DEVELOPMENT FOR AUTOMATIC LEVELING UP OF PIECES OF MATERIAL

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Fig. 5

Fig. 6

Fig. 7

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DEVICE FOR AUTOMATIC LEVELING UP OF PIECES OF MATERIAL

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This invention relates to an automatic device for leveling up pieces of material and consists of an inclined table, on which the pieces of material are placed by means of gripper arrangements which pick up the pieces of material from piles disposed next to the device. The table is inclined along two of its edges in such a manner that the material will slide along on the preferably highly polished plate, until it rests against two abutment rails which meet in a corner.

For holding the material securely a holding device is provided at the table, which may consist of a vacuum arrangement built into the table top. For this purpose there are provided in the table top, as far as the latter is covered by the pieces of material, openings which are in communication with a vacuum arrangement by way of the hollow axis of rotation, as soon as the pieces of material are on the table top occupy the correct position. A simple clamping plate of a kind known per se for the same purpose and capable of being turned over on hinges may also be used, between which and the table top the pieces of material are clamped.

Since, when further layers of material are placed on the first layer of material lying on the table top, a sliding up to the abutment rails will take place only under particularly favourable circumstances, owing to the considerably increased friction between the layer of material already lying on the table top and the layer of material placed on the said layer, there is provided for completing the arrangement a separate sliding plate which is disposed parallel to and at a small distance above the table top so as to be capable of being swung aside. This sliding plate is also highly polished, so that the deposited layers of material will slide on it up to the abutment rails.

A further feature of the invention consists in the special surface formation of the inner vertical surfaces of the abutment rails, against which the edges of the pieces of material strike, on the one hand and in the surface formation of the sliding plate on the other hand. The surfaces are so prepared that the coefficient of friction of the inner vertical surfaces of the abutment rails is less than the coefficient of friction of the surface of the sliding plate.

The details of the construction and mode of operation of the sliding plate shall now be more particularly described in connection with a constructional example with reference to the accompanying drawings.

Figure 1 of the drawings shows in plan view a leveling up device with a sliding plate, to which latter motion is imparted by crank drives, and with a clamping device having a clamping plate swung out into the horizontal position on line II—II of Figure 1.

Figure 2 shows the same device in elevation and partial section on line II—II of Figure 1.

Figure 3 shows a side elevation in partial section on line III—III of Figure 1, and Figure 4 shows the section according to Figure 2 with the sliding plate swung aside and the clamping plate in the hinged down position.

Figures 5 to 7 of the drawings illustrate the movement of a piece of material laid on the sliding plate in the various phases of movement, the inner vertical surface of the abutment rails and the surface of the sliding plate being made in accordance with the invention.

The device consists of a table with a table top 2, which is held on two columns 3, 4 and is capable of displacement in the bearings 5, 6 in the vertical direction. To the table top 2 is pivotally connected by means of a shaft 7 and hinges 8, 9 a clamping plate 10. A spring 11 seeks to bring the clamping plate into the closed position. At the three outer sides the table top 2 is surrounded by a frame 12, the inner edge of which is spaced away from the edge of the table top by a distance amounting to a few millimetres. At the longitudinal edge and at one narrow edge the frame is provided with abutment rails 13, 14.

The frame 12 is supported on the machine frame by pillars, of which one pillar 15 is shown in Figure 2. It is supported in such a manner that in the operative position the surface of the table top 2 is flush with the upper surface of the frame 12. Above the abutment frame 12 a box-shaped suction gripper 16 is guided on connecting rods 17, 18 by means of joints 19, 20 and is arranged to be movable by cam drives in such a manner that the suction gripper can perform upward and downward motions for bringing the pieces of material 1 to the table top and depositing them thereon and on the other hand lateral motions from a pile of pieces of material up to the abutment frame above the table top. Such a pile of pieces of material in a guiding container 21 is shown on the right-hand side of Figure 2. In this figure is also indicated in broken lines the position of the suction gripper 16, in which it is just about to descend into the guiding container, for the purpose of picking up a piece of material from the pile. The suction gripper consists of a box-like body which is closed on all sides and which is provided on the bottom smooth surface with a number of openings 22 which are in communication by way of
a common cavity 23 and a main connecting opening 24 with the suction nozzle 25. This suction nozzle 25 is connected by way of a flexible pipe 26 with a vacuum arrangement which is not shown in the drawings.

Above the table top 2 a sliding plate 27 is slidably guided on two guide rails 28, 29 which are arranged at an inclination to the longitudinal direction of the table top, but are horizontal. For this purpose two guide ways 30, 31 are provided on the sliding plate 27. The guide rails 28, 29 are mounted rigidly on the machine frame by standards 32, 33 and 34, 35. To two eyes 36, 37 of the sliding plate connecting rods 38, 39 are attached, which are pivotally connected at 40, 41 with crank discs 42, 43. These crank discs are rotatably mounted on shafts 44, 45 in bearings 46, 47 and have a rotary motion imparted to them by the main machine drive in a manner known per se, which is not illustrated in the drawings.

In the sliding plate a number of slots 48, in the example shown seven slots, are provided at an inclination to the longitudinal direction of the sliding plate in such a manner that they terminate at the crank side at a certain distance from the outer edge, whilst at the opposite side they open to the outside. Corresponding to the number of limbs 49 remaining between the slots (Figure 3) openings 50 are provided in the abutment rails 13, 14, so that at the places corresponding to the slots 48 bridging pieces 51 are formed in the abutment rails. Through this arrangement the sliding plate can be moved through the abutment rails.

When the device is in operation, the clamping plate 10 is in the erect position. The table top 2 is elevated by means of the columns 3, 4 to such an extent that the surface of the table top is flush with the surface of the frame 12. The sliding plate is swung by the crank drive into the abutment rail frame 12. Thereupon by means of the suction gripper 16 one layer of material is picked up from the pile of pieces out of the box 21 and, being simultaneously displaced vertically and laterally, is conveyed till it arrives over the abutment frame 12, where the piece of material is caused to drop by temporarily shutting off the vacuum pipe. The piece of material will not as a rule bear closely against the two abutment rails 13, 14. Only through the inclined outward motion which now starts, owing to the turning of the crank drive, will the piece of material be forced into the abutment frame 12 by the friction between the material and the sliding plate. On the sliding plate 27 being further and completely moved out, the layer of material will fall on to the table top 2 below it and the abutment frame 12. On the completion of this operation the sliding plate will again move into the abutment frame (position shown in Figure 2) and a further layer of material, for instance from another pile of material, can be deposited in the already described way. It is of importance for the distance between the lower surface of the sliding plate and the upper surface of the table top and of the abutment frame 12 to be so adjusted that the required number of layers of material will find an amount of space, which will allow the sliding plate to move completely across the uppermost layer of material. After the last layer of material has been deposited, the sliding plate is again moved out of the abutment frame and the clamping plate 10 is hinged over downwards (position shown in Figure 4) by actuating means not shown in the drawings. The layers of material clamped between the table top 2 and the clamping plate 10 are now in the accurately leveled-up position at none of the three exposed edges and may for instance be moved along past a sewing machine for the purpose of being stitched. It should be mentioned, that, when the device is used for stitching, it is necessary to adapt both the table top 2 and the clamping plate 10 as regards shape and size to the piece of material 1, so that a margin of the requisite width will be exposed at the edges to be stitched.

According to Figure 5 a piece of material 1 is placed on the sliding plate 27 which is in the swung-in position. It is assumed, that the piece of material, when deposited, will take up a position which is not parallel to but slightly inclined to the abutment rails 13 and 14. These conditions are shown greatly exaggerated in the figures, as to show them clearly. On the sliding plate 27 being moved by a crank mechanism in the direction of the arrow a, that is at an inclination to the abutment rails 13 and 14 of the table top 2, but in the direction towards these abutment rails, the piece of material 1 will be brought to the position shown by full lines in the first place parallel to itself into the position shown by dot-and-dash lines, until the corner 56 at the bottom to the right comes in the point 50 against the abutment rail 14. During the further motion of the sliding plate 27 the piece of material 1 which up to now has rested on the sliding plate 27 is swung about a point lying in the vicinity of the left-hand short edge of the piece of material, until the left-hand bottom corner 53 bears against the abutment rail in the point 51 (cf. Figures 5 and 6). During this motion the piece of material is moved simultaneously with its right-hand bottom corner along the abutment rail 14 from the point 50 to the point 52 to the left, this corner sliding along the bottom rail 14. For this sliding motion it is however necessary for the vertical abutment edge 14 to be smoother than the horizontal surface of the sliding plate 27. Should however, conversely, the vertical edge 14 be less smooth than the sliding plate 27, the further motion of the corner 56 will be arrested at the point 52, the abutment rail 14 and the piece of material 1 will be swung round, until its lower longitudinal edge bears against the abutment rail 14. In this position, however, the piece of material will still be at a certain distance from the left-hand abutment rail 13. This distance corresponds to the distance 52—50 of Figure 6. During a further motion of the sliding plate 27 the piece of material will, in spite of the frictional force directed to the left and exerted on the piece of material, nevertheless not be able to move to the left, as the piece of material is hindered from doing so by the greater friction at the abutment rail 14. Only through the abutment rail being made smoother than the sliding plate will the result be obtained, that the piece of material will come to bear correctly against the two abutment rails 13 and 14. These conditions of motion shall now be more particularly described.
the abutment rail 14 in the angle point 55 of the two rails 13 and 14.

The magnitude of the motion of the sliding plate 21, which is required for bringing the obliquely lying piece of material into the exact bearing position of the rails 13 and 14, is made up from the sum of the distance 63—51 (Figure 5) from the left-hand lower corner point 53 of the piece of material to the point of contact with the left-hand abutment rail 13 and from the distance 51—54, according to Figure 6, which consists of the oblique part motion of the sliding plate 21, the vertical component 51—55 of which results from the triangle of motion 51—54—55. The ascertaining of this value is of importance for the entire design of the device.

With an inclined arrangement of the table top and sliding plate the particular selection of the coefficients of friction between the inner vertical rail surface and the surface of the sliding plate plays no important part, as in this case the component of the force of gravity in the direction of the table top brings the piece of material into the correct position. Of greater importance however are the different frictional conditions, when the table top and the sliding plate are arranged horizontally as in this case only the frictional conditions are capable of bringing the piece of material into the correct bearing position.

What we claim is:

1. A device for the automatic leveling up of pieces of material, comprising a table inclined to the horizontal along two contiguous edges, abutment rails extending along the two lower contiguous edges of the table and gripper arrangements for depositing the pieces of material on the table, whereby the pieces of material can come with two contiguous edges against the abutment rails, clamping means for holding the pieces of material on the table.

2. A device for the automatic leveling up of pieces of material, comprising a table inclined to the horizontal along two contiguous edges, abutment rails extending along the two lower contiguous edges of the table and gripper arrangements for depositing the pieces of material on the table, whereby the pieces of material can come with two contiguous edges against the abutment rails, a clamping plate capable of being hinged over on its longitudinal edge for holding the pieces of material on the table.

3. A device for the automatic leveling up of pieces of material, comprising a table inclined to the horizontal along two contiguous edges, abutment rails extending along the two lower contiguous edges of the table and gripper arrangements for depositing the pieces of material on the table, whereby the pieces of material can come with two contiguous edges against the abutment rails, a sliding plate disposed in a plane parallel to the table top at a small distance above it and capable of being swung aside in the said plane and means for displacing the sliding plate in a direction approximating to the direction of the line bisecting the angle formed by the two abutment rails, for causing the pieces of material, on the sliding plate moving outwardly to come against the abutment rails with a slight pressure under the influence of the friction.

4. A device for the automatic leveling up of pieces of material, comprising a table inclined to the horizontal along two contiguous edges, abutment rails extending along the two lower contiguous edges of the table and gripper arrangements for depositing the pieces of material on the table, whereby the pieces of material can come with two contiguous edges against the abutment rails, a sliding plate disposed in a plane parallel to the table top at a small distance above it and capable of being swung aside in the said plane and in which the inner vertical surfaces of the abutment rails, against which the edges of the material impinge, are surface treated so as to have a smaller coefficient of friction than the surface of the sliding plate.

5. A device for the automatic leveling up of pieces of material, comprising a table inclined to the horizontal along two contiguous edges, abutment rails extending along the two lower contiguous edges of the table, gripper arrangements for depositing the pieces of material on the table, whereby the pieces of material can come with two contiguous edges against the abutment rails, a sliding plate disposed in a plane parallel to the table top at a small distance above it and capable of being swung aside in the said plane, and in which the inner vertical surfaces of the abutment rails, against which the edges of the material impinge, have a smaller coefficient of friction than the surface of the sliding plate.

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