

Aug. 28, 1962

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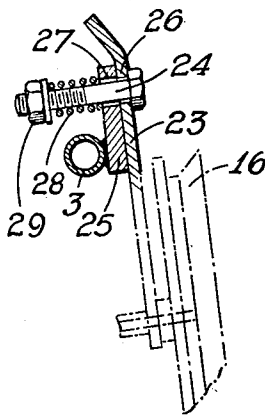
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DEVICE FOR HANDLING SHEET MATERIAL

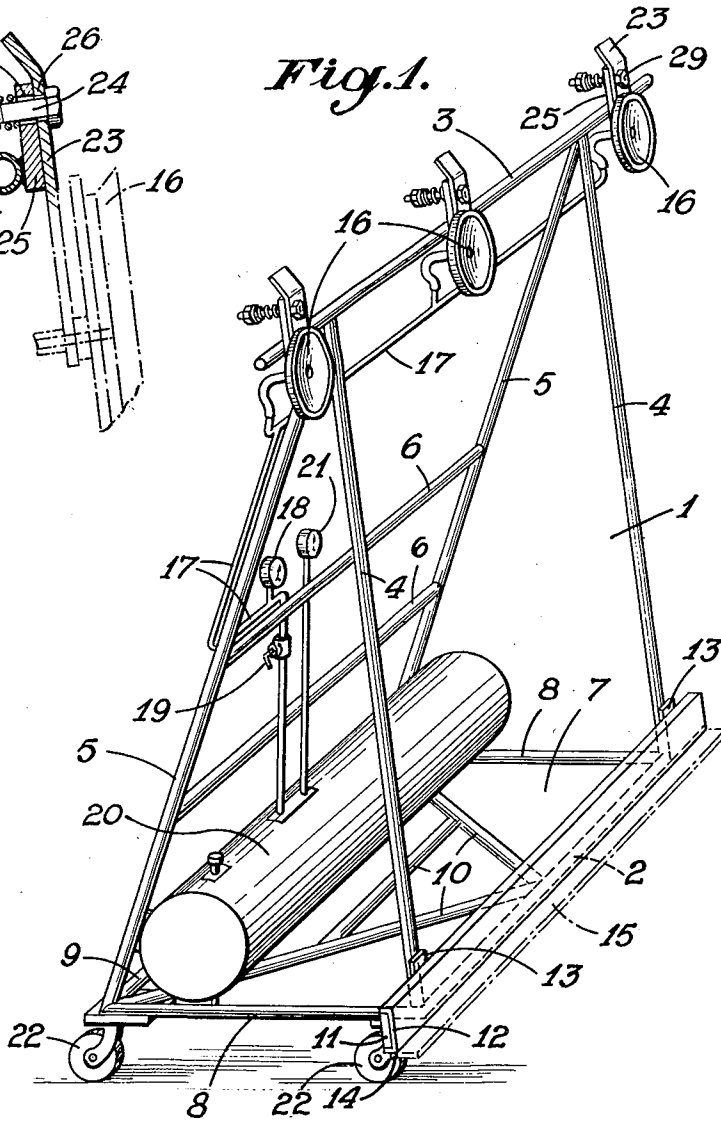
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2 Sheets-Sheet 1

*Fig. 2.*



*Fig. 1.*



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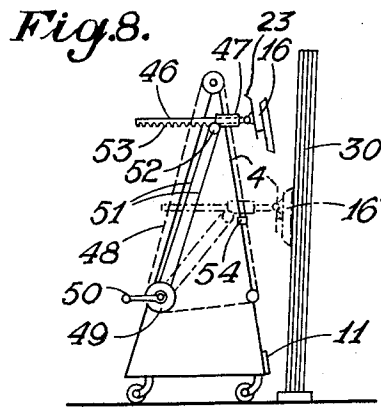
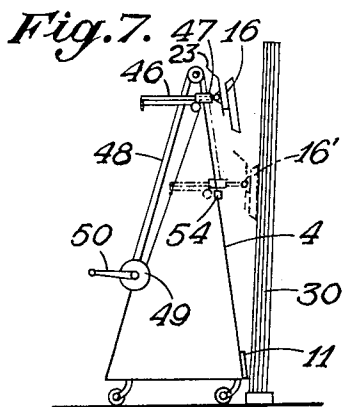
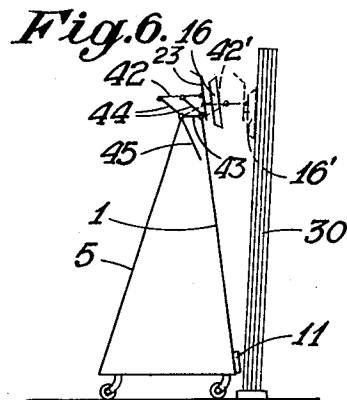
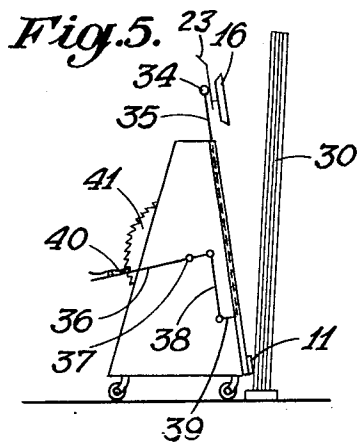
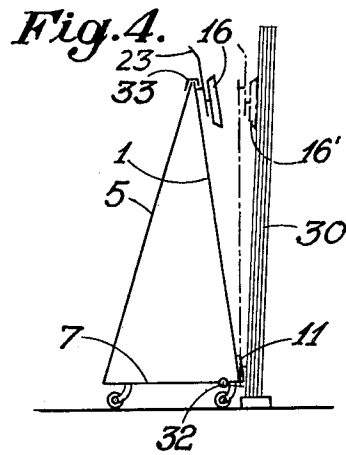
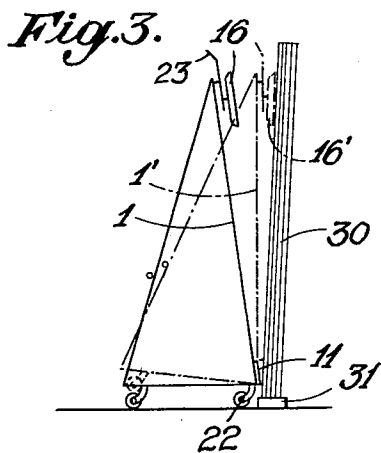
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DEVICE FOR HANDLING SHEET MATERIAL

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2 Sheets-Sheet 2



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3,051,331

**DEVICE FOR HANDLING SHEET MATERIAL**  
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 Claims priority, application Belgium Dec. 18, 1958  
 11 Claims. (Cl. 214—1)

The handling of materials in the form of sheets of large dimensions, such as sheet or plate glass, in workshops in which they are cut, finished and otherwise worked, is at present effected either manually, for example by means of manually operated suction members, or mechanically with the aid of suction members or clips suspended from the pulley tackle of a monorail or of a travelling crane. The manual movement of the sheets is laborious and, in the case of glass, involves danger of breakage and serious danger of injury to the workmen. In addition, it is limited by the weight of the sheets. The freedom of handling by means of the pulley tackle is determined by the track of the lifting gear and is consequently limited.

The handling device according to the invention is a horse comprising a slightly inclined face, suction members disposed substantially in the plane of the said face, and means which make it possible, with the aid of the suction members, to grip a sheet, to apply it and maintain it against the inclined face of the horse, and also to transport and deposit the sheet and to rest it against a vertical or slightly inclined support.

The horse is of relatively low cost and makes it possible to take a sheet of any weight, to tilt it, to lift it and to place it on the horse without compromising the balance of the latter, while requiring only a small amount of labour. The danger of breakage is eliminated, as also is the risk of serious injury to the staff. Since the horse is a travelling device, the movement can be effected without limitation and without any accessory device, and it can reach workshops in which there is no lifting gear. If desired, suspension rings may be provided to move it by means of a lifting gear.

The inclined face of the horse advantageously consists of a frame provided at the bottom with a horizontal bar against which the sheet to be moved rests, and provided at the top with suction devices, the said frame being mounted on the front edge of a frame constituting the base of the horse and being supported by a frame which is fixed on the rear edge of the base and preferably disposed at a greater inclination than the inclined face.

The horse is so designed that its inclined face can carry out a tilting movement about an axis extending in a vertical plane set back from the horizontal bar against which the sheet rests, this tilting movement permitting of establishing contact between the sheet to be moved and the suction members, of removing the sheet from the ground on which it is disposed on edge, and of depositing the moved sheet on the ground and withdrawing the suction members. For this purpose, the frame constituting the inclined face is either pivotally mounted on the frame constituting the base of the horse and provided with an engagement device by which it is made fast with the supporting frame during the movement of the horse, or rigidly connected to the frame constituting the base and the strut, the tilting movement of the inclined face then being effected by pivoting of the horse about the tilting axis of the frame constituting the inclined face.

The frame constituting the base of the horse is preferably mounted on steerable wheels, and when the whole horse is intended to be tilted the wheels close to the forward edge of the frame constituting the base are so disposed that, at the instant of the pivoting of the horse, their axes are situated approximately along the tilting axis of the frame constituting the inclined face.

The suction members are so orientable that they can be applied to the sheet to be gripped and follow the inclinations successively undergone thereby during the handling operations. The said suction members are resiliently mounted on the upper part of the inclined face, either on the bar forming the upper edge of the frame constituting the said face or on a horizontal bar which is fast with bars sliding in the uprights of the frame and provided with a mechanism for adjusting the height of the bar in the inclined face, so that on the one hand the positioning of the suction members can be adapted to the dimensions of the sheets, while on the other hand the sheet can be lifted from the ground by actuating the mechanism. The latter advantageously consists of a lever which controls the bars sliding in the uprights of the frame and which is fixed in the desired position by a pawl and toothed sector mechanism.

Instead of being resiliently secured to a horizontal bar, the suction members may be mounted on rods adapted to be moved in such manner that the suction members move downwards and towards the sheet to grip it, rise and move into the plane of the inclined face in order to maintain the sheet therein during the movement of the horse, whereafter they carry out the same movements in the opposite direction in order to deposit the sheet on the ground and to rest it against a vertical or slightly inclined support. For this purpose, the rods supporting the suction members may, for example, form part of a deformable parallelogram and constitute the arm opposite to an arm fixed to the top of the horse, one of the tilting arms being advantageously extended to form the lever controlling the deformation of the parallelogram. The said rods may also slide each in one guide mounted on the frame constituting the inclined face and be displaced by means of a cable wound on a drum actuated by a crank or by equivalent means.

The horses provided with horizontally movable suction members afford the particular advantage that they can maintain the sheet in a vertical position, whether or not resting on the ground, so that it is possible to examine the sheet and if desired to subject it to a treatment operation, such as cleaning, either before it is loaded on to the horse or before it is rested against a fixed support.

The guides in which the rods of the suction members slide may themselves be movable along the uprights of the frame constituting the inclined face, which movement may be controlled, for example, by a cable wound on a drum actuated by a crank. In this case, the cables controlling the movement of the rods supporting the suction members and the displacement of the guides in which the said rods slide are advantageously wound on the same drum, which is actuated by the crank in such manner that, when the drum turns in one direction, the suction members move away from the inclined face and travel downwards, and that when the drum is turned in the other direction the suction members move towards the inclined face and travel upwards.

In accordance with the invention, the horse comprises a device for actuating the suction members while they are applied against the sheet. This device may be a vacuum pump controlled manually or by a driving horse or, preferably, a vacuum reservoir mounted on the frame constituting the base of the horse, the reservoir being periodically connected to a vacuum source.

The accompanying drawings illustrate by way of example a number of embodiments of the invention.

FIGURE 1 is a view in perspective of a sheet handling horse;

FIGURE 2 shows the details of the mounting of a suction device, and

FIGURES 3 to 8 are diagrammatic views of various constructional forms of the horse.

The horse consists of an assemblage of bars consisting of any appropriate material, for example metal. The said bars are preferably tubes, which are advantageously welded at the intersections.

As will be seen from FIGURE 1, the inclined face is a frame 1 formed of horizontal bars 2 and 3 and uprights 4. The said frame is supported by struts 5 with cross-members 6, and is mounted on a horizontal frame 7 constituting the base of the horse and formed of the bars 2, 8 and 9 of the cross-members 10. A horizontal bar 11, preferably a rail covered with a layer of felt or like material 12, is fixed to the bottom of the frame 1, for example by flat irons 13. There may be pivotally mounted on the lower edge of the bar 11 by means of hinges 14 a raisable bracket 15 intended to retain the sheet resting against the bar 11 on the frame 1 at a distance from the ground in the event of failure of the suction members 16 mounted on the bar 3. The suction members are connected by ducts 17, in which are provided a vacuum gauge 18 and a valve 19, to a vacuum reservoir 20 mounted on the frame 7. When the manometer 21 indicates that the vacuum in the reservoir has become insufficient to ensure good operation of the suction members, the horse is moved towards a stationary vacuum pump. When it is desired to render the horse completely independent, there may be mounted thereon, in place of the reservoir 20, a manually operated vacuum pump, for example a reservoir with a diaphragm operated by a small lever or by a driving force, for example a petrol engine or an electric motor fed by an accumulator battery, or by any other source of energy.

The base 7 is preferably mounted on steerable wheels 22, of which those situated closer to the bar 11 are so arranged that at the instant when the horse is positioned in front of a sheet to be loaded their axles are situated in a vertical plane situated behind the said bar.

The suction devices 16 must be steerable in order that they may take the inclination of the sheet to be gripped and follow the various inclinations of the latter during the loading and unloading operations. For this purpose, they may be mounted on swivel joints or knuckle joints. In addition, the suction members must correctly align themselves in the plane of the sheet in contact with the latter. For this purpose, the swivel joints or knuckle joints on which the suction devices are mounted are secured to a metal strip 23 (FIGURE 2) resiliently pressed by the bolt head 24 against a flat iron 25 welded to the bar 3. Since, on the one hand, sufficient clearance is provided between the shank of the bolt 24 and the perforations 26 and 27, while on the other hand a spring 28 in compression is threaded on to the said shank between the member 25 and the nut 29, the suction devices 16 will align themselves perfectly along the plane of the sheet when they come into contact with the latter.

In order to grip a sheet 30 (FIGURE 3) the horse is placed in front of the said sheet, is advanced until the layer of felt 12 on the bar 11 comes into contact with the sheet, and is tilted on the front wheels 22 to enable the suction devices in the position 16' to bear against the sheet. The vacuum is then set up in the suction devices by opening the valve 19, and when they have become fixed to the sheet the horse is returned to the normal position. The sheet is obliged to follow this tilting movement, whereby it is raised, by virtue of the fact that the tilting axis is situated in a vertical plane set back from the bar 11. The sheet resting against the said bar is maintained in the raised position by the suction devices in a plane parallel to the frame 1, and ready to be moved together with the horse, the stable equilibrium of which is not affected by the load. In order to unload the sheet, the horse is tilted until the sheet comes into contact with the ground or rests on a base 31, the sheet is rested against a support and the vacuum in the duct 17 is interrupted in order to detach the suction members from the sheet and to return the horse to the normal position.

In a particular constructional form of the horse, the frame 1 alone is adapted to be tilted by pin-jointing it at 32 (FIGURE 4) to the horizontal frame 7 at the point of intersection of the same frame with the vertical plane set back from the bar 11. An engagement device 33 mounted at the top of the horse makes the frame 1 fast with the struts 5 fixed to the horizontal frame and an adequate device (not shown in the figure), for example a set of levers, serves to manipulate the frame rocking on the horse.

In order to adapt the horse for handling sheets whose dimensions vary considerably from one case to the other, the suction devices may be made vertically movable. In the case of FIGURE 5, the suction devices are mounted on a horizontal bar 34 (FIGURE 5) fast with rods or tubes 35 sliding in the uprights 4 of the frame constituting the inclined face of the horse. The height of the suction devices 16 may be adjusted, for example, by means of a lever 36 pivotally mounted at 37 and connected on the one hand by a link 38 to a pin 39 fixed on the rods 35 and sliding in a longitudinal slot in the uprights 4, and provided on the other hand with a pawl 40 engaging in a toothed sector 41. The horse diagrammatically illustrated in FIGURE 5 is adapted to tilt in the same manner as that of FIGURE 3, but as compared with the latter and with that illustrated in FIGURE 4 it has the advantage that the sheet can be lifted from the ground to the desired height, independently of the positioning of the tilting axis in a vertical plane set back from the horizontal bar 11.

In the constructional forms illustrated in FIGURES 6, 7 and 8, the suction devices are so mounted that they can simultaneously move forwards out of the plane of the inclined face and be lowered so as to grip the sheet to be moved, whereafter they can be raised and brought with the gripped sheet into the plane of the inclined face without the horse having to be tilted.

In accordance with FIGURE 6, the suction devices are mounted on the arm 42 of a deformable parallelogram, the opposite arm 43 of which is fixed to the top of the horse between the frame 1 and the struts 5, and at least one of the rockable arm 44 of which is extended downwards to form a lever 45 controlled by an appropriate mechanism not illustrated in the drawing to actuate the deformable parallelogram for the purpose of advancing the suction devices 16 towards the position 16' when the arm 42 reaches the position 42'.

The constructional forms according to FIGURES 7 and 8 comprise suction devices mounted on a rod 46 sliding in a guide 47 which is adapted to be moved along the uprights 4 either downwards or upwards by means of a cable or chain 48 winding on to or passing around a drum 49. Depending upon the direction of rotation imparted to the crank 50 controlling the drum 49, the movement of the cable or the chain advances and lowers the suction devices 16 from the normal position to the position 16' and thereafter causes them to return to the normal position. In FIGURE 8, the cable or chain 48 controls only the sliding of the guide 47 on the upright 4, and a second cable or chain 51 is provided to act on the rod 46 through the pulley 52 fast with a pinion engaging with the toothed rack 53 provided on the rod 46. The cables or chains 51 may be wound around or passed over the same drum 49 controlling the cables or chains 48, and a stop 54 is provided on the uprights 4 to limit the sliding of the guide 47 in the downward direction.

Naturally, the invention is not limited to the embodiments which have been described and illustrated by way of example, and modifications may be made thereto without departing from its scope.

I claim:

1. A movable hand truck for handling and transporting sheet material, such as sheet or plate glass, comprising a frame, a resting bar mounted on said frame in spaced, horizontal relation above the ground so as to be

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engaged by the bottom portion of the inner face surface of a sheet of material above the bottom edge thereof when such sheet is carried by said truck, a plurality of sheet supporting vacuum cups mounted on said truck at a substantial distance above said resting bar for supporting a sheet in depending relation against vertical movement, means yieldably supporting said vacuum cups enabling them to so carry such sheet that the weight of the latter will cause such bottom portion of the inner face surface of said sheet to bear against said rest bar, said vacuum cup supporting means being adapted to be moved to advance said vacuum cups forwardly to a position in front of said rest bar and into engagement with such inner face surface of a sheet of material standing vertically on edge before said resting bar and in such engagement enabling said vacuum cups to yield so as to come into proper bearing relation against the upper portion of such inner face surface of the sheet, and to retract said vacuum cups with the sheet of material secured thereto against vertical movement to a position in rear of said resting bar and so that in such retracting movement of said cups, the sheet of material will be lifted and the vacuum cups by the weight of said lifted sheet will yield to enable the bottom portion of such inner face surface to bear against said resting bar, so that in the retracted position of said vacuum cups said sheet will be entirely supported against vertical movement by said vacuum cups and held in upwardly inclined relation by said engagement of said vacuum cups and said resting bar with such inner surface thereof, and means on said truck for providing sufficient vacuum pressure to said vacuum cups to enable them to support the entire weight of a sheet of material against vertical movement.

2. A movable hand truck such as defined in claim 1, in which said means for movably supporting said vacuum cups includes resilient means arranged to dampen the contact of said cups with a sheet of material to be gripped.

3. A movable hand truck such as defined in claim 1, in which said vacuum cup mounting means comprises means slidably mounted on said upright frame for movement vertically relative thereto, said vacuum cups being mounted on said slidable means, and mechanisms for adjusting said slidable means to adjust the height of said vacuum cups on said frame.

4. A movable hand truck such as defined in claim 3, in which said slidable means comprises vacuum cup supporting slide bars, and in which said adjusting mechanism includes a member connected to said slide bars and operable to vary the positions of the latter on said frame, and means for detachably securing said member in an adjusted position.

5. A movable hand truck such as defined in claim 1, in which said vacuum cup mounting means comprises a mounting for each of said vacuum cups, means mounted on said upright frame for moving said mountings and therefore said vacuum cups, in forward and rearward directions relative to said frame, and means for operating said moving means.

6. A movable hand truck such as defined in claim 1, in which said vacuum cup mounting means comprises a mounting for each of said vacuum cups, means mounted on said upright frame for moving said mountings and therefore said vacuum cups, in forward and rearward directions and vertically relative to said frame, and means for operating said moving means.

7. A movable hand truck such as defined in claim 6, in which said moving means includes separate means for moving said mountings in forward and rearward directions and separate means for moving said mountings vertically, said operating means controlling the operation of both said separate means.

8. A movable hand truck for handling and transporting sheet material, such as sheet or plate glass, comprising a resting bar mounted on said truck in spaced, horizontal relation above the ground so as to be engaged by the bottom portion of the inner face surface of a sheet of mate-

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rial above the bottom edge thereof when such sheet is carried by said truck, an upright frame rising upwardly from said resting bar, a plurality of sheet supporting vacuum cups, means for mounting said cups on said frame at a substantial distance above said resting bar and yieldably supporting the same to enable said cups to so carry said sheet that the weight of the latter will cause said sheet surface to bear against said resting bar, means supporting said frame for pivotal movement about a horizontal axis parallel to said resting bar and enabling said frame to be pivoted forwardly to advance said vacuum cups to a position in front of said resting bar and into engagement with such inner face surface of a sheet of material standing vertically on edge before said resting bar, said yieldable mounting means in such engagement enabling said vacuum cups to yield so as to come into proper bearing relation against the upper portion of said inner face surface of the sheet, and said pivotal supporting means enabling said frame to be pivoted from such forward position to a retracted position to retract said vacuum cups with the sheet of material secured thereto to a position in rear of said resting bar and so that in such retracting movement of said cups, the sheet of material will be lifted and the vacuum cups by the weight of said lifted sheet will yield to enable the bottom portion of such inner face surface to bear against said resting bar, so that in the retracted position of said vacuum cups said sheet will be entirely supported against vertical movement by said vacuum cups and held in upwardly inclined relation by said engagement of said vacuum cups and said resting bar with such inner surface thereof, and means on said truck for providing sufficient vacuum pressure to said vacuum cups to enable them to support the entire weight of a sheet of material against vertical movement.

9. A movable hand truck such as defined in claim 8, including means for securing said frame in retracted position during the movement of the truck.

10. A movable hand truck for handling and transporting sheet material, such as sheet or plate glass, comprising an upright frame, a resting bar mounted on the bottom portion of said frame in spaced, horizontal relation above the ground so as to be engaged by the bottom portion of the inner face surface of a sheet of material above the bottom edge thereof when such sheet is carried by said truck, a plurality of sheet supporting vacuum cups mounted on said frame at a substantial distance above said resting bar for supporting a sheet in depending relation against vertical movement, means yieldably mounting said vacuum cups on a horizontal cross bar of said frame and enabling such cups to so carry such sheet that the weight of the latter will cause such inner sheet surface to bear against said resting bar, means supporting said frame for pivotal movement about a horizontal axis parallel to said resting bar and located rearwardly of said bar so that when said frame is tilted forwardly about said axis said resting bar will move forwardly and downwardly until said vacuum cups come into engagement with such inner face surface of a sheet of material standing vertically on edge before said resting bar, said yieldable mounting means in such engagement enabling said vacuum cups to yield so as to come into proper bearing relation against the upper portion of such inner face surface of the sheet and so that when said frame is tilted from such forward position to a retracted position in which such frame is inclined to the vertical, said frame will move upwardly in a lifting movement to cause the vacuum cups to lift the sheet of material secured thereto against vertical movement, the vacuum cups in such lifting movement and because of the weight of such lifted sheet, yielding to enable such inner sheet surface to bear against said resting bar, said lifting movement continuing to bring the sheet into an inclined position in which the raised upper portion of the sheet will be located to the rear of said resting bar, and the raised bottom inner surface of said sheet will be resting against said resting bar, and means on said truck for providing

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sufficient vacuum pressure to said vacuum cups to enable them to support the entire weight of a sheet of material against vertical movement.

11. A movable hand truck for handling and transporting sheet material, such as sheet or plate glass, comprising an upright frame slightly inclined with respect to the vertical and having its lower end extending along one edge of the truck in spaced horizontal relation above the ground, a horizontal resting bar mounted on the lower end of said frame and protruding outwardly from said edge so as to provide a rest for the bottom portion of the inner face surface of a sheet of material above the bottom edge thereof when such sheet is carried by said truck, a plurality of sheet supporting vacuum cups mounted on said frame at a substantial distance above said resting bar for supporting a sheet in depending relation against vertical movement, means yieldably mounting said cups on said frame in substantially horizontally aligned relation and enabling said cups to so carry such sheet that the weight of the latter will cause such inner sheet surface to bear against said resting bar, means providing for said truck and said frame thereof a horizontal tilting axis which is parallel with respect to said resting bar and located below said resting bar and between said bar and the middle of the truck so that when said truck is tilted forwardly about said axis to bring said frame to a vertical position, said resting bar will move forwardly and downwardly, until said vacuum cups come into engagement with such inner face surface of a sheet of material standing vertically on edge before said resting bar, said yieldable mounting means in such engagement enabling said vacuum cups to yield so as to come into proper bearing relation against the upper por-

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tion of such inner face surface of the sheet and so that when said truck is returned to its normal transporting position said frame will move upwardly in a lifting movement to cause the vacuum cups to lift the sheet of material secured thereto against vertical movement, the vacuum cups in such lifting movement and because of the weight of such lifted sheet, yielding to enable such inner sheet surface to bear against said resting bar, said lifting movement continuing to bring the sheet into an inclined position in which the raised upper portion of the sheet will be located to the rear of said resting bar, and the raised bottom inner surface of said sheet will be resting against said resting bar, and means on said truck for providing sufficient vacuum pressure to said vacuum cups to enable them to support the entire weight of a sheet of material against vertical movement.

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