Oct. 4, 1949. I. L. LESAVOY 2,483,584

SYSTEM OF FINISHING PLASTIC SHEETS

Filed Aug. 30, 1945 2 Sheets-Sheet 1

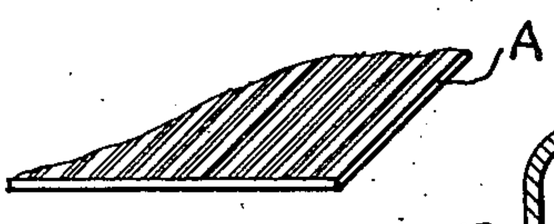

FIG. 5

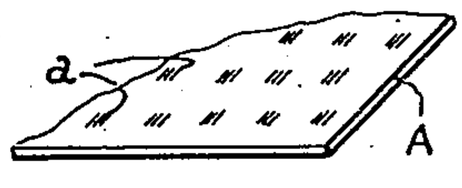

FIG. 6.

FIG. 1

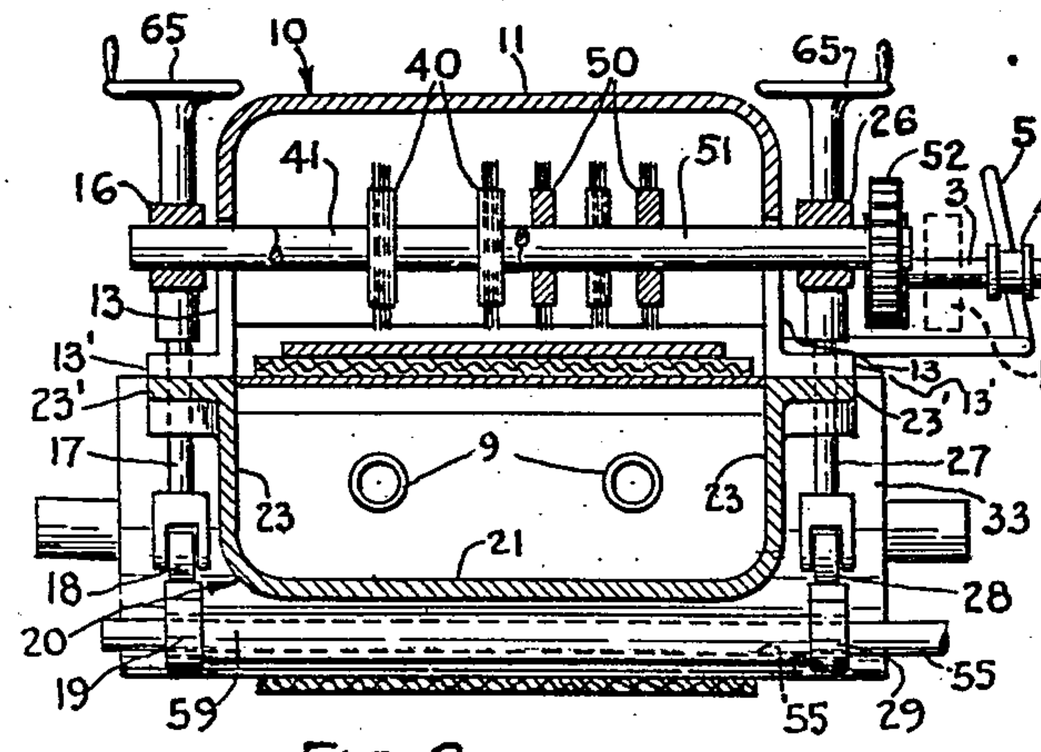

FIG. 2.

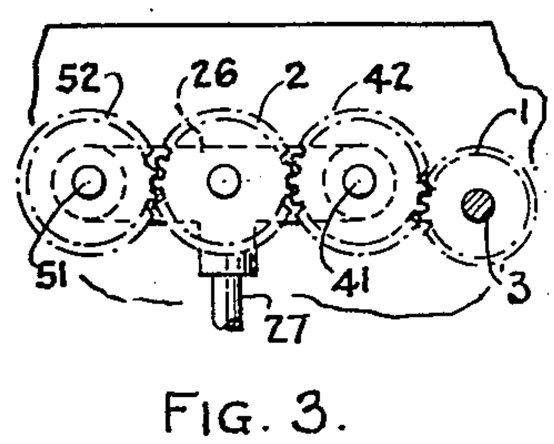

FIG. 3.

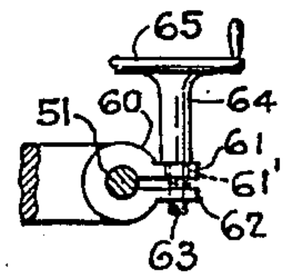

FIG. 7.

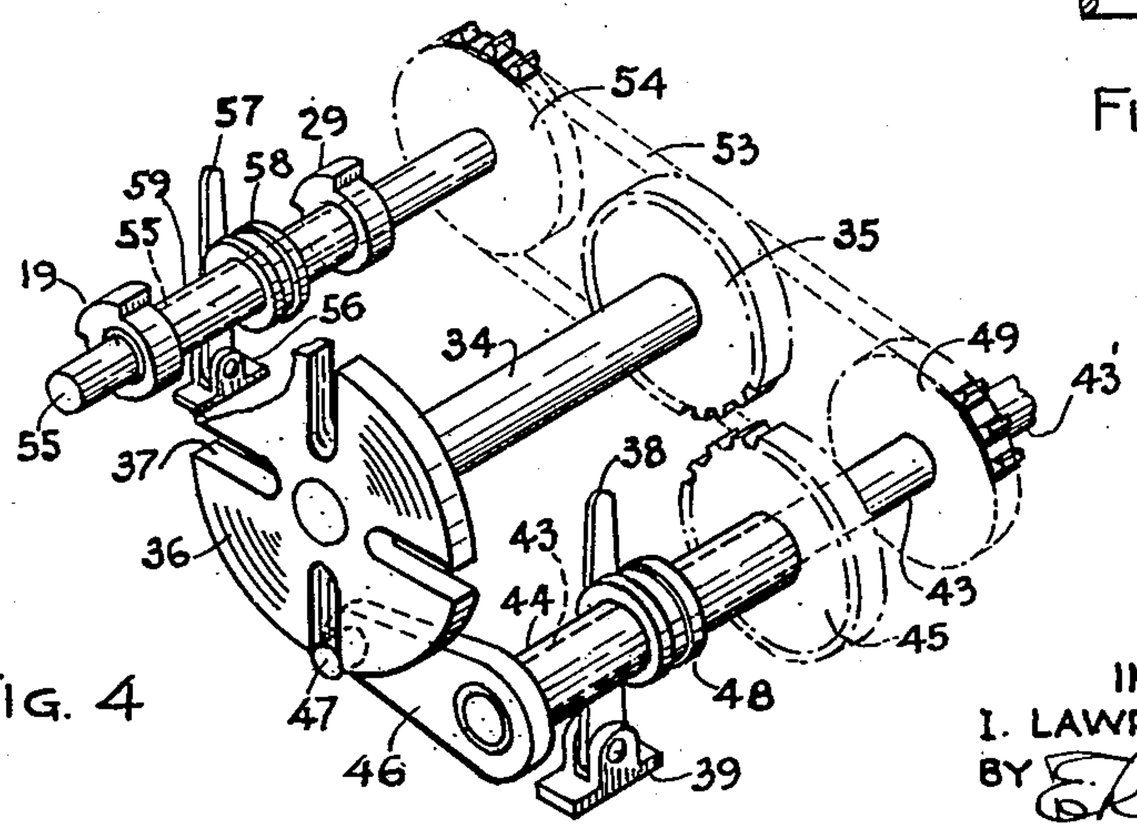

FIG. 4

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SYSTEM OF FINISHING PLASTIC SHEETS

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2 Sheets-Sheet 2

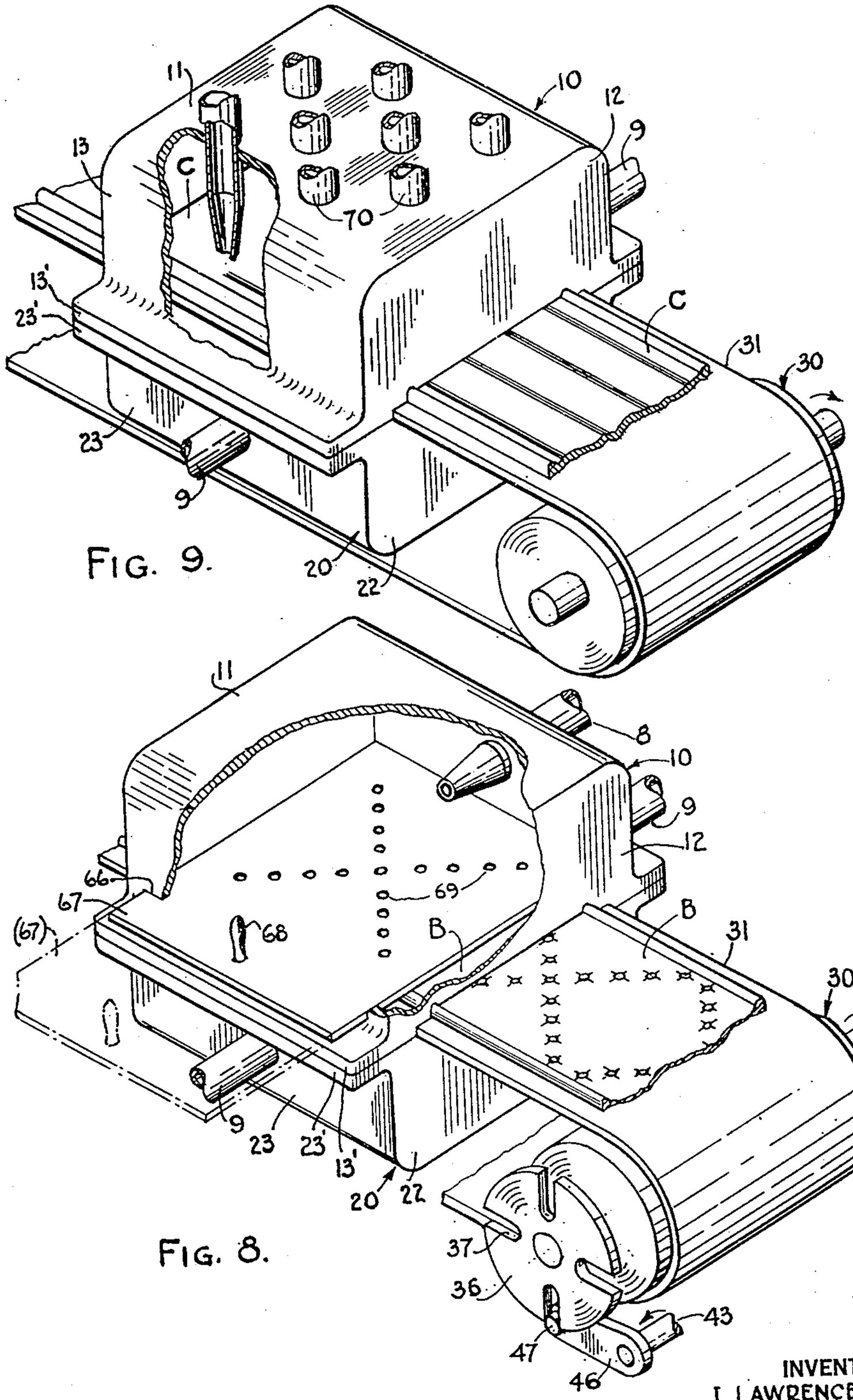

FIG. 9.

FIG. 8.

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SYSTEM OF FINISHING PLASTIC SHEETS

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Application August 30, 1945, Serial No. 613,655

1 Claim. (Cl. 41—1)

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This invention relates to apparatus for treating the surface of plastic sheets to give it a desired ornamentation or design. One object of the invention is to devise apparatus for giving the surface of plastic sheets a ribbed effect; another object is to devise apparatus for giving the surface of plastic sheets a checkered effect. An important object of the invention is to devise apparatus for giving the surface of plastic sheets either a ribbed or a checkered effect, depending upon adjustment of the apparatus. An allied object is to provide apparatus as described which may be readily adjusted to vary the surface ornamentation, whether ribbed or checkered. A further object of the invention is to devise apparatus for giving the surface of plastic sheets the designs of a selected pattern. An allied object is to provide apparatus as described in which the design pattern may be readily changed.

For the attainment of these and such other objects as may appear or be pointed out, embodiments of the invention are shown in the accompanying drawing, wherein:

Referring to the drawings:

Figure 1 is a front view of the improved apparatus;

Figure 2 is a sectional elevation taken on the line 2—2 of Figure 1;

Figure 3 is an end view of the gear transmission provided at the upper right end of machine as shown in Figure 2;

Figure 4 is a perspective view of the main drive transmissions and controls therefor;

Figure 5 is a perspective view of a portion of a plastic sheet having a ribbed surface according to the invention;

Figure 6 is a perspective view of a portion of a plastic sheet having a checkered surface according to the invention;

Figure 7 is a detail view of an arrangement for holding the rotary brushes against turning;

Figure 8 is a modified form of the invention shown in perspective employing compressed air and an apertured pattern plate; and

Figure 9 is a form similar to that of Figure 8, and also shown in perspective, but not employing a pattern plate.

Referring to Figures 1 and 2, the improved apparatus comprises an upper housing 10 having a roof 11, end walls 12, and side walls 13, the bottom being open, and a lower housing 20 having a floor 21, end walls 22 and side walls 23, being open at the top. As best seen in Figure 1, the end walls 12 of the upper housing 10 and the end walls 22 of the lower housing 20 are in vertical

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alignment and spaced to provide an elongated slot 14 at the left and a similar slot 15 at the right. As best seen in Figure 2, the side walls 13 of the upper housing 10 and the side walls 23 of the lower housing 20 are in vertical alignment and secured together, as by flanges 13', 23'. An endless conveyor 30, provided for carrying plastic sheets A through the housing 10, 20, has an upper loop 31 passing through elongated slots 14, 15; the sheets are moved from left to right, as shown by the arrow, Figure 1. The belt 31 is supported by one or more bridge-pieces 25 spanning the lower housing 20. Endless conveyor belt 30 is looped between a left pulley 33 and a right pulley 32, Figure 1.

Within the upper housing 10 are provided, as best seen in Figure 1, two rows of rotary brushes, the brushes of the left row being designated 40, and the right brushes, 50. The brushes 40, 50, are secured on shafts, respectively, 41, 51, extending through the upper housing from side wall to side wall, 13, as best seen in Figure 2; the ends of the shafts 41, 51 outside of the housing are journaled in bearing members 16 (at the front, Figure 1, or to the left, Figure 2), 26 (at the right, Figure 2). Shafts 51, 41 are rotated to turn their respective brushes 50, 40 in the same direction by the gear transmission best seen in Figure 3. To the right ends (as viewed in Figure 2) of shafts 51, 41 are secured gears, respectively, 52, 42, Figure 3, which mesh with an idler gear 2 between 52 and 42. One of the gears, 42 as shown in Figure 3, also meshes with a pinion 1 on a short spindle 3, see Figure 2, which is coupled by a clutch 4 to a power shaft 6. Manual 5 of clutch 4 may be shifted to connect or disconnect the power drive of the rotary brushes 42, 52, as desired (for a purpose explained below).

The bearing members 16, 26, supporting the brush shafts 41, 51, are secured at the upper ends of vertical rods, respectively, 17, 27, mounted in bearings, conveniently provided in the housing flanges 13', 23', for an extent of vertical movement. At their lower ends, vertical rods 17, 27 are provided with rollers, respectively 18, 28 which are engaged by cams, respectively 19, 29. Cams 19, 29, are rotated (in a manner subsequently described) to raise the rotary brushes 40, 50 out of contact with the plastic sheets or lowered to engage the sheets (for a purpose which will soon be apparent).

The conveyor pulley 32, Figure 1, which may be rotated either continuously or intermittently, is secured on a shaft 34, on which is also secured a gear 35 (for continuous movement of the con-

veyor) and a disc 36 having spaced pin slots 37 (for intermittent movement of the conveyor). Gear 35 and pin-slot disc 36 are best shown in Figure 4; gear 35 is driven by a gear 45 when the conveyor is required to be moved continuously, and dics 36 is driven by a crank arm 46 when the conveyor is required to be advanced intermittently. Crank arm 46 has a pin 47 at its distal end which is engageable in slots 37 of disc 36 to turn the latter during a portion of the revolution of arm 46, disc 36 (and the conveyor) remaining stationary during the remainder of the revolution of arm 46. Both the pin arm 46 and gear 45 are secured to a tubular shaft 44 which is feathered to an inner shaft 43 so as to be turned thereby and to provide for a limited extent of axial movement of the tubular shaft 44. By moving tubular shaft 44 to the right, its gear 45 meshes with gear 35 to impart continuous movement to the conveyor (at the same time withdrawing pin 47 rightwardly from pin slots 37 of disc 36); by moving tubular shaft 44 to the left, gear 45 is withdrawn leftwardly from meshing engagement with gear 35, and pin 47 is placed in position to engage the slots 37 to impart intermittent movement to the conveyor. To facilitate axial shifting of tubular shaft 44, it is provided with an annularly grooved collar 48 in which is received a pin (not shown) provided on a shift lever 38, the lower end of which is pivotly mounted on a bracket 39 secured to the machine frame.

The right end 43', Figure 4, of inner shaft 43 is coupled with a power shaft (not shown). Shaft 43 not only drives the conveyor, as just described, but also alternately raises and lowers the rotary brushes 40, 50. As already described, the rotary brushes are raised and lowered by cams 19, 29, which raise and lower the bearing members 16, 26, at each side of the apparatus, Figure 2. Referring to Figure 4, cams 18, 29, are secured to a tubular shaft 59 which is feathered on an inner shaft 55 so that tubular shaft 59 may be axially moved to bring cams 19, 29 in cooperative alignment with the cam rollers 18, 28 of the bearing members 16, 26 which carry the rotary brushes. To facilitate the axial movement of tubular shaft 59 it is provided with an annularly grooved collar 58 in which is received a pin (not shown) provided on a shift lever 57, the lower end of which is pivotly mounted on a bracket 56 secured to the machine frame. At the right end of inner shaft 55 is secured a pulley or sprocket 54 which is connected by a belt or chain 53 to a pulley or sprocket 49 secured at the right end of power shaft 43.

The brushes 40, 50, engage the surface of plastic sheet A, Figure 1, which is maintained in a semi-plastic state by suitable heating means, such as by steam which is conducted to the lower housing 21 by pipes 9. When it is desired to give the surface the ribbed effect or appearance as shown in Figure 5, the plastic sheet is advanced in a continuous movement through the apparatus, with the rotary brushes in their lower position in contact with the surface of the semi-plastic sheet. The machine is adjusted for this operation by turning lever 38, see Figure 4, to the right to mesh gear 45 with gear 35 and to withdraw pin crank 46 from slotted disc 36, and by turning lever 57 to shift cams 19, 29 to inoperative position. The rotary brushes 40, 50 may be permitted to be turned freely by the moving plastic sheet; in this case, manual 5, Figure 2, would be moved to disconnect spindle 3 from power shaft 6, in the manner described above. Or the rotary brushes

may be positively rotated, either in the same direction as the advancing sheets or in the opposite direction, by power shaft 6. The rotary brushes may also be held against rotation by the advancing sheet, so that stationary brushes will be presented to the moving sheet. For holding the brushes against rotation by the moving sheet, one or both of the bearings in which brush shafts 41, 51 rotate are of split construction as shown in Figure 7 which is a detail of the split bearing 60 for brush shaft 51. Bearing 60 is split at one side to provide a clearance between an upper ledge 61 and a lower ledge 62 of the bearing. The lower ledge 62 is tapped to receive a threaded screw 63 which projects from the shank 64 of a handwheel 65, to provide an annular shoulder at the end of the shank. The upper ledge 61 is provided with a hole 61' through which screw 63 freely passes. Handwheel 65 is turned to advance its screw 63 upwardly, when split bearing 60 is required to permit unrestrained rotation of shaft 51; by turning the handwheel in the opposite direction, the two ledges 61, 62 are brought closer together to clamp the shaft 61 (and thus hold the brushes stationary relative to the advancing sheets).

Different ribbed effects or appearances will be obtained depending upon whether the rotary brushes are permitted to be freely turned by the advancing sheet or are held against such rotation, or are positively driven and, in the latter case, whether they are driven in the same direction as the advancing sheet or in the opposite direction.

To obtain the checkered effect shown in Figure 6, the conveyor is intermittently advanced and the brushes rotated and alternately raised and lowered. The manner in which lever 38, Figure 4, is adjusted for intermittent conveyor feed, and lever 57, adjusted for alternate raising and lowering of the brush shafts 41, 51, and the manner in which manual 5, Figure 2, is adjusted for rotating the brushes, have already been described. The raising and lowering cams 19, 29, see Figure 4, are so timed relatively to the intermittent conveyor drive 36, 46, that during the advance movement of the conveyor, the brushes are held in their raised positions, and are lowered into contact with the surface of the plastic sheet only when the conveyor is stopped. It will be understood that the rotary brushes 40, 50 are in continuous rotation so that when the brushes are lowered to contact the stationary sheet, the brushes will make short markings *a*, Figure 6, on the surface of the sheet. The number of such spaced markings will depend upon the number of brushes on each shaft 41, 51. Since both shafts 41, 51 are mounted together in bearing members 16, 26, Figures 1–2, two rows of short markings *a* will be made each time the rotary brushes are lowered into contact with the plastic sheet. Since the rotary brushes 40, 50 of one shaft 41, 51 are staggered relative to the brushes of the other shaft, see Figure 2, the short markings *a* of the brushes of the respective shafts will likewise be staggered to give the checkered effect shown in Figure 6.

The surface of plastic sheets, maintained in a semi-plastic state, may be given repeated designs of a selected pattern, in a modified form of the apparatus described above with reference to Figures 1–7. This is shown in Figure 8 where the upper and lower housings 10, 20 and their associated parts are designated as in previous figures; likewise the conveyor 30 and its associated parts are similarly designated, and is

shown connected (36, 46) only for intermittent movement. The upper housing 10 is connected to the lower housing 20 in a manner to make the upper housing as air-tight as possible. Upper housing 10 is charged with compressed air conducted thereto by a pipe 8. The front wall 13, Figure 8, of upper housing 10 is provided with an elongated slot 66 extending substantially the full length of front wall 13 and disposed just above the upper loop 31 of the conveyor. Slidably received within elongated slot 66 is a pattern plate 67 which is supported, as by short ledges within the upper housing (not shown) in a position overlying plastic sheet B carried through the housing from left to right by the conveyor. Plate 67, which may have a handle 68 (or a hand slot, not shown) to facilitate insertion and removal, is provided with small apertures 69, which represent the pattern desired to be impressed on the surface of plastic sheet B.

The compressed air being conducted, by pipe 8, into the upper housing above pattern plate 67, passes through the small pattern apertures 69 at high velocity to impinge upon the surface of the semi-plastic sheet, to cause small depressions thereon, as shown at 69^x on the plastic sheet B leaving the upper housing 10, thus reproducing the design of the pattern plate. It is understood that this occurs during the stopping phase of the intermittent motion, after which the conveyor is quickly moved to present a fresh surface in underlying relation to the pattern plate. Means (not shown) may be provided to prevent passage of the compressed air through the pattern apertures of plate 67 during the advance of the plastic sheet. The conveyor is advanced the proper amount so that the design being impressed from pattern plate 67 will be contiguous to the design precedingly impressed, thus giving the plastic sheet a continuous and repeated design of the pattern. While circular apertures 69 are shown in Figure 8 for facility in illustration, the plate openings themselves may have a desired shape or outline. By interchanging the pattern plates, any desired design may thus be repeatedly reproduced.

A similar apparatus using compressed air for forming designs on the surface of plastic sheets, while in a semi-plastic state but which does not employ pattern plates (such as 67, Figure 8) is shown in Figure 9 where the housings and conveyor are designated as in Figure 8. The con-

veyor 30, in this case, is driven continuously to move the plastic sheet B (from left to right) in underlying relation to the nozzle ends of a plurality of compressed air tubes 70 passing through roof 11 of upper housing 10. The air being fed through tubes 70 may be heated, as by means of electric heating elements within the tubes (not shown). The jets of compressed and heated air from the nozzles of tubes 70 give the plastic sheet, maintained in semi-plastic state, the ribbed effect shown by sheet C in Figure 9. In the form of the invention shown in Figure 9, and also in Figure 8, in place of compressed air, other fluids, such as steam may be used.

In the accompanying drawings, the invention has been shown merely by way of example and in preferred form, but obviously many variations and modifications may be made therein which will still be comprised within its spirit. It is to be understood, therefore, that the invention is not limited to any specific form or embodiment, except insofar as such limitations are specified in the appended claim.

I claim:

In apparatus for treating the surface of plastic sheets, in combination, an endless conveyor, including a rotative drive member for carrying the plastic sheet, a plurality of brushes at spaced points across the width of the conveyor, a slotted disc and a gear secured for rotation with the said conveyor driven member, a power shaft, a crank arm on the said shaft having a distal pin engageable in the slots of the said disc, a gear on the said shaft meshable with the said conveyor gear, the said crank arm and gear being mounted on the said power shaft for limited axial movement selectively to a position with the said two gears meshing and the said crank arm out of engagement with the slotted disc or to a position with the said crank arm in engagement with the slotted disc and the said two gears out of mesh.

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