June 26, 1945. J. F. COSTELLO 2,379,279

VACUUM HOLDER

Filed June 29, 1943 9 Sheets-Sheet 1

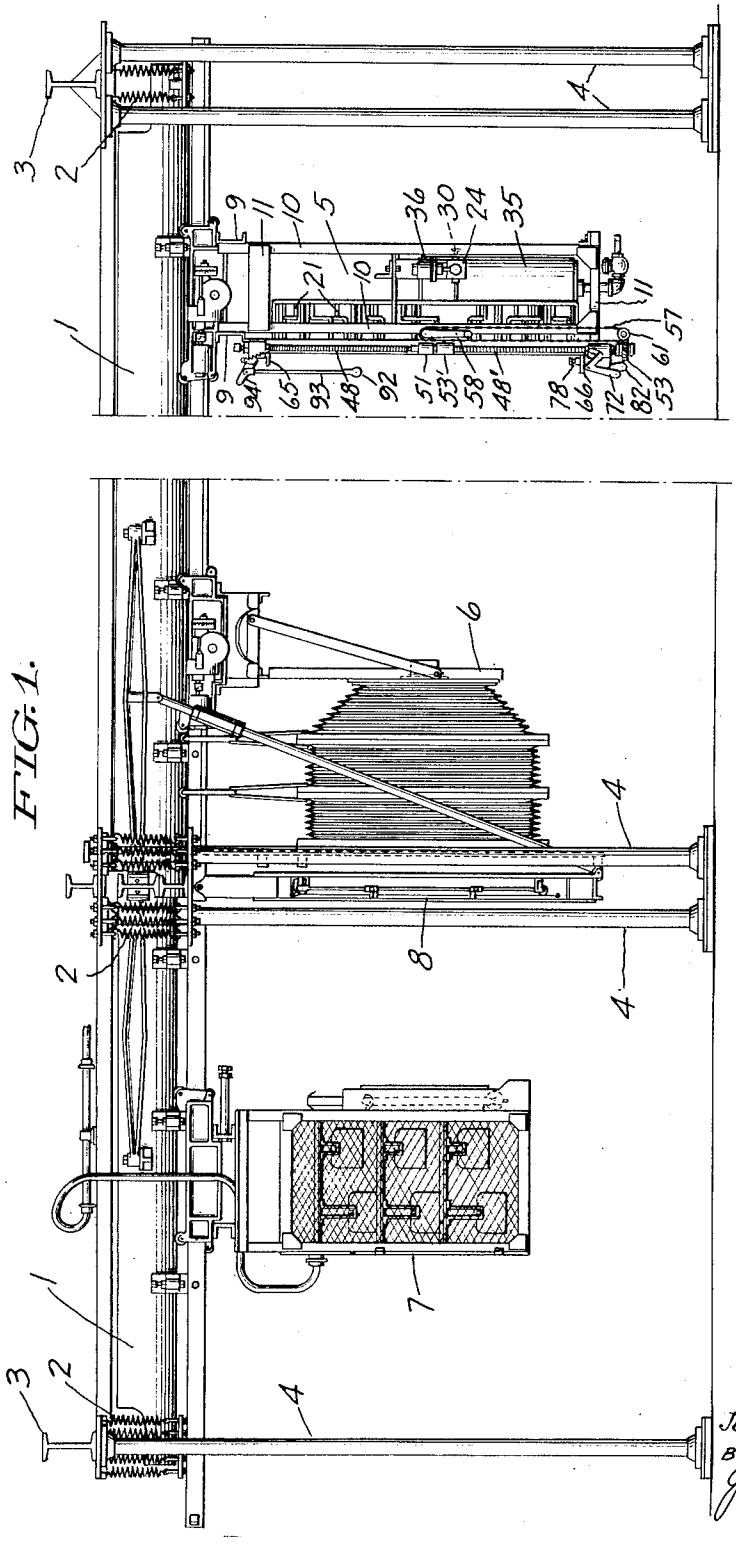

FIG. 1.

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Joseph F. Costello,
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HIS ATTORNEY.

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VACUUM HOLDER

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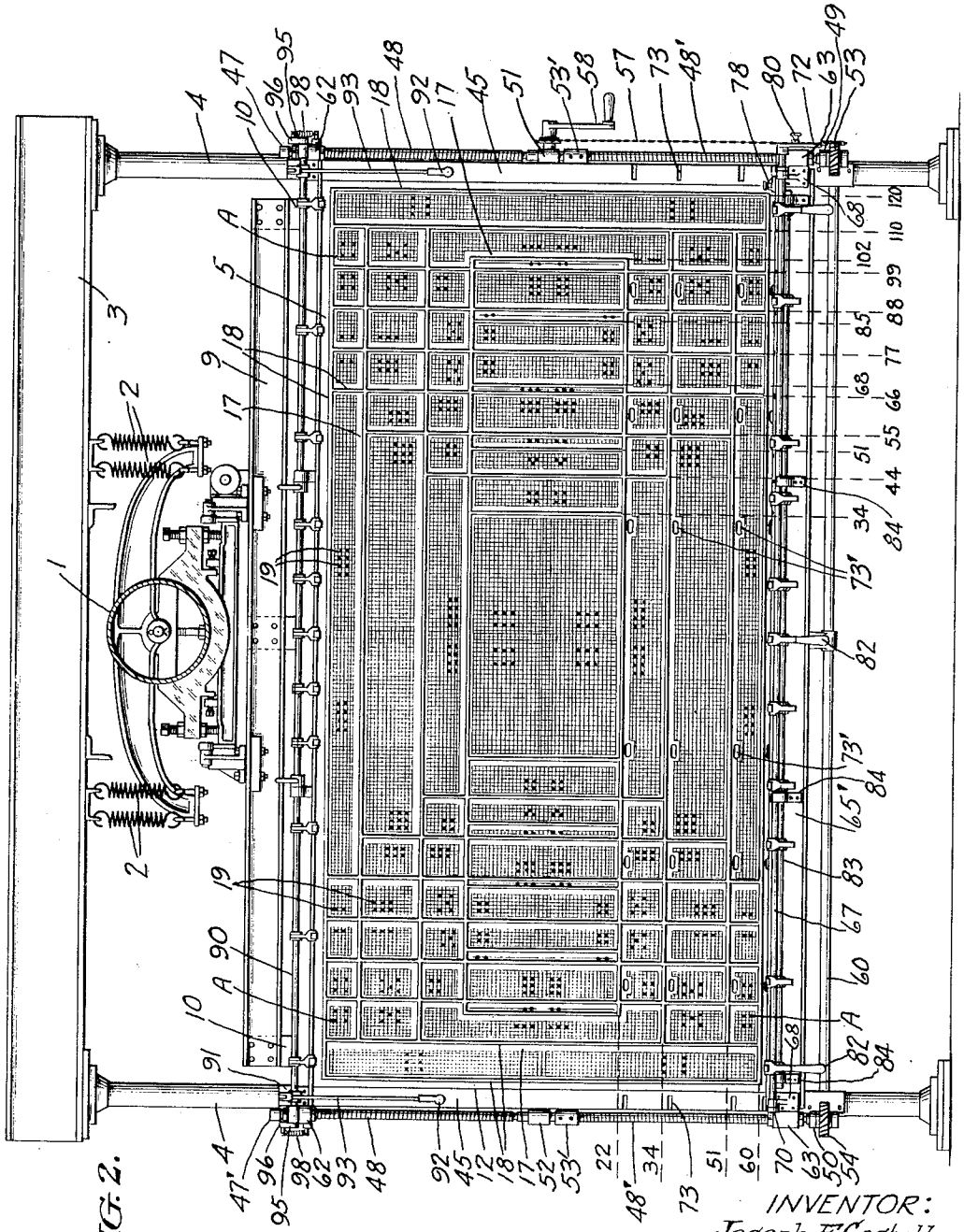

FIG. 2.

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VACUUM HOLDER

Filed June 29, 1943 9 Sheets-Sheet 3

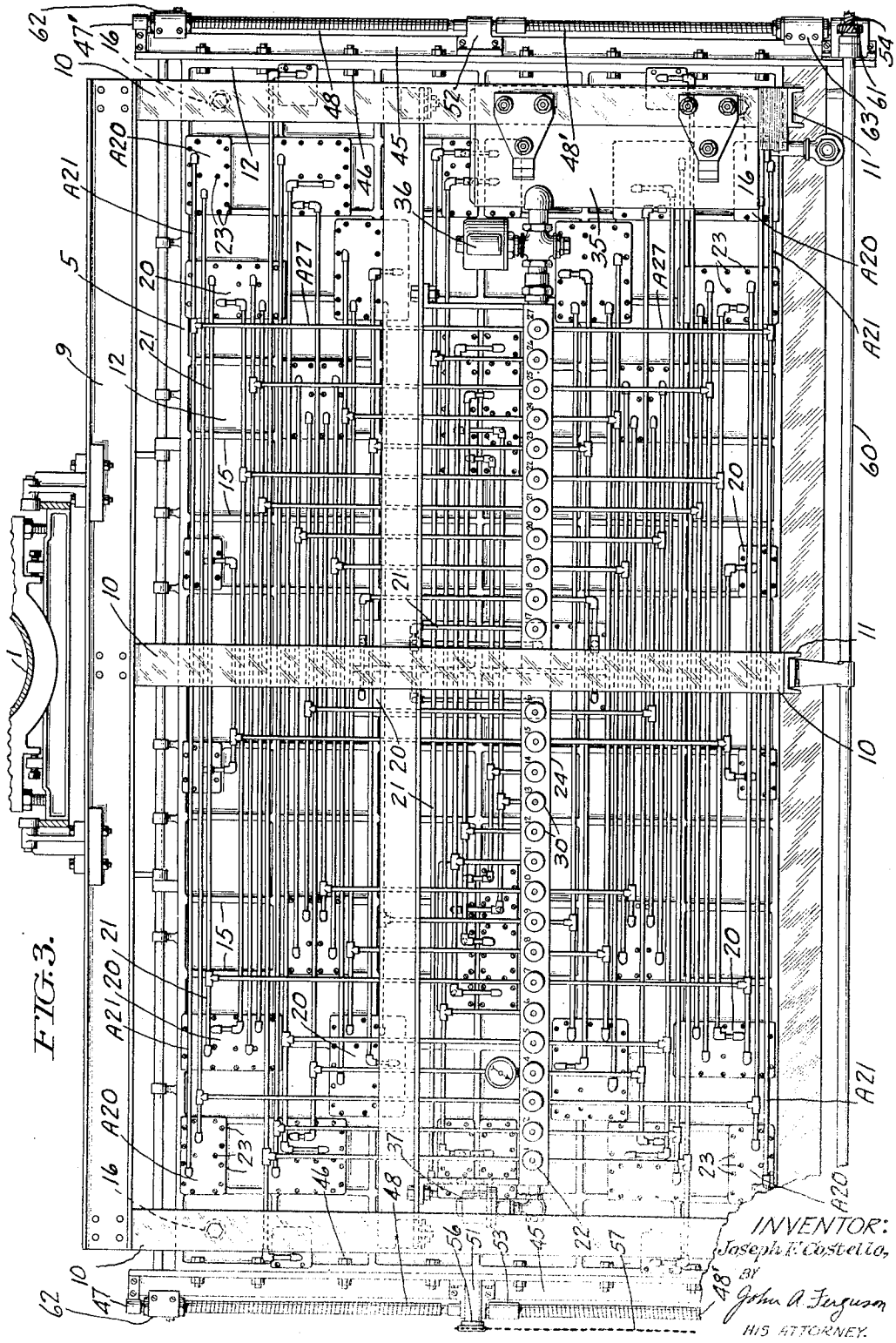

FIG. 3.

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VACUUM HOLDER

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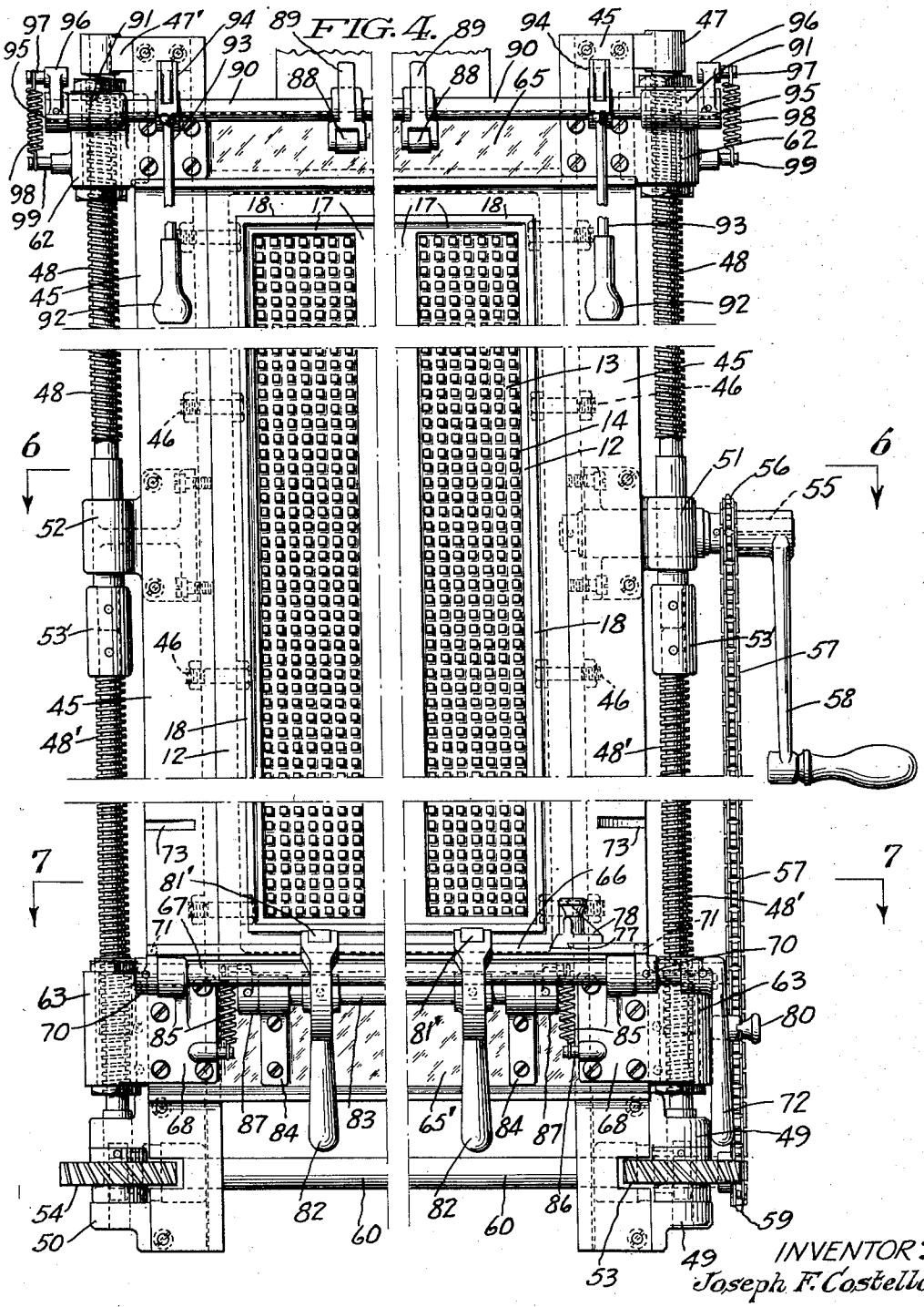
FIG. 4.



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VACUUM HOLDER

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FIG. 5.

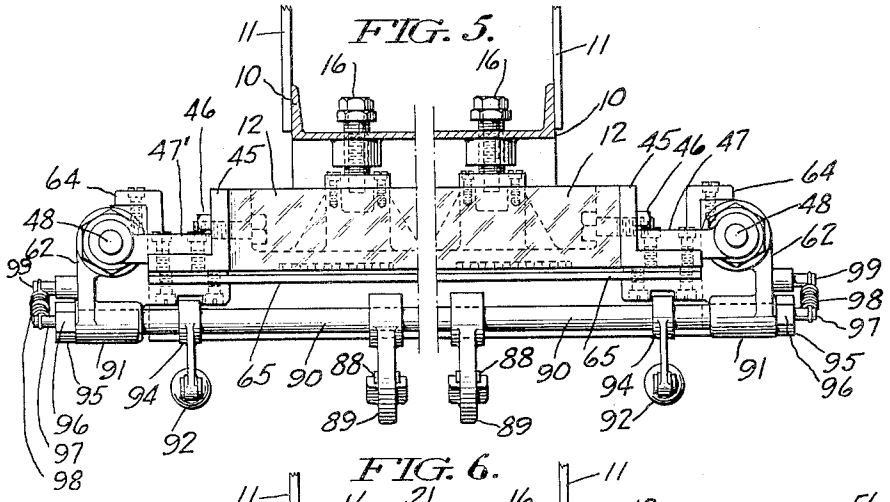


FIG. 6.

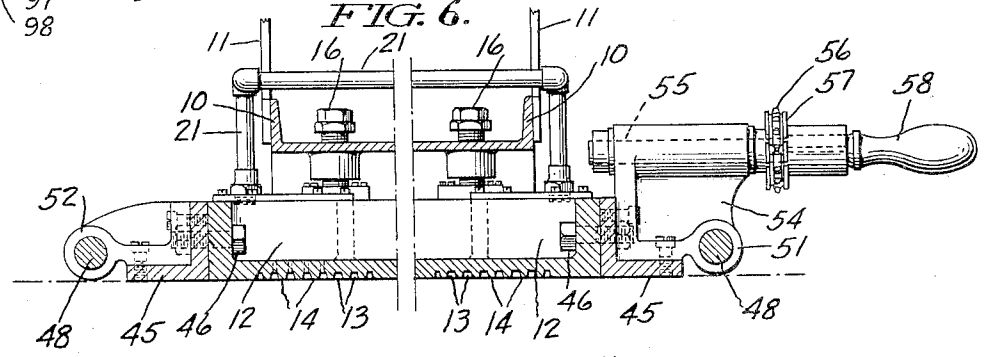
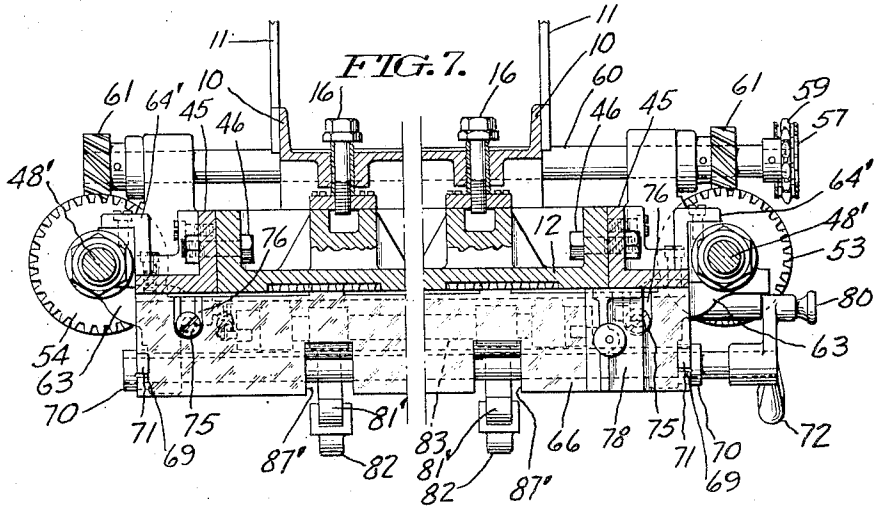


FIG. 7.



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VACUUM HOLDER

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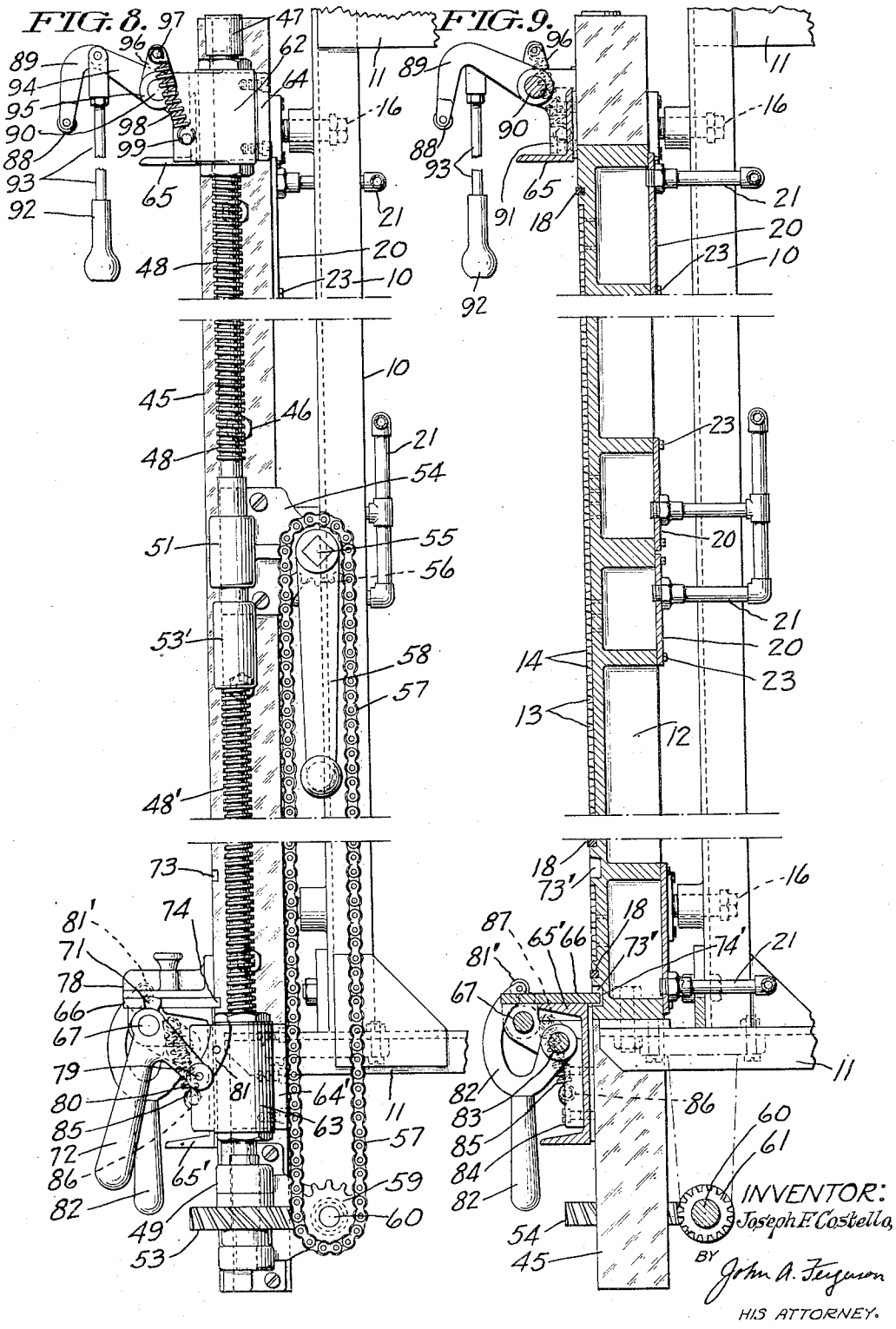

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VACUUM HOLDER

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FIG. 10.

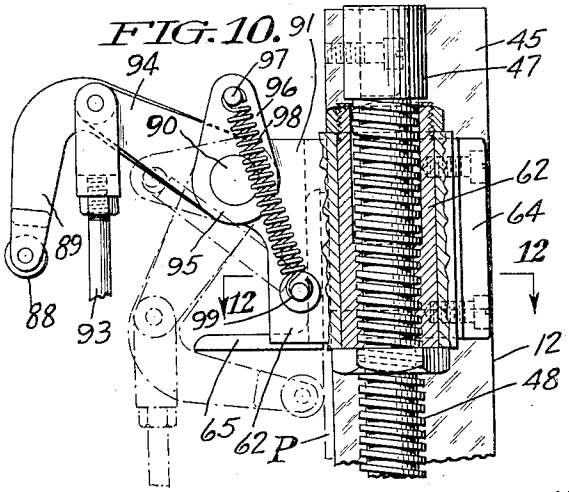


FIG. 12.

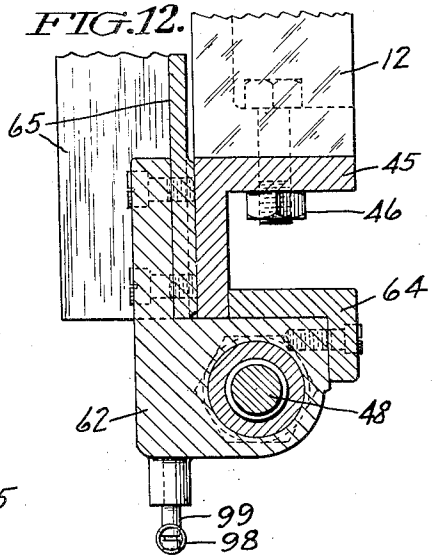


FIG. 11.

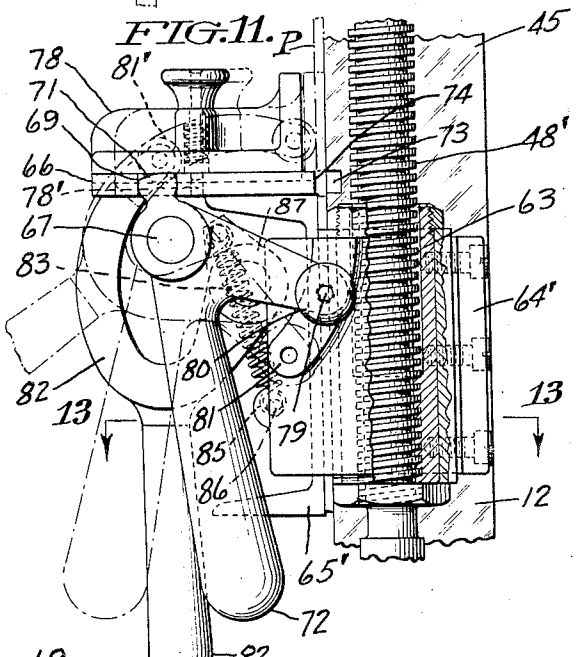


FIG. 13.

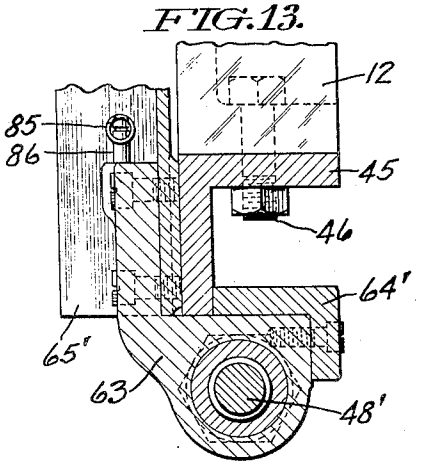
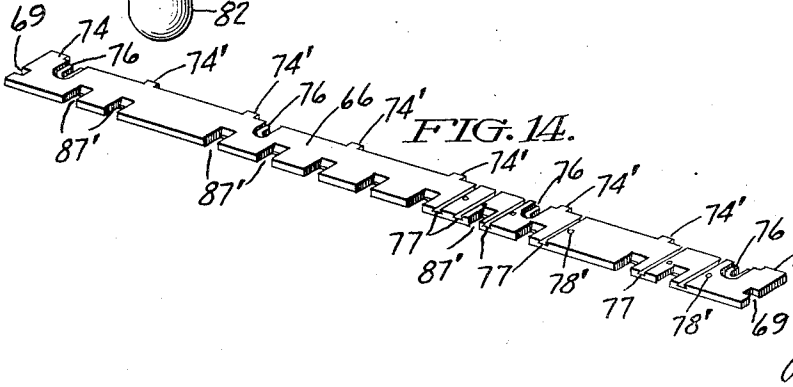


FIG. 14.



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VACUUM HOLDER

Filed June 29, 1943 9 Sheets-Sheet 8

FIG. 15.

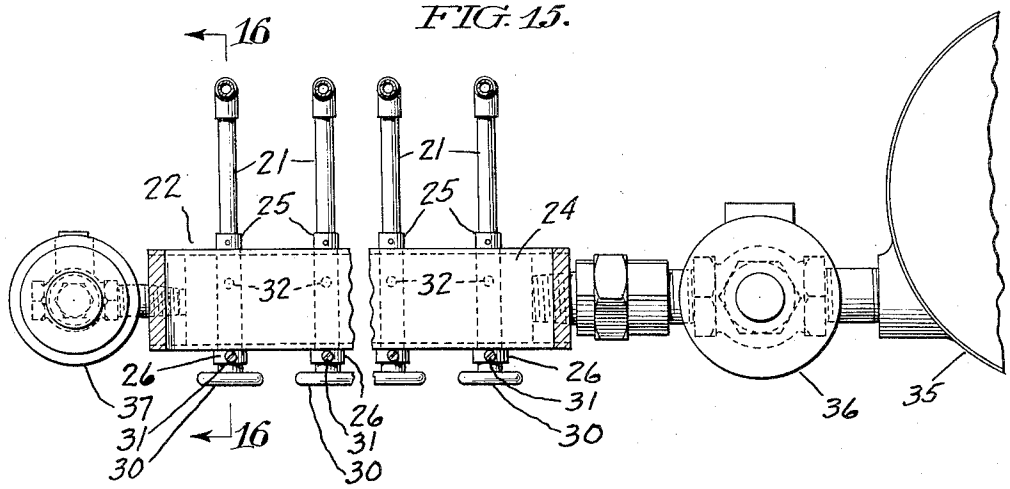


FIG. 16.

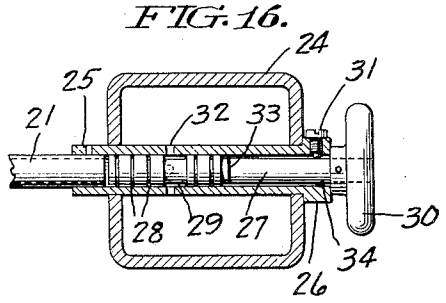


FIG. 17.

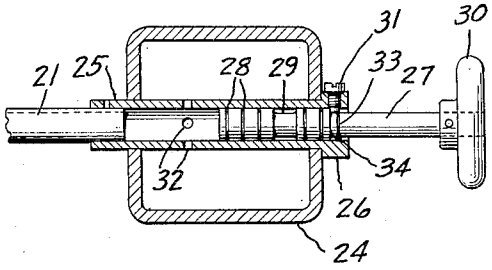


FIG. 18.

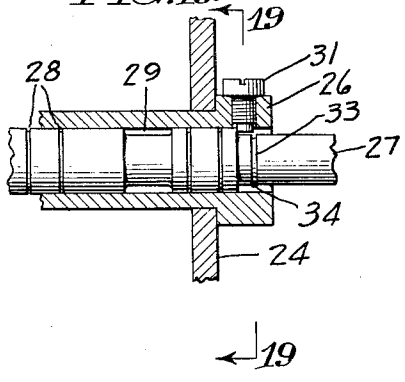
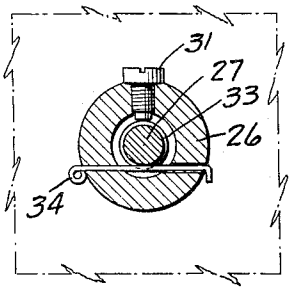


FIG. 19.



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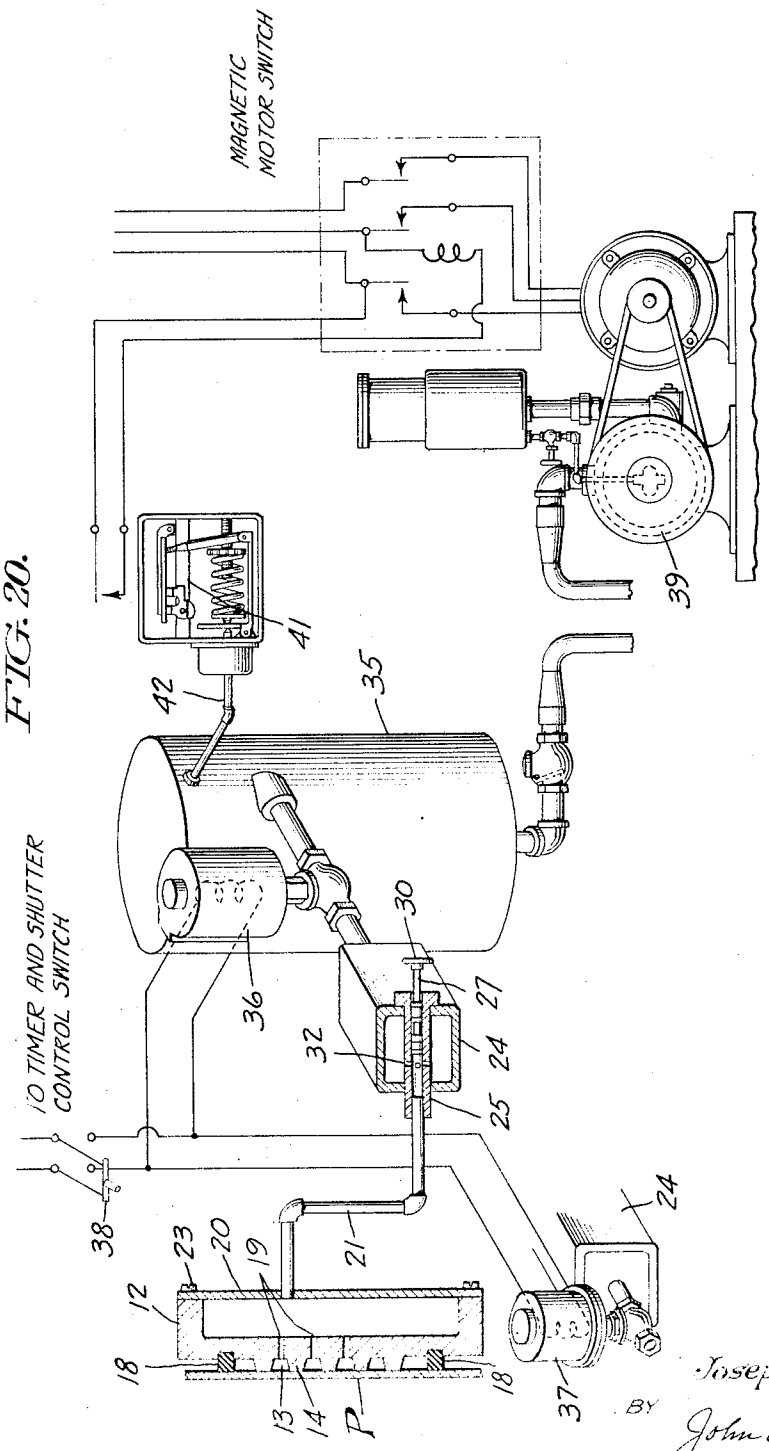
VACUUM HOLDER

Filed June 29, 1943 9 Sheets-Sheet 9

FIG. 20.



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Patented June 26, 1945

2,379,279

UNITED STATES PATENT OFFICE

2,379,279

VACUUM HOLDER

Joseph F. Costello, Philadelphia, Pa., assignor to Lanston Monotype Machine Company, Philadelphia, Pa., a corporation of Virginia

Application June 29, 1943, Serial No. 492,664

8 Claims. (Cl. 88—24)

This invention relates to cameras and particularly to camera vacuum holders, for holding the sheet bearing the picture, drawing or other indicia to be photographed; or, when the camera is used as a projection camera for holding a sheet in the form of a thin plate preferably of metal, which has been sensitized and on which a previously prepared negative is to be photographically recorded, usually in enlarged size. These projection cameras have found use in airplane manufacture and similar manufacturing processes and by their use a scale drawing of an airplane plate may be enlarged to full size on a sensitized plate positioned on the vacuum holder. After exposure and the usual developing treatment the plate may be cut and drilled in accordance with the photographed markings on it and then used as a template for making fuselage or wing or other plates in mass production processes; or the photographed plate may itself serve as a plate in the airplane. The holder for such plates must be of precise construction, must accommodate various plate sizes some of which are larger in area than the holder itself, must hold the plates firmly and must have other special constructional characteristics as will appear hereinafter, since it is with such cameras and holders that this invention is particularly concerned. The invention also relates to vacuum holders of the kind described, but which may be used in other locations than as a part of a camera, such as when used in connection with photo-composing machines. Obviously they may also be used for other purposes than in connection with airplane construction.

An object of the invention is to produce a camera and a vacuum holder to fulfill the requirements outlined above. Another object is to provide a holder which will accommodate various sizes of plates with valved vacuum constructions to apply vacuum only to the plate size being used. Another object is to provide means for the quick application of vacuum by simplified procedure on the part of the operator, as well as the quick release of the same, it being advantageous in manufacturing production of the kind indicated that the time element be shortened as much as possible. Another object is the provision of loading means for the plate and means for controlling said loading means as well as positioning it accurately before vacuum is applied, said loading means also holding the plate after vacuum has been released, thus making it possible for a single operator to position the plate, control the vacuum and remove the plate. Other objects will be specifically referred to hereinafter or will otherwise appear in connection with the following description of the embodiment of the invention shown in the accompanying drawings in which

Fig. 1 is a side elevation of an overhead type camera, part being omitted as indicated by vertical dot and dash lines.

Fig. 2 is a vertical section in front of the vacuum holder and showing the latter in front elevation.

Fig. 3 is a rear elevation of the vacuum holder.

Fig. 4 is a front elevation, enlarged, of the holder, certain intermediate portions being omitted as indicated by dot and dash lines.

Fig. 5 is a plan view of the holder as shown in Fig. 4.

Fig. 6 is a horizontal section approximately on line 6—6 of Fig. 4.

Fig. 7 is a horizontal section approximately on line 7—7 of Fig. 4.

Fig. 8 is a side elevation taken at the right side of Fig. 4.

Fig. 9 is a vertical section on the vertical dot and dash lines of Fig. 4, looking toward the left.

Fig. 10 is a side elevation of one of the upper screws for the loading means, parts being shown in section.

Fig. 11 is a side elevation of one of the lower screws, showing the support plate in unlocked position and parts, being in section,

Fig. 12 is a horizontal section approximately on line 12—12 of Fig. 10,

Fig. 13 is a horizontal section approximately on line 13—13 of Fig. 11.

Fig. 14 is a perspective view of the support plate,

Fig. 15 is a plan view, with parts in section, of the vacuum chamber, the operating valve, the exhaust valve and a portion of the vacuum storage tank,

Fig. 16 is a vertical section approximately on line 16—16 of Fig. 15,

Fig. 17 is a section similar to that of Fig. 16, but showing the hand valve in open, or operating, position,

Fig. 18 is an enlarged portion of Fig. 17 showing locking device,

Fig. 19 is a vertical section approximately on line 19—19 of Fig. 18, and

Fig. 20 is a diagrammatic view showing in assembly vacuum pump, storage tank, operating valve, one of the hand valves, the vacuum chamber of the holder, certain parts being in section, and the electrical connections.

The camera shown in Fig. 1 is of an overhead

type, the various operating parts being suspended from a horizontal tube or pipe 1 which is itself supported through the intermediary of springs 2 from cross beams 3 held in elevated position by pillars 4. The vacuum holder structure is indicated generally by 5 and is supported from the tube 1 on tracks so that it may be moved along the length of the pipe as by electric motor, as is well known in the art. Likewise the camera lens board 6 is independently movable as well as the projection illuminating unit 7 which may also be of any suitable type or construction known in the art. The holder 8 is for the film or glass plate to receive the picture when the vacuum holder is provided with the subject to be photographed or for the transparent negative plate when the camera is to be employed as a projection camera; in the latter case the vacuum holder is adapted to hold a sensitized sheet and light from the illuminating unit 7 passes through the negative in holder 8 and through the lens supported in the lens board 6 to photograph the markings on the negative usually in enlarged form upon the sensitized sheet. The holder 8 is fixed, as shown, and the elements 5, 6 and 7 are adjusted longitudinally of the tube for focussing and obtaining the precise amount of enlargment.

The vacuum holder is shown in front view in Fig. 2 and in rear elevation in Fig. 3. Its supports are of an open box-like structure of cross beams 9, depending from which are vertical beams 10 and horizontal sheets 11. The backing member or platen 12 is usually in the form of an aluminum casting and on account of the large sizes of sensitized plates to be operated upon, this member may be conveniently made of four sections bolted together along central, horizontal and vertical lines, but this construction is not shown in the drawings in order not to complicate them. This backing member or platen 12 has a flat face or front over its whole area, though this surface has been provided over substantially its whole area as by milling, with a series of cuts or channels 13 leaving knobs or supporting projections 14 each in the general form of a truncated pyramid (Figs. 4 and 20). The rear of the backing plate is provided with integral ribs 15 and the member as a whole is supported on the box-frame, 9, 10, 11 by fastening devices 16, shown in dotted lines in Fig. 3, which extend through the front vertical beams 10 and into suitable steel covers secured to ribs in the back of member 12 (Figs. 5, 6 and 7). These devices are preferably of a bolt and bushing type which is adjustable to position and maintain the member 12 in a manner to insure with great precision that the front supporting projections 14 be in a single vertical plane. The detail construction of these fastening devices 16 is shown in preferred form, in Figs. 5, 6 and 7.

The projections 14 extend over the whole front face of the member 12 except that dividing spaces or bands 17 are provided to produce a variety of areas to accommodate a variety of sizes of sensitized plates. These dividing spaces are provided with grooves in which are held rubber dams 18, the rubber thereof being very soft and spongy and extending out of their grooves to the front plane of the knobs 14 or a little beyond or in front of said plane. The dams meet each other so as to provide sealtight joints and each knob area is sealed by peripheral, connecting dams. When a sensitized sheet is held by vacuum against the knobs, these rubber dams are slightly compressed by the sheet under the action of the vacuum and serve to seal the various knob areas from each other. Thus, a small sheet would require vacuum only on a correspondingly small knob area and larger sheets would require vacuum to be applied to areas only as required by the size of the sheet in question. Each sealed area is provided with one or preferably several apertures 19 leading from the bottoms of the channels 13 to the rear of the backing member and are there connected with the vacuum system as will be clearly pointed out hereinafter.

The arrangement of knob areas and dividing sealed spaces 17 may be varied in any manner to accommodate the particular selection of plate sizes to be accommodated. As shown in the accompanying drawings, the spaces 17 are arranged for 30 sizes. The smallest size is the central area which is 22 inches by 34 inches as shown by the dash line 22 at the left of Fig. 2 and the dash line 34 at the bottom of said figure. For a width of 22 inches also lengths of 44, 51, 55, 66, 68, 77, 85, 88, 99 and 102 inches, as similarly indicated at the bottom of the figure, may be used. Similarly, for a width of 34 inches, lengths of 44, 55, 66, 77, 88, 99 and 110 inches may be used; for a width of 51 inches, lengths of 55, 66, 77, 88, 99 and 110 inches and for a width of 60 inches, lengths of 66, 77, 88, 99, 110 and 120 inches may be used, all as indicated as aforesaid. It is obvious that other area arrangements may be availed of for other sizes of plates, as desired, it being understood that the plates should extend over the various dams 18 sufficiently to make a sealing contact therewith. If the plates are slightly in excess of the designated sizes, no harm would result since the vacuum on the areas wholly covered by the plate would be sufficient to hold it in place flat against the contact surface formed by the knobs, particularly since clamping and holding members are provided additionally for retaining the plate in position as will be hereinafter described.

Turning to Fig. 3 showing the back of the holder, slightly enlarged over the showing of Fig. 2, it will be seen that the vacuum apertures 19 lead from the front areas to manifolds formed by integral ribs on the backing member and covered with sealed covers 20 into which lead pipes 21, connecting with the vacuum source. There are as many manifolds and covers as there are groups of apertures 19 and since the arrangement of areas shown on Fig. 2 is symmetrical, there is for each area, a corresponding area on the opposite side of either or both the horizontal and the vertical central lines of the board. For example, the area A, Fig. 2, is found at the top of the right end of the board and is correspondingly positioned at the top left end of the board as well as at the bottom right end and the bottom left end. This symmetrical arrangement will require no further description since it will be readily understood from an inspection of Fig. 2. From Fig. 3 it will be seen that the vacuum pipes 21 are arranged to connect all corresponding area manifolds with a single valve of the series 22 of valves. Considering the manifolds for area A, it will be seen that the manifold covers A20 also cover adjoining manifolds but it will be understood that a partition rib separates the manifolds so that they are not connected together although a single cover serves for both. The cover is secured to this partition rib by bolts 23. The vacuum pipe system A21 from the four areas A leads horizontally between

the top areas A and likewise horizontally between the bottom areas A and by branch A27 to the valve at the right of the valve bank 22, which valve is marked "27". Thus it is clear that valve "27" controls the application of vacuum to the four areas A. Likewise it can be shown that all of the areas of the board are selectively controlled by valves of the valve bank 22 in such a way that any plates of the sizes for which the board is adapted may be vacuum held by manipulating the proper valves for the areas covered in each case by the plates and at the same time vacuum is not applied to the portions of the board not covered by the plate. If we consider the plate to be of a size to cover the central area which as described is 22x34, that central area is served by the valve "17" alone as may be seen from inspecting the central manifold covered by cover 20 and following the pipe system 21 leading to valve "17." In fact all of the various area controls may be followed out on Figs. 2 and 3, without it being necessary to describe them all in detail, and it will be observed that the central area is controlled by one valve and the whole area, 60x120, by all of the valves. A chart attached to the back of the board is conveniently used to specify for the operator the particular valves to be opened for any given plate size. It is not deemed necessary to display this chart here or to further describe it, since the valve combinations are readily ascertainable from the drawings.

Valves 27 are all located in a pipe or manifold 24 which is square in section and is conveniently supported on the holder frame 5 at the back of the holder. This manifold 24 is horizontally disposed at a height from the floor which makes it easy for the operator to control the valve system 22. Each valve is numbered and as shown these numbers are from "1" to "27" inclusive. The proper valves to open for a given plate size are indicated by numbers on the chart above referred to. Since the operation of this camera for template work is a mass production operation, the camera being in fact a machine tool, speed of operation is essential and these valves are constructed for fast operation, only a pull being necessary to open each valve and a push to close it. Figs. 15 to 19 show the valve construction best. The manifold 24 is perforated to accommodate a valve sleeve 25 which extends horizontally through the manifold from front to back. The sleeve is in each case secured in the perforations to make an air-tight connection as by sweating, and the front end of the sleeve is similarly connected in air-tight manner to the pipe 21 leading to that valve. The rear end of the sleeve is provided with a collar 26 which comes against the back of the manifold. Slidably fitted within the sleeve is the valve 27 which is cylindrical in form and is provided with oil grooves 28 and clearance 29. The back end of the valve is provided with a handle 30 and this end is slightly reduced in diameter to form a shoulder against which the stopscrew 31 abuts when the valve is in open position as shown in Figs. 17 and 18. The sleeve 25 is provided with ports 32 to permit air to pass between the interior of the sleeve and the manifold chamber when the valve is pulled open. When pushed closed, as shown in Fig. 16 this communication is shut off by the valve stem. The latter is provided with a small annular groove 33 near the stop shoulder to accommodate a spring 34 which extends laterally through the sleeve shoulder 26 so as to enter the groove. One end of the spring is tightly fitted in an aperture in the shoulder and the other end has clearance since the aperture there is of larger diameter (Figs. 18 and 19). It is obvious that when the valve is opened this spring snaps into the groove and thus holds the valve against being drawn shut by the vacuum, but the spring yields readily when manual pressure is applied to close the valve.

The manifold 24 is provided at one end with a pipe connection to the vacuum storage tank 35 (Figs. 3, 15 and 20) but between the manifold and the tank is provided an electrically controlled valve 36 to permit communication when the valve is open and prevent it when the valve is closed. This valve may be of any suitable type as is the exhaust valve 37 at the opposite end of the manifold 24. When an electric switch is closed, such as knife switch 38 shown in the wiring system in Fig. 20, the valve 36 is opened and simultaneously the exhaust valve 37 is closed. The operator applies vacuum to the face of the backing member 12 and to the sensitized plate P (shown in Fig. 20) by closing the switch 38 after he has set the proper valves of the valve bank 22 in open position to correspond to the size of the plate P being acted upon. Thus the valve 36 opens communication between the tank 35 and the manifold 24 and causes atmospheric air in the manifolds of the backing plate 12 to pass through the pipes 21, valve sleeves 25 and apertures therein 32 and from the manifold 24 into the tank 35. The vacuum pump 39 shown in Fig. 20 may be of any suitable construction and is connected with the tank 35 through suitable piping. It is also preferably electrically operated and controlled through a suitable pressure sensitive switch device 41 connected with the tank by piping 42. When the degree of vacuum in the tank has lessened below the desired level, this switch device operates to cause the vacuum pump to run and thus increase the tank vacuum. And conversely, when the vacuum has reached the desired level, the switch device automatically cuts off the operation of the pump.

When the switch 38 is opened by the operator, the valve 36 is thus closed and the valve 37 is opened allowing atmospheric air to rush into the manifold and the pipes 21 corresponding to the opened valves 27, thus quickly releasing the plate P from being vacuum held. It will be observed that, so far as the vacuum system is concerned, the operator has only to open the proper valves 27 and then close the switch 38 to obtain a quick holding of the plate and then merely to open the switch 38 to obtain a quick exhaust and release of the plate. The tank 35 forms a large reservoir of vacuum so that quick action on the plate is assured and it is continually kept at proper vacuum automatically by the pump and its controls.

The sensitized plate P is held against the knobs or projections 14 and should possess sufficient stiffness as not to be drawn, even slightly, into the channels 13. It is preferably strong and rigid enough to support itself from one edge and if made of aluminum or other metal, as is usually the case, the plate should be thick enough to support itself in such manner. In some cases the sensitized plates are longer than the platen itself and may weigh as much as one hundred pounds. To handle these plates, a loading device has been made a part of the vacuum holder.

A preferred form of loading means is shown in the drawings which possesses certain special ad-

vantages and it will now be described. Two upright angle pieces 45 are provided, one at each side of the platen and secured to the latter by suitable bolts 46. These pieces form a lateral extension of the platen but do not project in front of the same. At the upper ends of these pieces are bolted bearing brackets 47, 47', each to provide an upper bearing for the vertical screw members 48, 48' one on each side of the vacuum holder. These members are supported at their lower ends by bearing brackets 49 and 50 and intermediately by bearing brackets 51 and 52. The latter are secured to the pieces 45 by bolts similarly to the upper brackets 47, 47'. The brackets 49, 50 are similarly secured to the pieces 45 at their lower ends and these brackets are bifurcated to accommodate between their forks the drive gears 53 and 54 respectively, these being pinned to their respective screws, so that when the gears are driven, the screws will be turned. Below the intermediate bracket bearings, each screw 48 is coupled to its extension screw 48' by a coupling 53', this being provided for ease of manufacture and assemblage of the pairs 48 and 48' which in effect constitutes one screw with the threads on the top screw being opposite to those on the bottom screw. The right-hand bracket 51 is provided with a rearward extension 54 for the accommodation of a stud 55 which extends horizontally through the bracket extension 54 in which the stud has a bearing. The outer end of the stud is provided with a chain gear 56 for the chain 57 and with a handle 58 located at a height for easy manipulation by the operator. The chain extends downwardly and engages a gear 59 on the shaft 60 extending horizontally between the lower screw-supporting brackets 49 and 50. The shaft is provided with gears 61 to mesh with the gears 53 and 54 on the screws 48'. It will be seen that when the handle 58 is operated, both of the screws 48, 48' are turned in unison in the same direction. It will further be observed that all of the mechanism for moving the screws, as well as the screws themselves, are behind the face of the platen.

Each screw 48 is provided at the top with a traveling nut 62 and at the bottom with a traveling nut 63, the upper and lower members of each screw 48, 48' being reversely screw-threaded so that as the screw is turned to move the lower nut upwardly, the upper nut will move downwardly and when the screw is oppositely turned the nuts will reversely move away from each other. The upper nut is shown clearly in Figs. 10 and 12. Each is of angular cross section, one leg being located in front of the angle piece 45 and the other being pierced and threaded to accommodate the screw 48. An angle iron 64 is secured by bolts to this leg and the end of the angle iron has a sliding bearing on the back of the front part of the angle piece 45. The right and left top nuts 62 are connected by a horizontal angle beam 65 to which the nuts are bolted. The lower part of the angle beam extends in front of the angle pieces 45 and, of course, in front of the platen 12 and serves as a top guide for the plate P when applied to the holder.

The lower nuts 63 (Figs. 11 and 13) are similarly mounted, being held by the angle irons 64' and channel beam 65'. The screws 48, 48' and the various brackets and nuts are all behind the plane of the knobs 14 of the platen 12, except that parts of the nuts and all of the beam members 65 and 65' are in front of said plane, but only beyond the surface of the platen being used for any given size of plate P. In other words, the mechanism described does not project in front of the plane of the knobs 14 between the upper guide part of the angle beam 65 and the upper horizontal part of the channel beam 65'. In a lateral direction there is nothing which projects beyond the plane in question and therefore any length of plate P can be employed and also any width which can be placed between the beam 65 and the platform beam 65'. This means the whole extent of the backing member from top to bottom can be used, with no restriction whatever in the dimension of the plate P from side to side as applied to the holder. The top beam 65 and the bottom, platform beam 65' move in front of the knobs 14 but are separated from them so as not to slide on them or on the rubber dams marking the platen sections. The sliding of the beams and the nuts is on the angle pieces 45 due to the construction of the nuts as described.

The supporting member of the loading device comprises the channel beam or platform 65' and the locking plate 66 which is located on the upper surface of the beam and is slidable thereon toward and away from the platen 12. The plate 66 extends forwardly of the platform beam 65' and below this extension is located a horizontal shaft 67 which extends the full length of the plate 66 and is rotatably supported in bracket bearings 68 formed on the nuts 63. The ends of the locking plate are each provided with a notch 69 (Fig. 14) and the shaft 67 is provided at or near each end with sleeves 70 secured to the shaft in any suitable manner. The sides of the sleeves rub against the bracket bearings 68 to hold the shaft from longitudinal movement and each sleeve has an upwardly extending cam projection 71 which seats in the notches 69. A handle 72 is provided at one end of the shaft 67 so that when the handle is pulled outwardly the cam projections operate in the notches to slide the locking plate inwardly toward the backing member or platen. A reverse movement slides the plate away from the member. The uprights 45 are provided with recesses 73 for the reception of the rearward projections 74 on the locking plate. The latter is slidably held upon the platform beam 65' by countersunk screws 75 seated in shouldered slots 76 in the locking plate. The plate P is adapted to contact as to its lower edge with the upper surface of the locking plate. Other recesses 73' are provided in the platen in line with the recesses 73 but these are clearance recesses for the projections 74' on the locking plate whereas the projections 74 and recesses 73 which are cut into the hard metal of the uprights 45 act as a lock to prevent movement of the plate 66 when slid into locked position. There are as many pairs of recesses 73 as there are sensitized plate sizes in a vertical direction (see Fig. 2) whereby the supporting member for each plate size is locked in proper position for each such size. The recesses 73' accommodate the projections 74' which are provided so that short plates which do not extend the full length of the plate 66 are supported on these projections when the plate 66 has been withdrawn to non-locking position. The projections 74' are supported in function while the lugs 74 are essentially for locking purposes.

As has been previously pointed out the holder is designed for definite sizes of plates P and the locking recesses 73 are located in sets in horizontal lines, each set locating the plate P in the exact position it should have for the vertical dimension of the plate. When the proper location has been reached by operating the chain drive handle 58 to move the supporting member

through the intermediary of the chain 57, shaft gears 61 on shaft 60 and the gears 53, 54 on the screws 48, 48', the handle 72 is pulled forwardly and the locking projections 74 enter the recesses 73. If they do not find a seat in the recesses the position is not proper for the particular plate and the handle 58 must be operated until the projections 74 can enter the corresponding recesses. Then the handle 72 is operated and in this way the correct positioning of the plate in a vertical direction is assured and the plate is centered; that is, one half is above and the other half below the horizontal center line of the platen. The support is thus locked also and cannot be moved until the handle 72 is pushed rearwardly.

For centering the plate P in a horizontal direction, the locking plate 66 is provided with dove-tail slots 77 (see Fig. 14), in the proper one of which a stop 78 is placed, having a tongue to cooperate with the dove-tail of the slots 77. This stop may be of any suitable construction and must have a side surface against which the end of the plate P may be contacted when it is located on the supporting locking plate 66. The construction of the stop 78 is obvious as shown in Figs. 4, 7 and 11. A knob with a spring detent to seat in the depression 78' near each slot 77 is provided in the construction shown, to position the stop properly lengthwise of the slot 77. The handle 72 is held in open and in closed positions by a spring pin 79 having an operating knob 80 (Figs. 7 and 8) to co-act with two holes in the segment 81 formed on the right-hand nut 63, one hole representing the locked position and the other the open position.

In feeding the large sensitized plates P to the holder in fast production operation they are required not only to be supported, as by the supporting platform assembly 65', 66, but, particularly when they are positioned just prior to applying vacuum, they should preferabily be moved and held rather tightly against the contact surface formed by the knobs 14 of the platen 12. Then the vacuum controlling valves may be opened and the switch closed for sucking air from the channels 13 and the vacuum pipes and manifold, whereby the plate is forced by atmospheric pressure tightly and immovably against the knobs 14 and the rubber dams 18 near the edges of the plate.

To hold the plate mechanically near the bottom of the plate before application of vacuum, contact rollers 81' on forked hand levers 82 are employed. One of the forks of each of these clamps or levers 82 is pinned on the horizontal shaft 83 extending parallel to the locking shaft 67 and below the locking plate 66 and journalled in brackets 84 bolted to the strap 65'. The other fork of each of these levers 82 is arcuate in form and extends forwardly of the shaft 67 so as not to be interfered with by said shaft (see Fig. 9) and upwardly to hold the roller 81' at its end and above the locking plate. When the lever is pulled forwardly the roller is moved as shown in dot and dash lines in Fig. 11 and contacts with the plate P. Springs 85, one at each end of the shaft 83 cause the lever 82 to be held in either clamped or unclamped position.

One end of each spring 85 (Fig. 4) is anchored to a pin 86 secured to the nut 63 and the other end to a radial projection on the sleeve 87 pinned to the shaft 83. The projection is located so that when the clamps 82 are open, the springs will be on one side of the axis of the shaft 83 and when the clamps are in closed or holding position, the springs will exert pressure in a direction on the opposite side of said shaft axis. The locking plate is provided with notches 87' (Fig. 14), to accommodate and provide clearance for the levers 82.

The upper part of the plate P is clamped by similar rollers 88 on arcuate levers 89 pinned to a horizontal shaft 90 journalled in brackets 91 on the upper nuts 62. These levers are operated in a downward direction to lock against the plate P by pulling the handles 92 on the rods 93 pivotally secured to arms 94 secured to the shaft 90 and extending radially therefrom. End sleeves 95 are secured to the shaft 90 and are provided each with a radial projection 96 for the pin 97 to which one end of the spring 98 is attached, the other end being anchored to the pin 99 on the nut 62. The operation of these springs 98 is the same as that of the springs 85 and hold the clamps 89 in closed or open position by exerting a pull in one position on one side of the shaft 90 and in the other position on the other side thereof. When it is desired to unclamp the plate P one or both of the handles 92 are pushed upwardly to the position shown in full lines in Fig. 10, the closed or clamping position being also shown in said figure in dot and dash lines.

In the operation of the holder it is only necessary to bring the supporting platform to the level indicated by the width of the sensitized plate and lock it in such position. The plate is placed on edge on said platform and brought to position horizontally by its forward vertical edge contacting with the end stop 78 which has previously been positioned in the appropriate slot 77 in the locking plate 66 in accordance with the length of the plate which it is desired to expose. When so positioned manually the lower clamps 82 are operated to cause their rollers 81' to press against the front of the sensitized plate and force its rear face against the face of the backing member 12. Likewise, since the upper guide beam 65 is simultaneously positioned with the platform beam 65', the upper clamps are in position to be operated by pulling downwardly on one of the handles 92. Thus the plate is positioned vertically by the position of the supporting platform and horizontally by contact with the stop 78 and is pressed against the face of the backing member by the clamps. The operator may now move to the back of the holder and pull out or open the appropriate valves 30 (if he has not previously done so) to correspond in their function to the area of the plate so that the vacuum subsequently applied will correspond with such area. Then the switch 38 (Fig. 20) is closed causing the exhaust valve 37 to close and the supply valve 36 to open. The vacuum of the tank 35 is quickly transmitted, in a manner previously explained, to that area of the platen which is controlled by the valves 30 which have been opened and the plate will be firmly and flatly held over all its area to be exposed against the accurately vertical and precisely flat surface of the platen formed by the front faces of the knobs 14. When the camera elements have been shifted to proper focus position in a well known manner and exposure has been made and it is desired to remove the plate the switch 38 is opened; the valve 36 is thus closed and the valve 37 opened and atmospheric air enters through the latter to destroy the vacuum in the holder and permit the unclamping of the plate and its manual removal. If the next plate is the same size it is only necessary to place it on the platform, clamp it in place and close the switch 38. If

it is of different size the valves 38 must be selectively manipulated and the platform positioned before the application of the plate. The vacuum degree is at all times kept proper by the pump 39 and the automatic control switch device 41, the tank 35 being large relatively to the pipes manifold and passages in the backing plate 12 and thus maintaining easily the vacuum level.

I claim:

1. A vacuum holding device comprising a platen the face of which is in a single plane and is provided with interconnecting channels over substantially its whole area except for dividing bands also in the plane of said face and defining the various sizes of plates for which the holder is adapted, rubber dams permanently built into said platen and seated in grooves in said bands and extending approximately even with said plane whereby each plate to be acted upon corresponds with an area defined by certain of said bands and dams and is adapted to be drawn by vacuum into contact with the face of the platen and to be peripherally sealed by said dams, apertures leading from the channels of each of said areas through the platen and means for applying vacuum selectively through said apertures whereby vacuum is applied only to the areas corresponding with the plate to be held.

2. A vacuum holding device comprising a platen having its face provided with interconnecting channels, rubber dams permanently built into said face and seated in grooves therein and extending approximately even with said face and dividing it into areas of various sizes to accommodate a variety of plates to be held by the device to form a continuous seal around the boundaries of each of said areas, apertures leading from the channels of each of said areas to the back of the platen, a back manifold for each area connecting with said apertures, a valve bank manifold, valves therein, piping connecting the back manifolds and the valve bank manifold through said valves, whereby communication is established selectively by setting appropriate valves in open position, a vacuum storage tank, means to provide a vacuum therein, an electrically operated valve between the tank and the valve manifold, an electrically operated exhaust valve for the valve manifold and circuits including a switch connected to open one electrically operated valve and close the other upon the closing of the switch.

3. A vacuum holding device for sensitized plates comprising a platen, means for producing a vacuum, connections between said means and said platen, loading means for the sensitized plate comprising a platform beam and a top beam, means for moving said beams vertically simultaneously in opposite directions in front of said platen to position said plate to precise position vertically with respect to said platen, means for locking said beams in said position, an end stop carried by said platform beam to position the plate horizontally, bottom clamps carried by said platform beam and top clamps carried by said top beam to hold the plate against the platen before and after the application of vacuum and valve means in said vacuum connections for applying and releasing vacuum.

4. A vacuum holder comprising a platen with connections for producing a vacuum at its face, a platform beam in front of the platen face and extending the length of the platen for supporting the plate to be held by the holder, guides at each end of the platen upon which the beam is slidably mounted, means for moving the beam vertically to a position suitable for the plate to be supported, a locking plate supported on the beam and being slidable toward and from the platen face, locking lugs on the locking plate adapted to enter into locking recesses in the guides when the locking plate is in its rearward position in proximity to the plate, clearance lugs on the plate intermediate the locking lugs and adapted to enter into recesses in the platen face when the locking plate is in its rearward position and to serve as supports for the plate to be held by the holder when the locking plate has been slid to its forward position.

5. A vacuum device particularly adapted for holding a succession of sensitized plates of varying sizes and sufficient rigidity to stand on edge, comprising a vertical platen having a face provided with inter-connecting channels against which face the plate being held is adapted to rest and form a closure for said channels, means for producing a vacuum in said closed channels, a loading device upon which the plates are supported before vacuum is applied, said loading device comprising a platform in front of said platen and extending the whole width thereof, a frame for supporting said platen and said platform, means for moving said platform and with it the plate supported thereon vertically to a definite position corresponding to the vertical dimension of the plate, whereby said plate is precisely located with respect to the vacuum channels to be closed by the plate and in which vacuum is to be produced for that size of plate, and means having cooperating locking elements, partly carried by said platform and partly by said frame for defining the position of the plate and locking the platform in said position, said means for moving the platform being located on the frame in position so as not to interfere with the unloading of one plate and the loading of the next plate.

6. A vacuum device particularly adapted for holding a succession of sensitized plates of varying sizes and sufficient rigidity to stand on edge, comprising a vertical platen having a face provided with interconnecting channels against which face the plate being held is adapted to rest and form a closure for said channels, means for producing a vacuum in said closed channels, a system of resilient dams carried in grooves in the platen to define the various plate sizes and to form a peripheral seal for the plate being held, a loading device upon which the plates are supported before vacuum is applied, said loading device comprising a platform in front of said platen and extending the whole width thereof, a frame for supporting said platen and said platform, means for moving said platform and with it the plate thereon vertically to a definite position corresponding to the vertical dimension of the plate whereby said plate is precisely located with respect to the vacuum channels to be closed by the plate and in which vacuum is to be produced for that size of plate, means for determining the position of the plate and for locking the platform in said position, and clamping means on the platform and having an upwardly extending arm to engage the lower part of the face of the plate and force the plate laterally against the platen to hold it in close contact therewith before the application of vacuum.

7. A vacuum device particularly adapted for holding a succession of sensitized plates of varying sizes and sufficient rigidity to stand on edge,

comprising a vertical platen having a face provided with interconnecting channels against which face the plate being held is adapted to rest and form a closure for said channels, means for producing a vacuum in said closed channels, a platform in front of said platen and extending the whole width thereof upon which platform the plates are supported before vacuum is applied, a beam above and parallel to said platform, a frame for supporting the platen, the platform and the beam, means on the frame for moving the platform and with it the plate supported thereon and also moving simultaneously the beam, both movements being vertical but in opposite directions to position the plate to a definite position corresponding to the vertical dimension of the plate, the beam being in proximity to the upper edge of the plate when positioned, means having cooperating locking elements, partly carried by said platform and partly by said frame, for defining the position of the plate and locking the platform in said position, clamping means on the platform and having an upwardly extending arm to engage the lower part of the face of the plate and force the plate laterally against the platen and to hold it in close contact therewith before the application of vacuum, and clamping means on the beam and having a downwardly extending arm to engage the upper part of the face of the plate and similarly hold the plate against the platen, said means for moving the platform and the beam and said clamping means being located so as not to interfere with the successive loading and unloading of plates.

8. A vacuum device particularly adapted for holding a succession of sensitized plates of varying sizes and sufficient rigidity to stand on edge, comprising a vertical platen having a face provided with interconnecting channels against which face the plate being held is adapted to rest and form a closure for said channels, means for producing a vacuum in said closed channels, a system of resilient dams carried in grooves in the platen to define the various plate sizes and to form a peripheral seal for the plate being held, a loading device upon which the plates are supported before vacuum is applied said loading device comprising a platform in front of said platen and extending the whole width thereof, a frame for supporting said platen and said platform, means for moving said platform and with it the plate thereon vertically to a definite position corresponding to the vertical dimension of the plate whereby said plate is precisely located with respect to the vacuum channels to be closed by the plate and in which vacuum is to be produced for that size of plate, a positioning and locking plate carried by the platform and provided with locking lugs adapted to enter recesses in the frame when the plate has been positioned, means for moving the positioning and locking plate laterally towards the platen for locking the platform and away from the platen for unlocking the platform, a series of grooves on the upper surface of the positioning and locking plate and an end stop adapted to be seated in a selected one of said grooves and to be secured to said plate, said end stop thus positioned serving to center the plate horizontally, clamping means on the platform and having an upwardly extending arm to engage the lower part of the face of the plate and force the plate laterally against the platen and to hold it in close contact therewith before the application of vacuum, and valve means in said vacuum producing means for controlling the application and release of vacuum.

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