Oct. 16, 1928. 1,688,059

W. SACK

PHOTO COPYING APPARATUS

Filed June 30, 1925 2 Sheets-Sheet 1

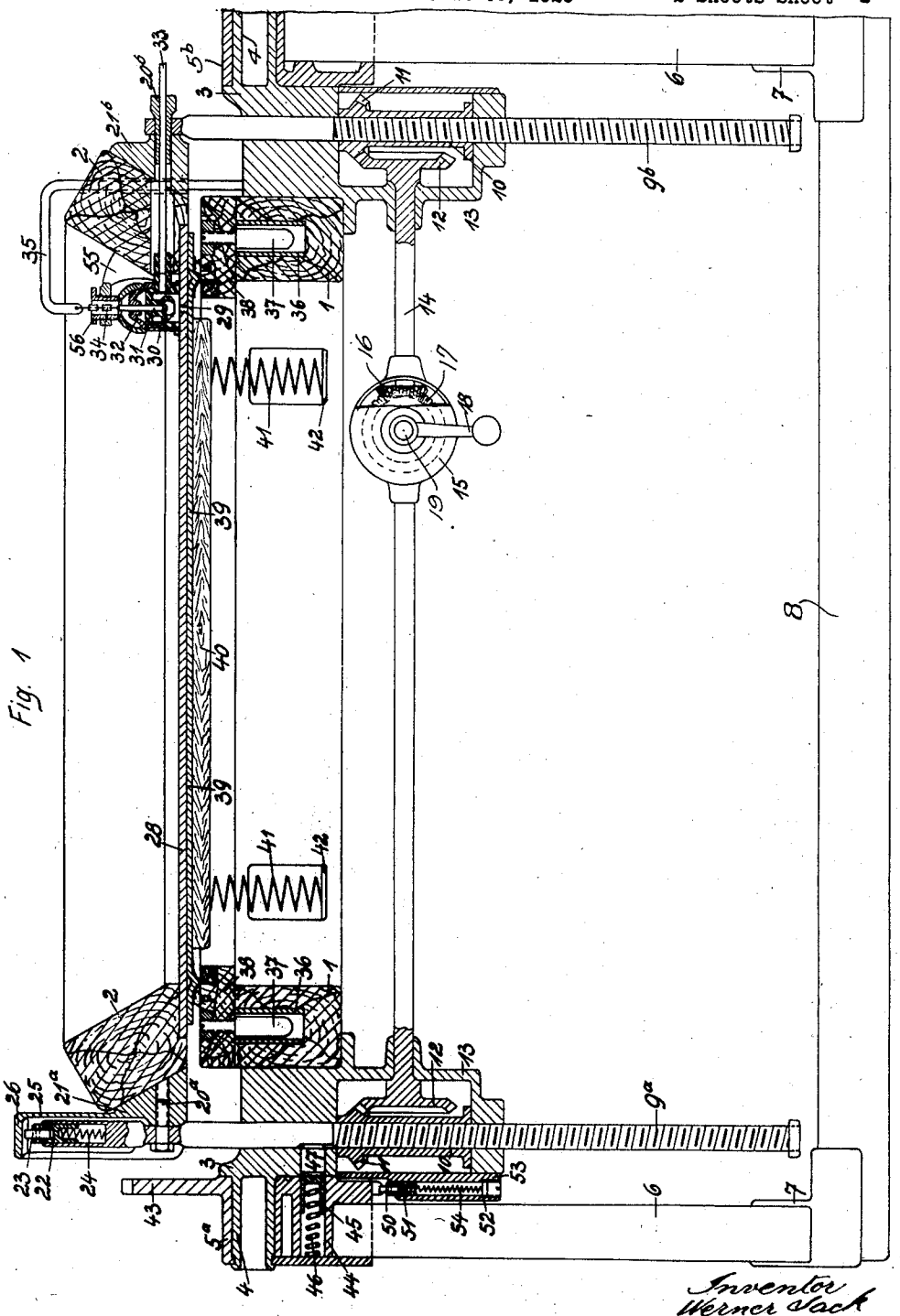


Fig. 1

Inventor
Werner Sack
Pfeil & Jennings
attorneys

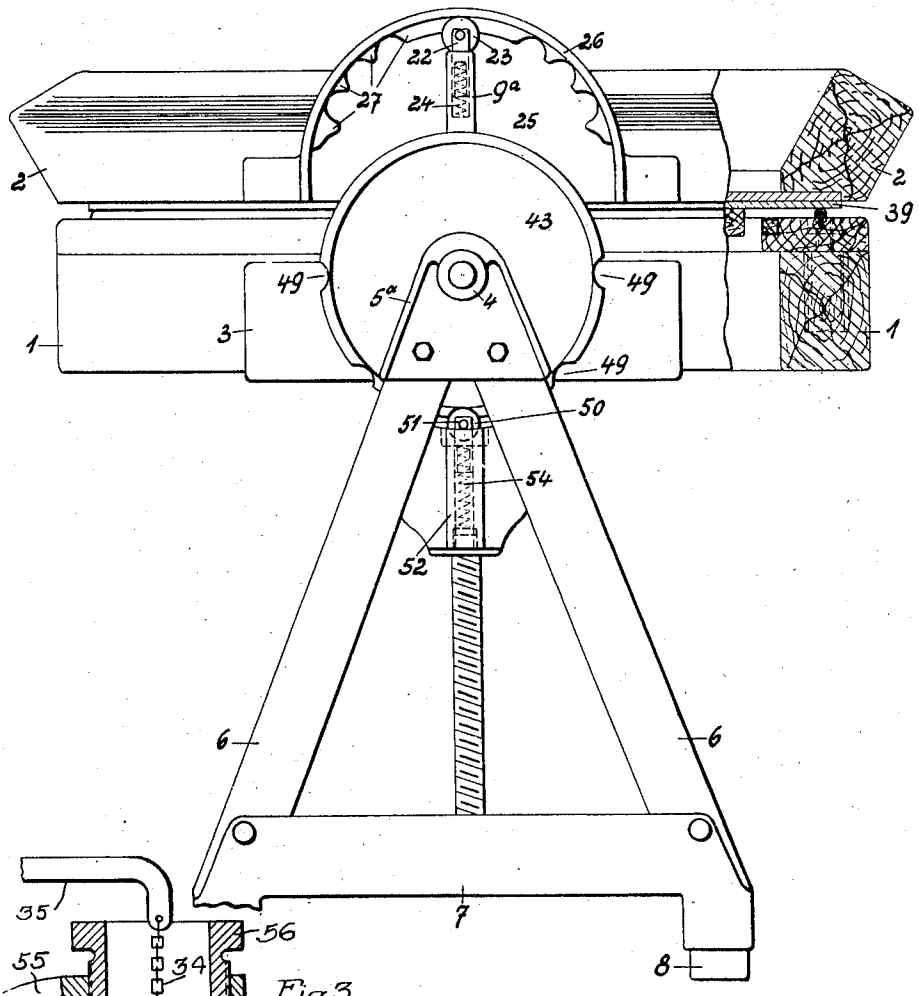
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Filed June 30, 1925 2 Sheets-Sheet 2

Fig. 2



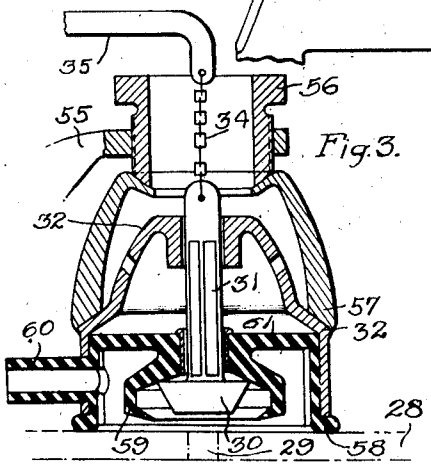


Fig. 3.

Inventor
Werner Sack
by
Gifford & Jennings
attorneys

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UNITED STATES PATENT OFFICE.

WERNER SACK, OF DUSSELDORF-RATH, GERMANY.

PHOTO COPYING APPARATUS.

Application filed June 30, 1925, Serial No. 40,632, and in Germany June 26, 1924.

This invention relates to photo copying apparatus and has for its object to provide an improved form of apparatus whereby more efficient copies are obtained.

An essential object of the invention is to provide means whereby a rubber cover and a transparent plate can be pressed together adjacent their edges so as to obtain a fluid-tight joint adjacent said edges.

A further object of the invention is to effectively withdraw the air from between the rubber cover and the transparent plate.

Another object of the invention is to provide means whereby two frames, in which the transparent plate and the rubber cover are respectively supported, can be separted from one another and brought towards one another.

Further objects of the invention will appear from the following description with reference to the accompanying drawings wherein—

Figure 1 shows a longitudinal section through the middle of the photo copying apparatus.

Figure 2 shows an end elevation of the copying apparatus, partly in section, and

Figure 3 shows a vertical section of a valve for use in connection with the apparatus.

The photo copying apparatus consists of a rectangular wood frame 1 which is adapted to support a second rectangular wood frame 2. To opposite sides of the frame 1 there are secured brackets 3, these brackets being adapted to lie along the central axis of the frame. Along this axis the brackets 3 are provided with pivots 4 which are rotatably mounted in bearings 5^a and 5^b. These bearings are provided in supporting structures 6, 7, 8.

Through suitable holes provided in the brackets 3 are passed screw threaded spindles 9^a, 9^b engaging with nuts 10 rotatably mounted in casings 13 provided on the brackets 3. The nuts 10 are each formed integral with a bevel wheel 11 engaging with bevel wheels 12 keyed to a shaft 14 rotatably mounted in the brackets 13.

On the shaft 14 is also keyed a bevel wheel 16 gearing with a bevel wheel 17 keyed to a shaft 19 adapted to be rotated by means of a crank 18. The bevel wheels 16 and 17 are enclosed in a casing 15 suitably secured to the supporting structure.

Through the upper ends of the screw spindles 9^a, 9^b pass freely rotatable bolts 20^a and 20^b which are screwed into brackets 21^a and 21^b arranged at the middle of opposite sides of the frame 2. In this manner the frame 2 is rotatably supported by the spindles 9^a and 9^b.

The spindle 9^a is extended beyond the bolt 20^a and is provided with an axial bore into which is fitted a sliding member 22 in which there is rotatably mounted a roller 23. The roller 23 is urged outwardly by a spiral spring 24 disposed between the bottom of the bore and the sliding member 22. The bracket 21^a is provided with an extension 25 having a semi-circular wall 26. The inner surface of the wall 26 is provided with projections 27 so as to form notches for co-operation with the roller 23. By means of this arrangement the frame 2 which is rotatable on the bolts 20^a and 20^b can be locked in a horizontal or any suitable inclined position. The frame 2 can be tilted by simply gripping this by hand and moving it into the required position.

Into the frame 2 is fitted a plate 28 of glass or other transparent material. This plate is provided with an opening 29 which may be closed by a valve body 30. The valve body 30 is rigidly connected to a rod 31 which can easily move up and down in a valve casing 32.

To the frame 2 is secured a bracket 55 into which is screwed a hollow sleeve 56 adapted to press the lower edge of a bell-shaped member 57 into engagement with the bell-shaped valve casing 32. The lower portion of the valve casing is lined with a double cup-shaped rubber body 58, 59. When the screw sleeve 56 presses the body 55 downwards this in turn presses downwardly the body 32 and this presses the edge of the body 58 into close contact with the glass plate 28. The position of the inner cup 59 is such that the edge thereof will also be pressed against the glass

plate. The cup 58 is provided with a tubular extension 60 to which a suction pipe 33 is attached. This pipe passes through the hollow bolt 20^b and is connected to a suction pump or suction applying means. By means of this pipe 33 air is withdrawn from the interior of the cup 58 either constantly or as may be desired. The valve rod 31 is suspended by means of a chain 34 from a rod 35. When the apparatus is closed the rod 35 engages with the bracket 3 so that the valve body 30 is withdrawn from the glass plate 28 as shown in Figure 1. The air contained underneath the glass plate can thus be withdrawn through the opening 29 into the pipe 33 as in this position the valve body 30 has also raised the cup 59 away from the glass plate. This lifting is possible, in spite of the fact that the outer cup 58 is pressed against the glass plate, by reason of the fact that the double cupped member is of rubber and the upper connecting wall 61 between the two cup members permits of this movement. If however the frame 2 has been raised from the frame 1 the rod 35 is no longer supported by the bracket 3 and therefore moves downwardly. The valve body 30 suspended from the rod 35 partakes of this movement and will consequently come into engagement with the glass plate. The cup member 59 will now no longer be raised from the glass plate and consequently its lower edge, by reason of the elasticity of the rubber and the air pressure acting from the top on the wall 61, will be pressed tightly against the glass plate. Air can then no longer pass through the valve into the pipe 33.

Into each of the four corners of the frame 1 are fitted sleeves 36 with which engage pins 37 secured to an auxiliary frame 38. To this frame there is secured in the known manner a rubber cover 39. In order that this will lie as flat as possible and in order that it may bear closely against the glass plate even before withdrawal of air takes place, this rubber cover is supported by a plate 40 resting on spiral springs 41. These spiral springs are supported by plates 42 secured to the frame 1.

The bearing 5^a has secured thereto a disc 43 (Figures 1 and 2) and is also provided with a cylindrical extension 44 in which is slidably mounted a pin 45. A spiral spring 46 fitted into the cylindrical extension presses the pin 45 to the right and when the frame is in a horizontal position this pin is pressed against a bolt 47 slidably mounted in a bore provided in the bracket 3. When the apparatus is closed, that is to say when the glass plate 28 rests on the cover 39 or on the interposed drawings or the like, a recessed portion 48 provided on the screw spindle 9^a is opposite the bolt 47. The depth of this recess and the length of the roller 47 are such that in the position shown in Figure 1, therefore when the apparatus is closed, the left hand end of the bolt 47 is flush with the left hand face of the bracket 3, that is to say does not project therefrom. In this position the frame 1 can be tilted. If however the screw spindles 9^a and 9^b have been raised, the recess 48, as shown in Figure 1, is no longer adjacent the bolt 47 and the latter is therefore pressed to the left by the screw spindle 9^a. The bolt will therefore partly engage with the bracket 3 and partly with the cylindrical extension 44 thus preventing the bracket 3 from being tilted. This arrangement is for the purpose of preventing the frame 2 from being raised from the frame 1 when the spindles are in an inclined position and would thus render the apparatus liable to be tipped over. The spindle 9^a can then only be moved from the position shown in Figure 1, when the bolt 47 has been moved outwardly by the spindle and this can only be effected when the frame 1 is in the horizontal position, as only in this position will the cylindrical extension 44 be opposite the bolt 47 and enable this to pass into the said extension 44.

When the apparatus is closed the frame 1 together with the frame 2 can be tilted about the pivots 4 in any suitable direction as then the centre of gravity of the frames coincides substantially with the axis of rotation of the pivots 4 so that the apparatus will not tip over. This tilting is necessary in order to enable the surface of the apparatus to be exposed to be set in a position according to the direction of the sun. In order to secure the apparatus in any desired tilted position the periphery of the disc 43 is provided with notches 49 (Figure 2) with which engages a roller 50 rotatably mounted in a guide member 51. The member 51 can slide freely up and down in a hollow casting 52 of a plate 53 which serves as a cover for the casing 13. The spiral spring 54 presses the roller 50 constantly against the periphery of the notched disc 43 or into the notches 49.

From the above description the manipulation of the apparatus will be readily understood. Assuming the apparatus is in the position shown in Figure 1. By suitably turning the crank 18 the nuts 10 will be rotated and thus the screw spindles 9^a and 9^b together with the frame 2 will be raised. The glass plate 28 is thus raised from the rubber cover 39 and the sensitized paper or the like can be placed on this. On the sensitized paper is then placed the drawing to be copied. In order that this operation may be effected more conveniently the frame 2 is tilted by tilting this on the pivots 20^a and 20^b. The frame is then held in the required tilted position by the engagement of the roller 23 between two adjacent projections 27. When the frame 2 is to be returned into its horizontal position then by applying pressure to the frame the roller 23 will be moved against the action of the spring 24 and will spring

over any projection until it engages with a recess corresponding with the horizontal position of the frame.

If the crank 18 is now turned in the opposite direction the screw spindles 9^a and 9^b together with the frame 2 will be lowered until the glass plate 28 comes into contact with the rubber cover 39 or the material which has been placed thereon. During the last portion of this movement the rod 35 has come into contact with the bracket 3 thus lifting the valve body 30 and the inner cup member 59 from the glass plate so that the air, which is still between the glass plate and the rubber cover, can be withdrawn through the opening 29 and the pipe 33.

In order to tilt the apparatus, which is now closed, fully towards the sun, the frame 1 is tilted in the desired direction and is secured in this position by the roller 50 which by reason of the action of the spring 54 engages with a corresponding recess 49 of the disc 43.

The screw thread of the screw spindles 9^a and 9^b is single threaded. Consequently the lifting and lowering device is self-locking, that is to say that the frame 2 cannot be lowered from its raised position by its own weight or by any other additional load and it cannot be raised from its lowered position. This arrangement has the advantage that separate locking means are not necessary and that the frame must retain the position imparted thereto by the rotation of the crank 18 until it is moved into a fresh position by rotating the crank in one direction or the other. The raised frame 2 therefore automatically remains in the raised position and when it has been brought by the rotation of the crank 18 so that its glass plate bears tightly upon the rubber cover it retains this position. If this automatic locking means were not available separate locking means would be necessary and it would be necessary to operate such means so that the manipulation of the apparatus would not be so simple.

In photo copying apparatus known hitherto the air is withdrawn through an opening in the rubber cover. The withdrawal of the air through an opening in the glass plate has the advantage that the formation of an air-tight joint with the valve casing is simpler and more effective than when it is applied to the yielding rubber cover. In addition there is better accommodation for the valve casing on the glass plate than on the rubber cover supported by a plate. Further the withdrawal of air through the pivot of the upper frame is more convenient and simpler. Of considerable importance is the automatic closing of the valve when the apparatus is open and the automatic opening of the valve when the apparatus closes, the operation being simpler because the valve is provided at the top and the opening to be closed is underneath it.

The auxiliary frame 38 is desirable and advantageous for the following reasons. If it is not provided then when the movement of the frame 2 from the frame 1 commences the glass plate is torn from the rubber cover 39 thus considerably damaging the latter. With the present arrangement however the auxiliary frame 38 first moves upwardly for a short distance with the frame 2 as the rubber cover still adheres to the glass plate 28 and is secured to the frame 38. By reason of the weight of the rubber cover and the auxiliary frame 38 to which it is connected this adhesion of the rubber cover to the glass plate is somewhat loosened and consequently air enters between them which separates the rubber cover from the glass plate smoothly so that the auxiliary frame 38 returns to the frame 1 whilst being guided by the pins 37.

By arranging the bell-shaped part 57 between the valve casing 32 and the screw sleeve 56 and if necessary forming the contacting surfaces of the sleeve 56 with the part 57 and of the part 57 with the casing 32 of spherical shape it is possible to adjust the casing relatively to the axis of the sleeve 56 and thus cause the edges of the double bell-shaped member 58, 59 to bear completely upon the glass plate even when the axis of the sleeve 56 is inclined to the glass plate. In this manner an efficient joint is obtained between the said edges and the glass plate.

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

1. Photo copying apparatus comprising a supporting structure, a frame mounted in said supporting structure, a rubber cover supported in said frame, a second frame mounted in said supporting structure, a transparent plate fitted in said second frame, said transparent plate having an opening therein, means for moving said frames towards and away from one another, said means serving to hold said frames when together and when separate, the edges of the rubber sheet being adapted to be pressed into close contact with the transparent plate so as to form an air tight joint between said rubber cover and said transparent plate, a valve casing with a valve seating fitted over said opening, said valve casing normally bearing on the transparent plate around said hole whilst the valve seating is opposite said opening but slightly removed therefrom, a valve body co-operating with said seat and slidably mounted therein said valve body being adapted to close and expose said opening, and a suction tube connected to said valve casing, said valve casing being adapted to form an air-tight joint with said transparent plate when the valve body exposes said opening.

2. Photo copying apparatus comprising a supporting structure, a frame mounted in said supporting structure, a rubber cover supported in said frame, a second frame mounted in said supporting structure, a transparent plate fitted in said second frame, said transparent plate having an opening therein, means for moving said frames towards and away from one another, said means serving to hold said frames when together and when separate, the edges of the rubber sheet being adapted to be pressed into close contact with the transparent plate so as to form an air tight joint between said rubber cover and said transparent plate, a valve casing with a valve seating fitted over said opening, said valve casing normally bearing on the transparent plate around said hole whilst the valve seating is opposite said opening but slightly removed therefrom, a valve body co-operating with said seat and slidably mounted therein said valve body being adapted to close and expose said opening, a suction tube connected to said valve casing, said valve casing being adapted to form an air-tight joint with said transparent plate when the valve body exposes said opening, and actuating mechanism for said valve body, the arrangement being such that when the said frames are moved towards one another the valve body exposes said opening whilst when the said frames are separated from one another said valve body closes said opening.

3. Photo copying apparatus comprising a supporting structure, a frame mounted in said supporting structure, a rubber cover supported in said frame, a second frame mounted in said supporting structure, a transparent plate fitted in said second frame, said transparent plate having an opening therein, means for moving said frames towards and away from one another, said means serving to hold said frames when together and when separate, the edges of the rubber sheet being adapted to be pressed into close contact with the transparent plate so as to form an air-tight joint between said rubber cover and said transparent plate, a valve fitted over said opening, a suction tube connected to said valve, and pivots secured to said second frame and revolubly mounted in said supporting structure, one of said pivots being hollow, said suction tube passing through said hollow pivot.

4. Photo copying apparatus comprising a supporting structure, two frames mounted in said supporting structure, a rubber cover secured to one of said frames, a glass plate fitted into the second frame, said glass plate having an opening therein, screw spindles non-rotatably engaging one of said frames, whilst the second frame is attached to said screw spindles, nuts through which said screw spindles pass, mechanism for rotating said nuts, whereby on the rotation of the nuts the spindles are simultaneously lowered in order to press the edges of the rubber cover into close contact with the glass plate adjacent the edges thereof so as to form an air-tight joint at all points of contact, and to raise the spindles, according to the direction of rotation of the nuts, and means connected to said opening adapted to withdraw the air through said opening from between the glass plate and the rubber cover.

5. Photo copying apparatus comprising a supporting structure, two frames mounted in said supporting structure, a rubber cover secured to one of said frames, a glass plate fitted into the second frame, said glass plate having an opening therein, single threaded screw spindles non-rotatably engaging one of said frames, pivots secured to the second frame, said pivots being revolubly mounted in said spindles, nuts rotatably mounted and engaged by said screw spindles, and mechanism for rotating said nuts simultaneously whereby on the rotation of the nuts in one direction the spindles are moved downwardly so as to lower the second frame upon the first frame in order to press the rubber cover against the glass plate into close contact with the glass plate adjacent the edges thereof at all points of contact simultaneously, and when the nuts are rotated in the opposite direction to raise the second frame from the first frame, the engagement between the spindles and nuts serving to retain them in their relative positions, and means connected to said opening adapted to withdraw the air through said opening from between the rubber cover and the glass plate.

6. Photo copying apparatus comprising a supporting structure, two frames mounted in said supporting structure, a rubber cover secured to one of said frames, a glass plate fitted into the second frame, said glass plate having an opening therein, screw spindles non-rotatably engaging one of said frames, whilst the second frame is attached to said screw spindles, nuts through which said screw spindles pass, mechanism for rotating said nuts, whereby on the rotation of the nuts the spindles are simultaneously lowered in order to press the edges of the rubber cover into close contact with the glass plate adjacent the edges thereof so as to form an air-tight joint at all points of contact, and to raise the spindles, according to the direction of rotation of the nuts, means connected to said opening adapted to withdraw the air through said opening from between the glass plate and the rubber cover, and means for locking the frame which is attached to the spindles in any desired position, in relation to said spindles, said means comprising an extension on one of said spindles, a spring actuated member carried by said extension, and a notched arc-shaped member

connected to said second frame, the spring actuated member being adapted to engage with said notches.

7. Photo copying apparatus comprising a supporting structure, two frames mounted in said supporting structure, a rubber cover secured to one of said frames, a glass plate fitted into the second frame, said glass plate having an opening therein, screw spindles non-rotatably engaging one of said frames, whilst the second frame is attached to said screw spindles, nuts through which said screw spindles pass, mechanism for rotating said nuts, whereby on the rotation of the nuts the spindles are simultaneously lowered in order to press the edges of the rubber cover into close contact with the glass plate adjacent the edges thereof so as to form an air-tight joint at all points of contact, and to raise the spindles, according to the direction of rotation of the nuts, means connected to said opening adapted to withdraw the air through said opening from between the glass plate and the rubber cover, a disc with a notched periphery secured to said supporting structure, and a spring actuated roller carried by one of the frames and adapted to co-operate with the notches in the disc for the purpose of retaining the frame in various inclined positions.

8. Photo copying apparatus comprising a supporting structure, two frames mounted in said supporting structure, a rubber cover secured to one of said frames, a glass plate fitted into the second frame, said glass plate having an opening therein, screw spindles non-rotatably engaging one of said frames, whilst the second frame is attached to said screw spindles, nuts through which said screw spindles pass, mechanism for rotating said nuts, whereby on the rotation of the nuts the spindles are simultaneously lowered in order to press the edges of the rubber cover into close contact with the glass plate adjacent the edges thereof so as to form an air-tight joint at all points of contact, and to raise the spindles, according to the direction of rotation of the nuts, means connected to said opening adapted to withdraw the air through said opening from between the glass plate and the rubber cover, an apertured disc carried by the supporting structure, a bolt slidably mounted in one of said frames, one of said screw spindles having a recess therein for co-operation with said bolt, a spring actuated locking pin being adapted to co-operate with said bolt, said locking pin being adapted normally to press the said bolt into engagement with the recess to permit of rotation of the frames, the arrangement being such that when the bolt is out of engagement with the recess it locks the frame to the disc and thus prevents the frame from being tilted.

9. Photo copying apparatus comprising a supporting structure, a frame mounted in said supporting structure, a rubber cover supported in said frame, a second frame mounted in said supporting structure, a transparent plate fitted in said second frame, said transparent plate having an opening therein, means for moving said frames towards and away from one another, said means serving to hold said frames when together and when separate, the edges of the rubber sheet being adapted to be pressed into close contact with the transparent plate so as to form an air-tight joint between said rubber cover and said transparent plate, a valve fitted over said opening, a suction tube connected to said valve, and mechanism for actuating said valve, said mechanism being such that it closes the valve after one of the frames has been raised a short distance and opens the valve to suction when the frames are brought together.

10. Photo copying apparatus comprising a supporting structure, a frame mounted in said supporting structure, a rubber cover supported in said frame, a second frame mounted in said supporting structure, a transparent plate fitted in said second frame, said transparent plate having an opening therein, means for moving said frames towards and away from one another, said means serving to hold said frames when together and when separate, the edges of the rubber sheet being adapted to be pressed into close contact with the transparent plate so as to form an air-tight joint between said rubber cover and said transparent plate, means connected to said opening, adapted to withdraw the air through said opening from between the rubber cover and the transparent plate, a supporting plate arranged underneath the first frame and adapted to support the rubber cover, and resilient supporting members on which said supporting plate is mounted.

11. Photo copying apparatus comprising a supporting structure, a frame mounted in said supporting structure, a rubber cover supported in said frame, a second frame mounted in said supporting structure, a transparent plate fitted in said second frame, said transparent plate having an opening therein, means for moving said frames towards and away from one another, said means serving to hold said frames when together and when separate, the edges of the rubber sheet being adapted to be pressed into close contact with the transparent plate so as to form an air-tight joint between said rubber cover and said transparent plate, means connected to said opening, adapted to withdraw the air through said opening from between the rubber cover and the transparent plate, and an auxiliary frame mounted in the first frame, said auxiliary frame having the rubber cover attached thereto.

12. Photo copying apparatus comprising a supporting structure, a frame mounted in said supporting structure, a rubber cover sup-

ported in said frame, a second frame mounted in said supporting structure, a transparent plate fitted in said second frame, said transparent plate having an opening therein, means for moving said frames towards and away from one another, said means serving to hold said frames when together and when separate, the edges of the rubber sheet being adapted to be pressed into close contact with the transparent plate so as to form an air-tight joint between said rubber cover and said transparent plate, means connected to said opening, adapted to withdraw the air through said opening from between the rubber cover and the transparent plate, and an auxiliary frame mounted in the first mentioned frame, and means for guiding the auxiliary frame relatively to the first frame whereby the auxiliary frame is free to follow a portion of the movement of the second frame.

WERNER SACK.