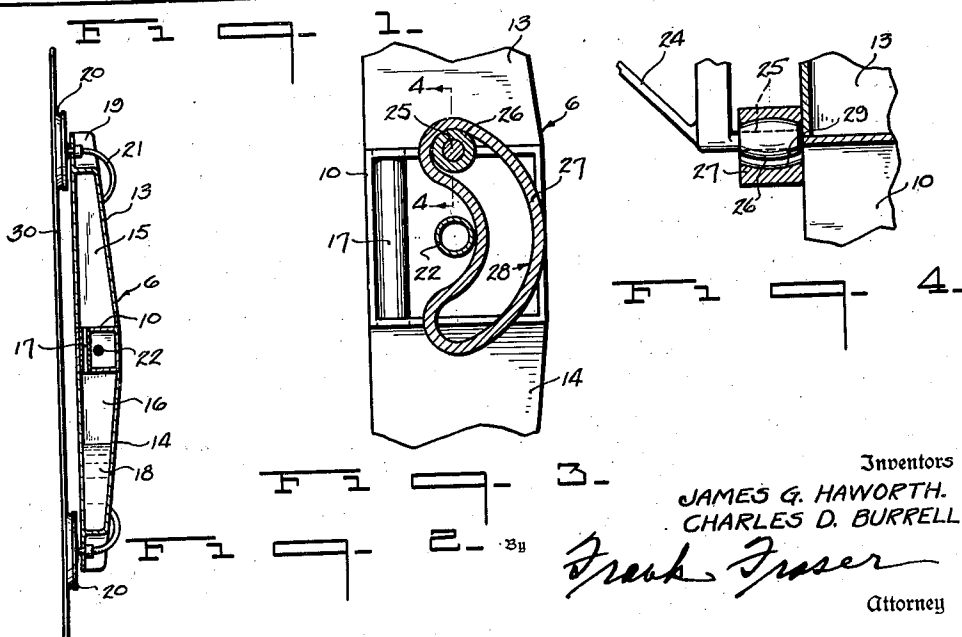
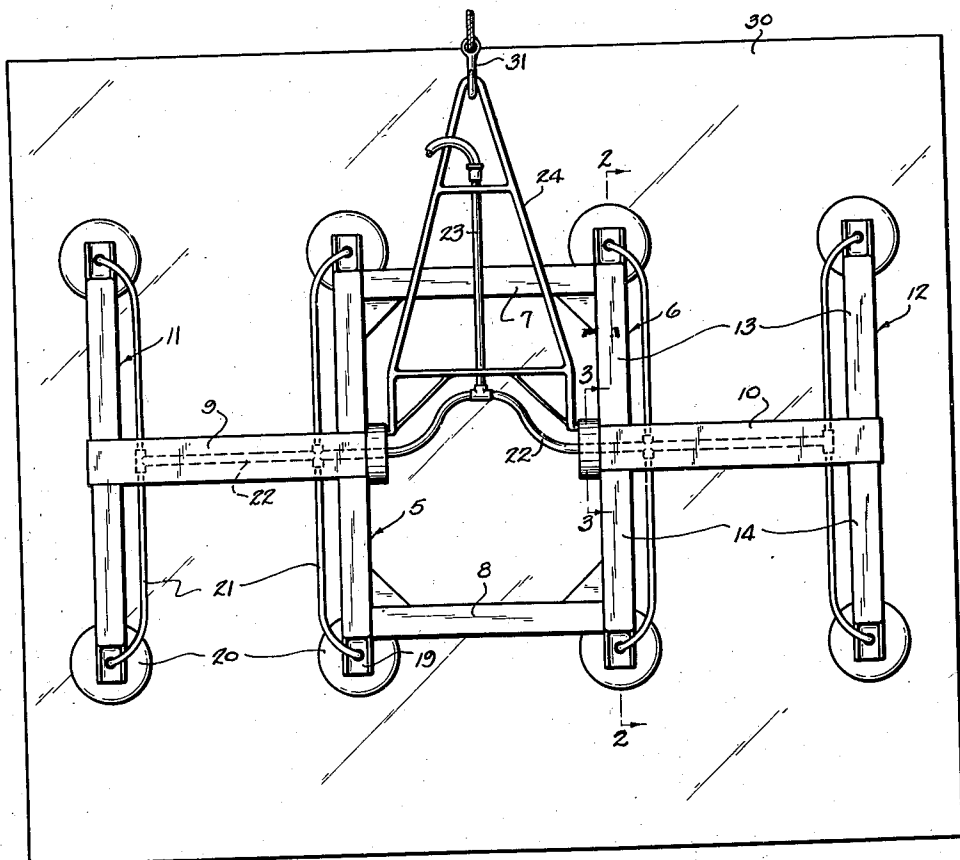


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SHEET GLASS HANDLING APPARATUS

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SHEET GLASS HANDLING APPARATUS

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14 Claims. (Cl. 294—65)

The present invention relates broadly to apparatus for handling sheet material and more particularly to an improved type of lifting vacuum frame.

5 The invention is of utility in the transferring of glass sheets from one location to another, especially during the grinding, polishing and subsequent handling thereof, including the washing, cleaning and inspection operations, although it
10 may obviously be employed for many other purposes in this as well as in other arts.

It is the primary object of this invention to provide a vacuum frame of improved construction whereby the handling and transfer of glass sheets
15 from one location to another may be greatly facilitated and expedited.

Another object of the invention is the provision of a vacuum frame of reversible construction in that the position of the glass sheets carried thereby can be readily and conveniently reversed by simply turning the said frame about
a horizontal axis.

Other objects and advantages of the invention will become more apparent during the course of the following description, when taken in connection with the accompanying drawing.

In the drawing, wherein like numerals are employed to designate like parts throughout the same:

Fig. 1 shows, in elevation, a vacuum frame constructed in accordance with the present invention;

Fig. 2 is a sectional view taken substantially on line 2—2 of Fig. 1;

Fig. 3 is a sectional view taken substantially on line 3—3 of Fig. 1; and

Fig. 4 is a detail sectional view taken substantially on line 4—4 of Fig. 3.

In the embodiment illustrated in the drawing, the vacuum frame comprises a pair of spaced parallel arms 5 and 6 which are connected together adjacent their opposite ends by the cross bars 7 and 8. Carried by the arms 5 and 6, intermediate the ends thereof, and extending outwardly at right angles with respect thereto, are the tubular members 9 and 10 respectively, substantially rectangular in cross section, and carrying at their outer ends arms 11 and 12, similar to and arranged parallel with the arms 5 and 6.

Each of the arms 5, 6, 11, and 12 consists, in effect, of two sections 13 and 14 arranged in alignment with one another and welded or otherwise suitably secured at their inner ends to the opposite sides of the respective tubular member
9 or 10 which is received therebetween. The sec-

tions 13 and 14 are hollow or of tubular construction, as shown in Fig. 2, to provide the chambers 15 and 16 respectively. The chambers 15 and 16 are suitably closed at their outer ends, while the inner ends thereof communicate
5 with one another by means of a pipe or opening 17 carried by or formed in the respective tubular member 9 or 10. The arms 5, 6, 11, and 12 are each adapted to contain a supply of mercury or other suitable liquid indicated at 18 and the pipe
10 or opening 17 is provided to permit the liquid to flow from one chamber to the other when the vacuum frame is turned over or reversed, the liquid serving as a counter-balance to maintain the vacuum frame normally in a substantially
15 vertical position.

Each of the arms 5, 6, 11, and 12 is also provided at each end thereof with an extension 19 and carried by said extensions are the sheet holding members 20 preferably in the form of suction
20 devices or cups. Communicating with the interior of each suction cup is a vacuum or suction tube 21, which tubes may all be conveniently connected with a conduit 22, in turn connected with a pipe 23 having connection with a suitable
25 suction creating device (not shown). The suction pipe 23 may be carried by the ball or hanger 24 for the vacuum frame, said hanger being substantially triangular and provided at its lower end with outwardly extending substantially
30 horizontal trunnions 25 upon which are mounted the freely rotatable rollers 26.

Carried upon the inner side of each of the arms 5 and 6 is a cam member 27 having a substantially arcuate shaped, closed, internal cam-
35 way 28 within which is received the respective trunnion 25 and roller 26. As shown in Fig. 4, the rollers 26 are longitudinally convex or, in other words, are of the greatest diameter at the centers and gradually taper toward their opposite
40 ends, while the inner faces of the walls of the cam-way 28 are correspondingly concave as indicated at 29. The cam-way 28 is of such shape and size as to permit of a complete turning over or reversal of the vacuum frame through approximately
45 180° about a horizontal axis. When this is done, the hanger 24 and trunnions 25 remain stationary while the cams 27 are turned with the frame causing the cam-ways 28 to ride over the rollers 26.

When it is desired to transfer and reverse the position of a glass sheet, the vacuum frame is first moved to engage the sheet which is shown
50 at 30. The suction means is then operated to create a suction within the suction cups 20 so as to

firmly attach the glass sheets thereto. After the desired vacuum has been set up, the frame may be raised to lift the glass sheet upwardly. The vacuum frame may be suspended from a hook or the like 31 carried by an overhead crane and by means of said overhead crane, the glass sheet can be transferred to any desired location. During the transfer of the sheet, the vacuum frame is maintained in a vertical position by the liquid 18 contained in the arms 5, 6, 11, and 12. In reversing the position of the sheet or, in other words, turning it over so that it faces in the opposite direction, it is simply necessary to swing the vacuum frame horizontally through 180°, whereupon the cam-ways 28 will move over the rollers 26 as explained above. Simultaneously, the liquid 18 will flow from the chambers 16 into the chambers 15 of the arms or vice versa through the pipes 17 to counter-balance the frame and maintain it in reversed substantially vertical position. When the glass sheet 30 has been transferred to the desired location, the suction within the suction cups 18 is released so that the vacuum frame can be removed.

It is to be understood that the form of the invention herewith shown and described is to be taken as the preferred embodiment of the same, and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

We claim:

1. In a sheet lifting frame of the character described, a plurality of substantially parallel arms connected together, suction devices carried thereby and adapted to engage and lift said sheet, a vertical hanger, and means for mounting said arms intermediate their ends upon the lower end of said hanger so that they can be turned vertically about a horizontal axis through approximately 180°.

2. In a sheet lifting frame of the character described, a plurality of substantially parallel arms connected together, suction devices carried thereby and adapted to engage and lift said sheet, a hanger, cam means for swingably supporting said arms upon said hanger so that they can be turned vertically about a horizontal axis through approximately 180°, and means for normally maintaining said arms in a substantially vertical position.

3. In a sheet lifting frame of the character described, a plurality of substantially parallel arms connected together, suction devices carried thereby and adapted to engage and lift said sheet, a hanger, and cam members carried by certain of said arms and engaging said hanger so that the said arms can be turned vertically about a horizontal axis through approximately 180°.

4. In a sheet lifting frame of the character described, a plurality of substantially parallel arms connected together, suction devices carried thereby and adapted to engage and lift said sheet, a hanger having oppositely disposed, outwardly extending trunnions, rollers carried by said trunnions, and cam members carried by certain of said arms and supported by said trunnions so that the said arms can be turned vertically about a horizontal axis through approximately 180°.

5. In a sheet lifting frame of the character described, a plurality of substantially parallel arms connected together, suction devices carried thereby and adapted to engage and lift said sheet, a hanger provided with oppositely disposed, outwardly extending trunnions, rollers carried by

said trunnions, and cam members having arcuate shaped, closed internal cam-ways for receiving the rollers and trunnions therein, said cam-ways riding over said rollers upon swinging of said arms about a horizontal axis.

6. In a sheet lifting frame of the character described, a plurality of substantially parallel arms connected together, suction devices carried thereby and adapted to engage and lift said sheet, a hanger provided with oppositely disposed, outwardly extending trunnions, rollers carried by said trunnions, and cam members having arcuate shaped, closed internal cam-ways for receiving the rollers and trunnions therein, said cam-ways riding over said rollers upon swinging of said arms about a horizontal axis, the said rollers being of greatest diameter at their centers and gradually tapering toward their opposite ends, while the inner faces of the walls of said cam-ways are correspondingly concave.

7. In a sheet lifting frame of the character described, a plurality of substantially parallel arms connected together, suction devices carried thereby and adapted to engage and lift said sheet, means for mounting said arms so that they can be turned vertically about a horizontal axis through approximately 180°, said arms being hollow, and a liquid contained in the said arms acting as a counter-balance to normally maintain the arms in substantially vertical position.

8. In a sheet lifting frame of the character described, a plurality of substantially parallel arms connected together, suction devices carried thereby and adapted to engage and lift said sheet, means for mounting said arms so that they can be turned vertically about a horizontal axis through approximately 180°, said arms being hollow and each having spaced chambers communicating with one another at their inner ends, and a liquid contained in said arms acting as a counter-balance and adapted to flow from one chamber to another to normally maintain the said arms in a substantially vertical position.

9. In a sheet lifting frame of the character described, a plurality of substantially parallel arms connected together, suction devices carried thereby and adapted to engage and lift said sheet, a hanger, cam members carried by certain of said arms and engaging said hanger so that the said arms can be turned vertically about a horizontal axis through approximately 180°, said arms being hollow, and a liquid contained in the said arms acting as a counter-balance to normally maintain the arms in a substantially vertical position.

10. In a sheet lifting frame of the character described, a plurality of substantially parallel arms connected together, suction devices carried thereby and adapted to engage and lift said sheet, a hanger having oppositely disposed, outwardly extending trunnions, rollers carried by said trunnions, cam members carried by certain of said arms and supported by said trunnions so that the said arms can be turned vertically about a horizontal axis through approximately 180°, said arms being hollow and each having spaced chambers communicating with one another at their inner ends, and a liquid contained in said arms acting as a counter-balance and adapted to flow from one chamber to another to normally maintain the said arms in a substantially vertical position.

11. In a sheet lifting frame of the character described, a plurality of substantially parallel arms connected together, suction devices carried thereby and adapted to engage and lift said sheet,

a hanger having oppositely disposed, outwardly extending trunnions, and cam members carried by certain of said arms and supported by said trunnions so that the said arms can be turned 5 vertically about a horizontal axis through approximately 180 degrees.

12. In a sheet lifting frame of the character described, a plurality of substantially parallel arms connected together, suction devices carried 10 thereby and adapted to engage and lift said sheet, a hanger having oppositely disposed, outwardly extending trunnions, and cam members having arcuately shaped, closed internal cam-ways for receiving the trunnions therein, said cam-ways 15 riding over said trunnions upon swinging of said arms about a horizontal axis.

13. In a sheet lifting frame of the character described, a plurality of substantially parallel arms connected together, suction devices carried

thereby and adapted to engage and lift said sheet, a hanger, and means carried by certain of said arms and loosely engaging said hanger so that the said arms can be turned vertically about a horizontal axis through approximately 180 de- 5 grees relative to said hanger.

14. In a sheet lifting frame of the character described, a plurality of substantially parallel arms connected together, suction devices carried 10 thereby and adapted to engage and lift said sheet, a hanger having oppositely disposed, outwardly extending trunnions, and members carried by certain of said arms and loosely engaging and supported by said trunnions so that the said 15 arms can be turned vertically about a horizontal axis through approximately 180 degrees relative to said hanger.

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