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Sept. 6, 1960 R. H. DUMKE ET AL 2,951,430

PHOTOGRAPHIC PRINTING MACHINE

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X2649
X2656
X2651

Fig. 1

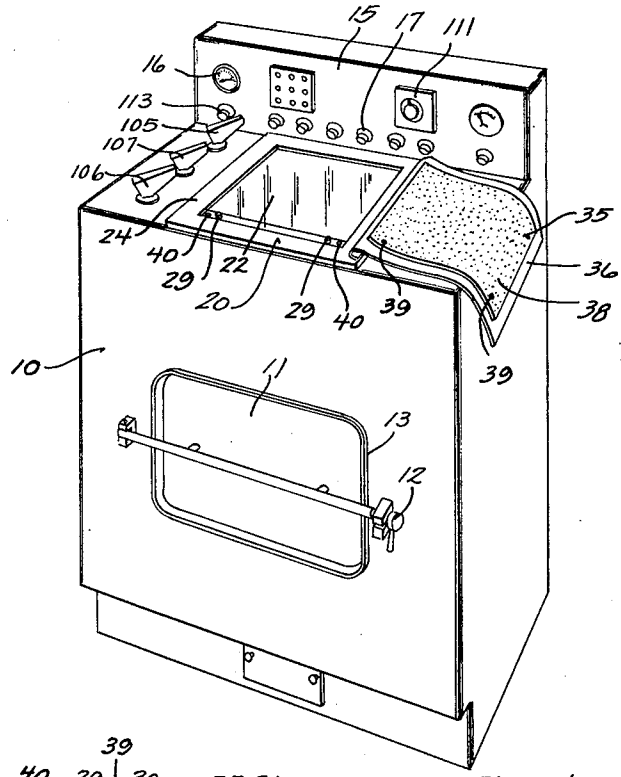
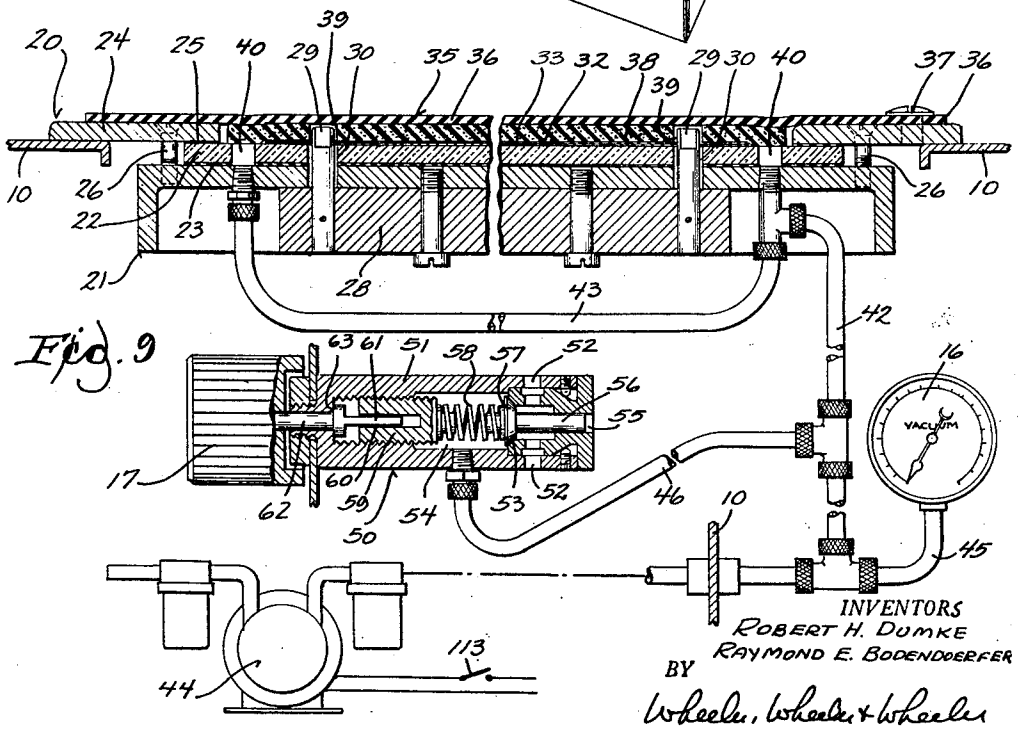


Fig. 9



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Fig. 2

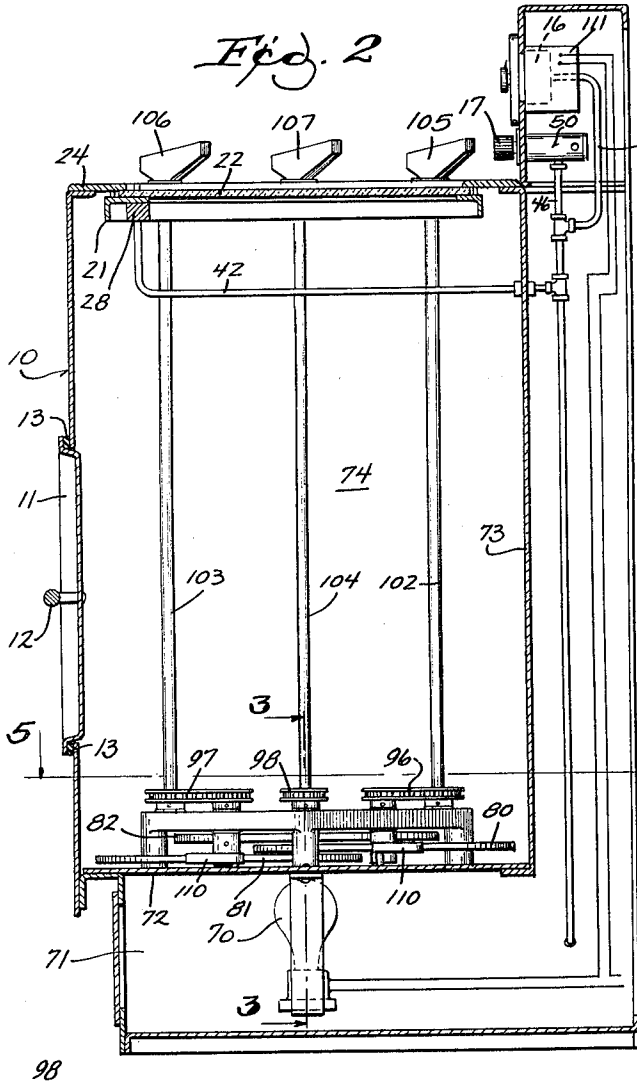


Fig. 6

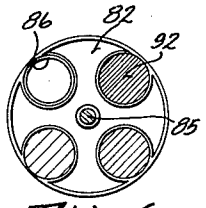


Fig. 7

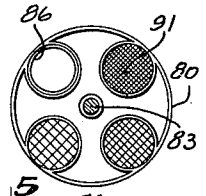
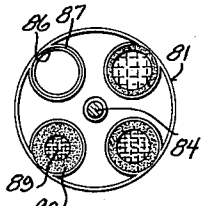


Fig. 8



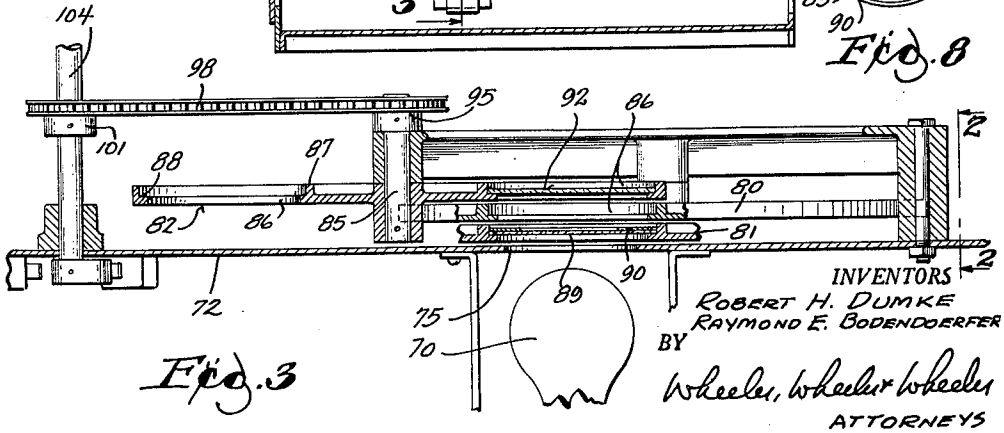


Fig. 3

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Fig. 4

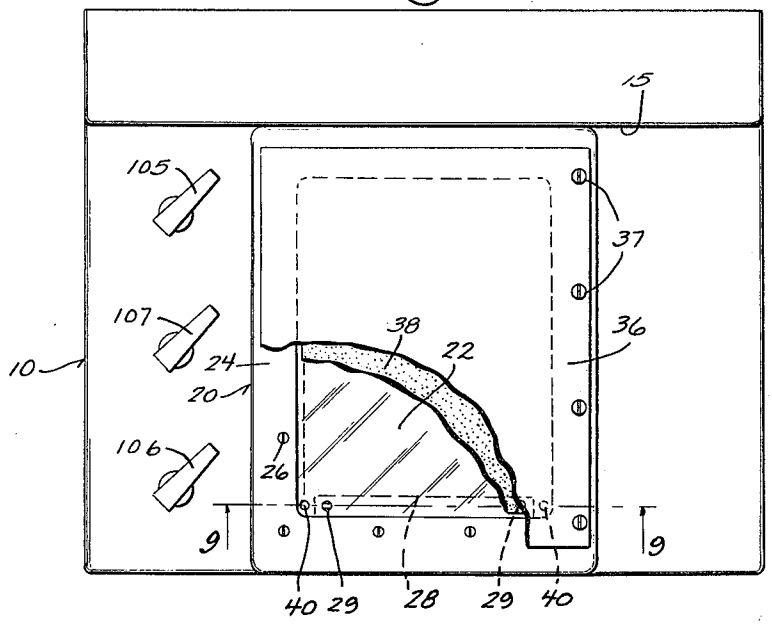
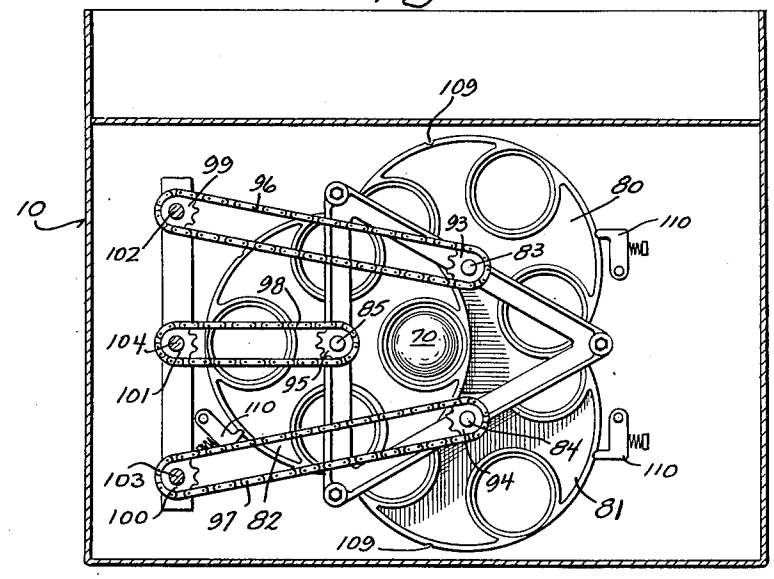


Fig. 5



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PHOTOGRAPHIC PRINTING MACHINE

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4 Claims. (Cl. 95—76)

This invention relates to a photographic printing machine having a vacuum printing frame and also having sets of coacting filters organized for the making of color separation negatives.

The vacuum printing frame is placed at the top of a cabinet which has a light and filters in its lower portion. The transparency and negative material are superimposed on the glass of the printing frame and held thereto by a pressure member which desirably comprises a web of natural or synthetic rubber having a sponge rubber cushion facing, the web being connected at one side to the frame and freely movable to and from position over the work. An opening or openings through the glass have vacuum connections so that when the web is placed over the work, all air between the cushion and the work and the glass of the frame is immediately evacuated. Atmospheric pressure on the flexible backing web assures intimate contact between the transparency and the negative material (paper or film).

The pressure on the work is accurately controlled by a bleed valve which can be adjusted to provide vent relief when the desired degree of vacuum is achieved.

Separation filters, mask filters and neutral density filters are mounted on separate turntables which can be indexed individually to bring selected filters of each turntable into registry with the source of illumination.

In practice I provide each turntable with four openings and provide filters for three of these, leaving a clear opening in each turntable, any one or more of which may be registered between the lamp and the work. Control shafts extend downwardly from the level of the printing frame and have chain and sprocket connections with the various turntables whereby the position of each may be adjusted by manipulation of its shaft, without affecting the setting of the others.

In the drawings:

Fig. 1 is a view in perspective of apparatus embodying the invention.

Fig. 2 is a view taken through the apparatus of Fig. 1 in vertical section from front to rear in the plane indicated at 2—2 in Fig. 3.

Fig. 3 is an enlarged detail view taken in section on the line 3—3 of Fig. 2.

Fig. 4 is a plan view of the apparatus shown in Fig. 2, all control knobs and dials other than handles for the indexing of the turntables being omitted and the pressure member of the printing frame being partially broken away.

Fig. 5 is a view taken in section on the line 5—5 of Fig. 2.

Figs. 6, 7 and 8 are diagrammatic views on a reduced scale showing the various turntables in plan, the cross-hatching of the filters being for contrast only.

Fig. 9 is a view taken on an enlarged scale on the line 9—9 of Fig. 4, the vacuum pump and vacuum controlling connections being diagrammatically illustrated partially in section and partially in side elevation.

The device comprises a cabinet 10 with a front access door 11 clamped shut by means of the cam shaft 12 and sealed by the gasket 13.

At the back of the cabinet is a control panel 15 having a number of controls including a vacuum gauge 16 and a vacuum regulating knob 17, vacuum pump motor switch 113 and exposure timer 111. The remaining controls are not pertinent to this particular invention.

The printing frame generically designated by reference character 20 comprises a base casting 21 which is downwardly flanged for strength as best shown in Fig. 9. The glass 22 is supported from this casting on an interposed gasket 23 and is subject to clamping pressure of the frame member 24 through an upper gasket 25. The screws 26 connect the frame member 24 to the base casting 21.

Suspended from the base casting is a bar 28 from which the locating dowels 29 project upwardly through openings provided at 30 in the glass 22. The work usually comprises a transparency 32 and negative material 33. These sheets are punched with holes with which the dowels 29 register accurately, whereby the work sheets may be engaged over the dowels and thereby positioned with accuracy on the glass pending closing of the pressure member thereover.

The pressure member generically designated by reference character 35 comprises a flexible blanket or web of natural or synthetic rubber at 36 which is connected by screws 37 with the frame member 24 whereby the glass is clamped. The web is of sufficient area to extend across the opening in frame member 24. Carried by the web 36 as a part of the pressure member 35 is a flexible sheet of sponge rubber 38 of such dimensions as to be received within the opening of frame member 24, resting upon the work and upon such portions of the glass 22 as may be exposed outside of the work as shown in Fig. 9. The thickness of the sponge rubber insert 38 will be approximately equal to that of the frame member 24 although this is not critical due to the fact that the entire pressure member 35 is flexible and readily conforms to the work. Openings are provided at 39 in the sponge rubber insert 38 to accommodate the upper ends of the dowels 29. Desirably the dowels are not so long as to deflect the web 36, the web being therefore continuous and unbroken over the upper ends of the dowels. The dowels are engaged tightly only by the work, the sockets 39 in the sponge rubber insert 38 being sufficiently large to afford ample clearance.

The printing frame glass 22 has an opening or openings at 40. I have found it sufficient to provide two such openings, both located at the front and near the sides of the opening through the frame member 24. The vacuum line 42 and branch line 43 provide vacuum connections to the openings 40 from the vacuum pump 44. Another branch line 45 leads to the vacuum gauge 16. A bleed line 46 leads from the pressure regulating valve generically designated by reference character 50 and shown in section in Fig. 9.

The valve casing 51 has vent ports 52 communicating through a valve seat 53 with chamber 54 into which the bleed line 46 opens. The casing has a bearing at 55 in which there is carried the stem 56 of spring bias valve 57 which is normally engaged with the seat 53.

The valve operated spring 58 is adjustable as to its bias by means of a plug type of spring seat 59 threaded to the casing 51 and provided with a slot 60 of noncircular cross section in which the similarly contoured actuator 61 is engaged. This actuator comprises a feather or key on the end of the spindle 62 which carries the knob 17. A shoulder 63 on the spindle engages the casing interiorly whereby the spindle is anchored against

any appreciable axial displacement in the course of its rotation. In consequence, the knob **17** does not move inwardly or outwardly but has only rotative movement. The splined connection between the feather or key **61** and the spring seat **59** permits the spring seat to move inwardly and outwardly upon its threads when rotation is imparted to it by the knob **17**.

Whenever the degree of vacuum imposed on the printing frame causes the valve **57** to be subject to a pressure differential in excess of that to which its spring **58** is set, the valve opens to admit atmospheric air through the vents **52** and past the valve and through the biasing spring and through the bleed connection **46** to relieve the vacuum. The relief continues until the spring pressure equals atmospheric pressure on valve **57**, whereupon the valve closes.

The vacuum pump **44** acts so rapidly that it is practicable to start and stop it when the work is placed and, preliminary to work removal, switch **113** being used for this purpose. To predetermine the desired pressure, the operator simply adjusts the knob **17** until the vacuum index is shown on the vacuum gauge **16**. This exact degree of vacuum will be maintained automatically thereafter whenever the vacuum pump **44** is in operation. It has been found that this bleeding arrangement provides much more accurate control of the vacuum than is possible in any other manner.

Light for exposing the negative material through the transparency in the printing frame may be provided from any appropriate source such as the bulb **70** in the base of the cabinet. In practice the chamber **71** in which the bulb is located is separated from the rest of the cabinet by a horizontal partition **72** and upright partition **73**. The only opening into the chamber **74** of the cabinet is through the port **75** immediately above the lamp **70** and centered between the lamp and the printing frame.

Mounted within the chamber **74** of the cabinet are the separately indexable filter carriers or turntables **80**, **81** and **82** mounted respectively on shafts **83**, **84** and **85**, the axes of which are symmetrically disposed about the light-supplying opening **75**.

The radii of the various turntables are such that each extends across the opening **75** to intercept light passing from the lamp **70** toward the printing frame. Each of the turntables is provided with a number of openings **86** (four being shown in each) each of which is encircled by a circular flange **87** as best shown in Figs. 3, 5 and 6 to 8. The flanges are spaced from the respective openings to provide shoulders **88** upon which the various filters **89** may be placed.

I sometimes superimpose two or more filters, the term "filters" being used generically herein to include the annuli **90** shown in Fig. 8, which have different sizes of openings and are interchangeably positioned on top of the neutral density filters carried by disk **81**.

In practice each of the disks is provided with only three filters or sets of filters, one opening being left unobstructed. In the lowest disk **81** I mount the neutral density filters, the filters **89** comprising different shades of gray and the light passing through the filter or filters being further restricted if desired by the filter annuli **90** to any desired extent. On the intermediate disk **80** I employ the masking filters **91**. On the top disk **82** I provide the color separation filters **92** which, as is well-known in this art, are usually in three colors.

For adjusting the disks or turntables, the shafts **83**, **84**, **85** are provided respectively with sprockets **93**, **94**, **95** driven by chains **96**, **97**, **98** from sprockets **99**, **100**, **101** on the upright shafts **102**, **103** and **104**. These shafts extend upwardly through the cabinet and are provided with control handles **105**, **106** and **107** respectively. It will be noted that the actuating chains are all offset from the light projection zone.

In order to assure that the several disks will be accurately fixed in the respective positions to which they are adjusted by these control handles, the peripheries of the disks are desirably provided with notches as shown at **109** in Fig. 5 and in selected positions of adjustment these notches are engaged by detents **110**.

The organization is such that in every operative position of the several turntables or disks there will be openings **86** of all three disks registered above the lamp **70** in the direct line between the lamp and the printing frame. Thus, the selected filters or lack of filters will be effective in the zone in which the printing frame and the work therein is irradiated from the source **70**. For example, the separation filters shown in Fig. 6 would almost invariably be used, assuming that the printer is employed for the making of separation negatives. However, the disk **80** would normally be adjustable to a position in which its open aperture **86** would be presented to the beam of light. Normally one or another of the neutral density filters would be placed in the beam and it might also be necessary to use one or another of the masking filters in conjunction with one of the color separation filters.

The skilled operator will measure his requirements and can almost instantly adjust the disks to give him the proper color and intensity of light for the desired printing operation. Using a given transparency, he will open switch **113** to release the vacuum and will then open the printing frame following his first exposure, substituting a second negative sheet and changing his filter or filters for the second exposure and repeating for the third color separation negative. Each time the flexible blanket or pressure-applying member is replaced over the work, the vacuum pump will be started by means of the manually operable switch **113**. With the work thus firmly clamped against the glass, the lamp or other light source will be energized for a period predetermined by the timer **111** to make the exposure through the selected filters.

We claim:

1. In a photo-printer, a work-supporting glass, a pressure member movable to and from work supported on the glass, a vacuum duct communicating with the space between the pressure member and the glass for withdrawing air therefrom, the glass being provided with an aperture communicating with said duct and opening into the space between said pressure member and said glass, means for creating a vacuum in said duct, a valve for admitting atmospheric air into the duct to relieve the vacuum therein, means biasing said valve against admission of atmospheric air, means for adjusting the bias on said valve to regulate sub-atmospheric pressure in said duct, a light source for the illumination of said glass from beneath and a plurality of filter carrier disks having mounting shafts disposed at different sides of said source, the respective disks extending across the path of light between the source and the glass and having apertures respectively registrable with each other upon said path, the disks having filter positioning means for disposing filters in respective apertures, and means for rotating the disks to make different apertures of respective disks register with each other on said path, the bleed valve and the means for rotating the filter positioning disks being mounted in proximity to the printing frame whereby all portions of the device requiring adjustment by an operator are accessible in one location.

2. In a photo-printer, a cabinet, a printing frame in a horizontal surface of the cabinet, a light source in the cabinet remote from the frame, a plurality of rotatable shafts spaced on the circumference of a circle about the light source, filter-carrying disks severally supported on the shafts for overlapping at their intersection with the beam of light from the source and each having plural apertures registrable severally with the light source, the disks severally having plural peripheral notches severally corersponding to the registry of an aperture with the

light source, indexing means mounted adjacent each disk and engageable in sequence with the notches therein, means for individually driving the disk supporting shafts for rotation of the disks to various indexed positions, said means being provided with handles above said cabinet surface and adjacent the printing frame therein, and comprising shafts severally connected by a chain to a sprocket on a disk supporting shaft, the driving shafts being mounted for aligning the handles along one side of the printing frame.

3. In a photo-printer, the combination with a light source and a remote printing frame, of an interposed set of rotatably mounted indexable filter carriers, each having filter receiving apertures movable with the carrier across the path of a light beam from the source to the printing frame, the apertures of the several carriers being movable by carrier rotation to and from alignment with selected apetures of another carrier, a cabinet supporting the printing frame and enclosing the carriers and provided with mechanical carrier-adjusting means having handles exposed in convenient proximity to the printing frame, the frame comprising a rigidly mounted glass upon which work is receivable and a flexible blanket having a fixed mounting on one side of the glass, and dowel means for fixing the position of work respective the glass, the blanket including a cushion socketed to receive the dowel means and a web portion to which the cushion is attached and which is continous across the dowel means, and means for evacuating air from the face of the glass in an area covered by the blanket and provided with means mounted in proximity to the printing frame for manually controlling the degree of evacuation of air.

4. In a photo-printer, the combination with a light source and remote printing frame, of an interposed set of rotatably mounted indexable filter carriers each having filter-receiving apertures movable with the carrier across the path of a light beam from the light source to the printing frame, each of the apertures of the several carriers being moved by carrier rotation to and from registry with any selected aperture of every other carrier, the fame comprising a rigidly mounted glass upon which work is laid and dowel means for fixing the position of the work on the glass and a flexible blanket having a fixed mounting at one side of the glass, the blanket including a cushion socketed to receive the dowel means and a web portion to which the cushion is attached and which is continuous across the dowel means, means for evacuating air from the face of the glass in an area covered by the blanket whereby the blanket is urged by atmospheric pressure toward the glass, and means adjacent the printing frame for manually controlling the degree of evacuation of air.

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