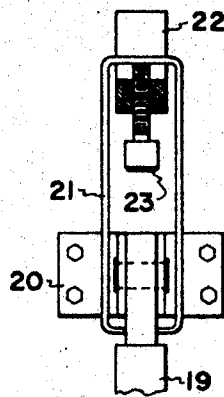


FIG. 5

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VACUUM FRAME FOR SILK SCREEN STENCILS
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3 Claims

ABSTRACT OF THE DISCLOSURE

An improved vacuum frame for preparation of silk screen stencils is provided in which a flexible rubber clamping sheet is carried in a frame which is hinged for movement relative to a transparent base against which a stencil is supported for photographic exposure. The hinged frame is provided with a novel spring-loaded mechanism for holding the frame in an opened position during loading. The apparatus is provided with adjustable hinges and with adjustable clamps for varying the degree of compression of a peripheral air and light seal. The apparatus is a self-contained unit and is pivotally mounted for rotation of the transparent support surface into a position for exposure of the contained stencil to light. Application of vacuum to the flexible sheet in the cover member causes the sheet to press one or more stencils tightly and uniformly against the transparent exposing surface.

BACKGROUND OF THE INVENTION

The use of silk screen stencils for labeling or decorating containers or other objects, including various forms of flat stock, has been well established in industrial use for many years. Throughout this specification, the term "silk screen stencil" is used in the generic sense of screen process stencil and the term "silk screen" refers to all types of meshes used for screen printing. In the preparation of silk screen stencils, it is customary to place a fine silk screen mesh across a wooden (or metal or plastic) supporting frame and secure the screen to the frame tightly. The screen is then provided with a film or coating, which is a negative design of the desired imprint, so that ink forced through the screen will form the desired imprint on a surface which is stenciled or printed using the silk screen. For many years silk screen stencils have been prepared by a photographic process. In the photographic preparation of silk screen stencils, the silk screen is provided with a photosensitive coating which is hardened upon exposure to light. The screen is placed over a photographic negative or positive having the desired design or imprint thereon and is photographically exposed and development of the silk screen, the unexposed portions of the photosensitive coating of the screen are washed or dissolved away so that a stencil opening in the mesh is formed which will produce the desired design or imprint when ink is forced through the screen by action of a squeegee.

In the past, one of the principal problems in the preparation of silk screen stencils by photographic processes has been the proper maintenance of a tight and secure contact between the photosensitive screen and the design positive which is to be developed as a suitable negative design or opening in the screen. One method of providing a tight contact between the screen and the positive or pattern during the stencil preparation has been the use of wooden blocks to the screen to maintain the necessary tight contact. This method has been commercially undesirable since it is very difficult to handle a variety of stencils of different size and shape for simultaneous printing.

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DISCUSSION OF THE PRIOR ART

In the field of photography, printing frames are often used having a flexible sheet member which holds printing paper against a photographic negative upon application of a vacuum between the flexible sheet member and the supporting surface for the negative, see Hatt U.S. Patent 1,151,460, Sweigard U.S. Patent 1,234,416, Koppe U.S. Patent 1,839,230, Weisker U.S. Patent 1,813,689, Ulshimer U.S. Patent 2,257,581, Gelb U.S. Patent 2,760,419, Kendall U.S. Patent 2,969,731, Sigler U.S. Patent 2,988,979, and Benson U.S. Patent 3,043,204.

There have been numerous attempts to apply the principle of the vacuum printing frame as used in photography to the printing of silk screen stencils. These attempts have been generally without success for a variety of reasons. Silk screen stencils are provided with a frame which is of substantial thickness. The vacuum printing frames which have been used in photography have not been designed to provide for securing thick stencil frames in position, but are rather designed only for the handling of thin sheet material. The flexible, vacuum-operated, pressure-applying member in the photographic type vacuum frame does not have the flexibility or sufficient clearance from the supporting surface to handle a single photographic plate having a supporting frame of appreciable thickness and is completely useless in handling a variety of photosensitive plates (i.e. photosensitized screen stencils) supported by frames of varying sizes, thicknesses, and shapes.

Another difficulty which has arisen in attempts to utilize the photographic, vacuum-printing frame in the silk screen stencil art has been that the photographic, vacuum-printing frames have not provided for the support of a large number of stencils of different sizes and for movement of the stencils into a desired position for light exposure. Also, the photographic vacuum printing frames have not been provided with any means to seal the periphery of the frame adequately against light leakage when used with stencils of substantial thickness and particularly when used with a variety of stencils of varying size. In addition, the photographic vacuum printing frames have had no provision for adjustment of the vacuum frame portion to accommodate stencils of varying size.

STATEMENT OF OBJECTIVES AND FEATURES OF THE INVENTION

It is therefore one object of this invention to provide a new and improved method and apparatus for preparing silk screen stencils using a vacuum operated supporting frame of novel construction.

Another object of this invention is to provide an improved method and apparatus for preparing silk screen stencils photographically using a vacuum printing frame provided with means for adjusting the point of support and the point of securing the members of the frame to each other whereby stencils of varying size may be accommodated without light leakage.

Another object of this invention is to provide a new and improved vacuum printing frame for silk screen stencils having an improved structure permitting ease of opening of the frame and easy movement of the frame to a light exposure position.

A feature of this invention is the provision of a new and improved, vacuum-operated printing frame for silk screen stencils having a pair of frame members pivotally connected to each other with one frame member provided with a transparent supporting plate and the other frame member having a sheet of rubbery material actuated by vacuum to secure a stencil in place on the supporting plate, the apparatus being provided with a peripheral, light-sealing gasket and adjustable hinge and clamp mem-

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bers for varying the position of one of the frame members in relation to the other.

Other objects and features of this invention will become apparent from time to time throughout the specification and claims as hereinafter related.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, to be taken as a part of the specification, there is clearly and fully illustrated a preferred embodiment of this invention, in which drawings,

FIG. 1 is a view in front elevation of the novel vacuum printing frame which is a preferred form of this invention,

FIG. 2 is a view in side elevation of the printing frame shown in FIG. 1,

FIG. 3 is a sectional view taken on the line 3—3 of FIG. 2, showing the relationship of the printing frame members to screen stencils which are to be processed in the frame,

FIG. 4 is a view in cross-section substantially the same as that shown in FIG. 3 but with the rubber sheet member moved to a clamping position against the silk screen stencils and transparent supporting base by application of the vacuum thereto, and

FIG. 5 is a detail view of one of the clamp members for the printing frame which permits adjustment of the frame members to accommodate varying sizes of screen stencils in the apparatus.

SUMMARY OF THE INVENTION

This invention relates to a new and improved vacuum printing frame for the preparation of silk screen stencils. In particular, this invention is concerned with a vacuum printing frame having a pair of frame members hinged together and arranged to secure one or more silk screen stencils in position for photographic processing. One of the frame members is provided with a transparent base for photographic processing. The other frame member is provided with a flexible rubbery sheet to which vacuum may be applied to cause the sheet to conform to the surface of the silk screen stencils being processed and to hold the same tightly against the transparent supporting surface. The apparatus is provided with a peripheral deformable gasket for sealing out air around the edges of the apparatus is also provided with adjustable hinges and adjustable clamps permitting the rubber-sheet-supporting member to be adjusted in relation to the transparent supporting base to accommodate silk screen stencil frames of varying size. The apparatus is also provided with a spring-operated mechanism for holding the upper portion of the frame in open position during loading and the entire printing frame mechanism is constructed to permit rotation to the most advantageous position for light exposure.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings by numerals of reference, and more particularly to FIGS. 1 and 2, there is shown a vacuum printing apparatus generally designated 1. Vacuum printing apparatus 1 includes printing frame 2 comprising lower supporting frame 3 and upper frame 4.

The apparatus is provided with a supporting housing or framework comprising a bottom frame portion 5 provided with a plurality of casters 6 for movement of the apparatus. Bottom supporting portion 5 is secured to and integral with upwardly extending supporting portions 7 and 8, respectively. Frame 3 is pivotally secured to upwardly extending supporting portions 7 and 8 by hinge members 9 and 10 respectively.

Frame members 3 and 4 are secured together at their rear end by a plurality of adjustable hinges 11 (only one of which is seen in FIG. 2). Hinge 11 includes a flange

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portion 12 on frame member 4 to which there is a provided a pivotal connection 13. Pivot member 13 has a supporting pin 14 extending downwardly through flange member 15 on frame 3. Pin member 14 is secured adjustably on flange member 15 by a pair of nuts 16. A peripheral light seal in the form of a continuous O-ring 17 is provided between frame members 3 and 4. O-ring 17 is preferably secured on frame member 3, although it could be secured on frame member 4 if desired. The O-ring or tabular sealing gasket 17 provides a continuous light seal between frame members 3 and 4 when in closed position.

At the front of the apparatus, there are provided a plurality of clamp members 18 for securing frame members 3 and 4 together. Clamp member 18 is shown in side view in FIG. 2 and somewhat enlarged and partially in section in FIG. 5. Clamp member 18 comprises lever arm 19 mounted on pivot flange 20 on frame 3 and is provided with pivoted clamping loop 21 for hooking over the notched end of clasp member 22 on frame member 4. As seen in FIG. 5, the notched portion of clasp member 22 is provided with adjustment screw member 23 extending upwardly through the notch and limiting the positioning of the end of the clamping loop member 21. Adjustment of the screw member 23 upward, as seen in FIG. 5, will cause upper frame member 4 to be drawn more tightly against sealing gasket or O-ring 17 to collapse the same toward engagement with frame member 3. Adjustment of screw member 23 and of adjusting screws 16 on hinges 11 may be used to vary the position of frame member 4 in relation to frame member 3 for sealing against air leakage.

Lower frame member 3 is provided with a transparent supporting plate 24 of glass or clear plastic. Upper frame member 4 is provided with a flexible elastic sheet 25 of rubber which is sealed to frame member 4 at the edges thereof. Rubber sheet member 25 is provided with an opening and connecting fitting 26 which is connected to conduit 27 extending to a source of vacuum. Application of vacuum through fitting 26 will cause rubber sheet 25 to conform to the surface of stencil frames 28 which are being secured in position for processing in the printing frame.

The frame member 3 is provided with lever member 29 which extends beneath abutment roller 30 extending from the side of upper frame member 4. Lever member 29 has a crank arm portion 31 secured integrally therewith which is connected to one end of spring 32. The other end of spring 32 is connected through an adjustment member, such as turnbuckle 33, to support 34 carried on the underside of frame 3. The tension of spring 32 is adjusted by turnbuckle 33 to provide sufficient force to lever arm 29 to hold frame member 4 in an opened position when frame member 4 is lifted upward to accommodate the introduction of screen stencils to the apparatus for processing. Stop bracket 31^a on lower frame member 3 limits movement of lever arm 29 by engagement with crank arm 31 when frame member 4 is lifted upward.

The apparatus is provided with movable stop members 35 and 36 which cooperate with abutment member 37 on frame member 3. Stop member 35 is provided with actuator handle 38 and stop member 36 is provided with actuator handle 39. Movement of actuator handle 39 causes stop member 36 to be moved out of engagement with abutment member 37 to permit the frame members 3 and 4 to be pivoted in a clockwise direction as viewed in FIG. 2. Movement of knob 38 causes stop member 35 to be moved out of engagement of abutment 37 and permit the frame members 3 and 4 to be pivoted in a counter clockwise direction as viewed in FIG. 2, which may be followed by an opening of the frame to permit easy access to the transparent supporting plate 24 in frame 3 for cleaning.

The apparatus is provided with vacuum pump 40 which is arranged to apply vacuum through conduit 27 to rub-

ber sheet 25. Vacuum pump 40 is electrically energized and controlled through switchbox 41.

OPERATION

In utilizing the improved apparatus described above, one or more silk screen stencils 28 are placed on supporting plate 24 in preparation for processing. A suitable photographic or other positive design is placed on supporting plate 24 with stencils 28 positioned therein. In the processing of a silk screen stencil having a photographic emulsion thereon, it is essential that the screen be held in very tight uniform contact with the positive design which is being printed on the screen.

Upper frame member 4 is closed against peripheral sealing ring or gasket 17 and clamped tightly in position by clamps 18. Hinges 16 may be adjusted and adjustment members 23 in clamp members 18 may also be adjusted to permit frame 4 to be brought closer or farther away from frame 3. This provides an efficient air seal when vacuum is applied. Of course, the adjustment of frame member 4 away from frame member 3 must never be so great as to take the frame out of contact with light sealing ring or gasket 17.

When stencils 28 are positioned over the desired positive design and frame member 4 closed against sealing gasket 17 and clamped in position, vacuum pump 40 is started to supply vacuum through conduit 37 to fitting 26 on rubber sheet 25. Air is thus withdrawn through conduit 27 to create a vacuum between rubber sheet 25 and supporting plate 24. Withdrawal of air from that space causes rubber sheet 25 to fit tightly around stencils 28 to hold the same tightly against supporting plate 24, as seen in FIG. 4.

While the stencils are held in position by evacuation of the space beneath the rubber sheet 25, the frame is rotated to a suitable position for exposure to a light source. After the stencils have been suitably exposed, the frame is returned to its initial position and the vacuum pump turned off to permit the frame to be opened. Clamp members 18 are then released and frame member 4 is lifted to permit stencils 28 to be removed from the apparatus. While frame member 4 is in the lifted position it is supported by lever member 29 and spring 32.

The stencils which are removed from the apparatus are developed and the unexposed portions of photographic emulsion washed or dissolved away so that the remaining stencil has the desired negative design. The desired design or imprint is produced when ink is forced through the silk screen by a squeegee.

While this invention has been fully and completely described with reference to a preferred specific embodiment thereof, as required by the patent laws, it should be understood that within the scope of the appended claims this invention may be practiced otherwise than as specifically described herein.

What is claimed is:

1. In a printing frame for silk screen stencils, a supporting housing, a pair of frame members pivotally supported on said housing, a plurality of hinge members secured to said frame members along one side thereof and adjustable to vary the lateral spacing of said frame members, a plurality of cooperating clamp members secured to the opposite side of said frame members and including adjustment means for varying the lateral spacing of said frame members when in a closed position, the lower one of said frame members having a transparent supporting plate, the upper one of said frame members having a rubber sheet sealed to the edges thereof and provided with an outlet fitting for connection to a source of vacu-

um, a flexible, air-sealing gasket member extending around the entire periphery of one of said frame members and engaged by the other frame member when in a closed position, an abutment member on one side of said upper frame member, a crank arm lever supported on said lower frame member and engageable with said abutment member, and adjustable spring tensioning means supported on said lower frame member for effecting rotation of said crank arm lever to engage said abutment member and hold said upper frame member in a substantially stationary position when moved to an open position.

2. In a printing frame for silk screen stencils, a supporting housing, a pair of frame members pivotally supported on said housing, a plurality of hinge members secured to said frame members along one side thereof, said adjustable hinge members including threadedly adjustable pivot pins secured in supporting flanges on said frame members and provided with adjusting nuts for establishing a predetermined lateral spacing of said frame members, a plurality of cooperating clamp members secured to the opposite side of said frame members and including adjustment means for varying the lateral spacing of said frame members when in a closed position, the lower one of said frame members having a transparent supporting plate, the upper one of said frame members having a rubber sheet sealed to the edges thereof and provided with an outlet fitting for connection to a source of vacuum, and a flexible, air-sealing gasket member extending around the entire periphery of one of said frame members and engaged by the other frame member when in a closed position.

3. In a printing frame for silk screen stencils, a supporting housing, a pair of frame members pivotally supported on said housing, a plurality of hinge members secured to said frame members along one side thereof and adjustable to vary the lateral spacing of said frame members, a plurality of cooperating clamp members secured to the opposite side of said frame members and including adjustment means for varying the lateral spacing of said frame members when in a closed position, each of said adjustable clamp members comprising a moveable lever and a loop member attached thereto, supported on one of said frame members, and an abutment supported on another of said frame members and having a notched end portion arranged for engagement by said loop member, said notched abutment member having an adjustable screw extending into the notched portion thereof and adjustable to vary the position of said frame members when said loop member is positioned in clamping position within said notch, the lower one of said frame members having a transparent supporting plate, the upper one of said frame members having a rubber sheet sealed to the edges thereof and provided with an outlet fitting for connection to a source of vacuum, and a flexible, air-sealing gasket member extending around the entire periphery of one of said frame members and engaged by the other frame member when in a closed position.

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