March 23, 1943. E. L. BENEDICT 2,314,757

MACHINE FOR PLAITING

Filed Feb. 19, 1940 2 Sheets-Sheet 1

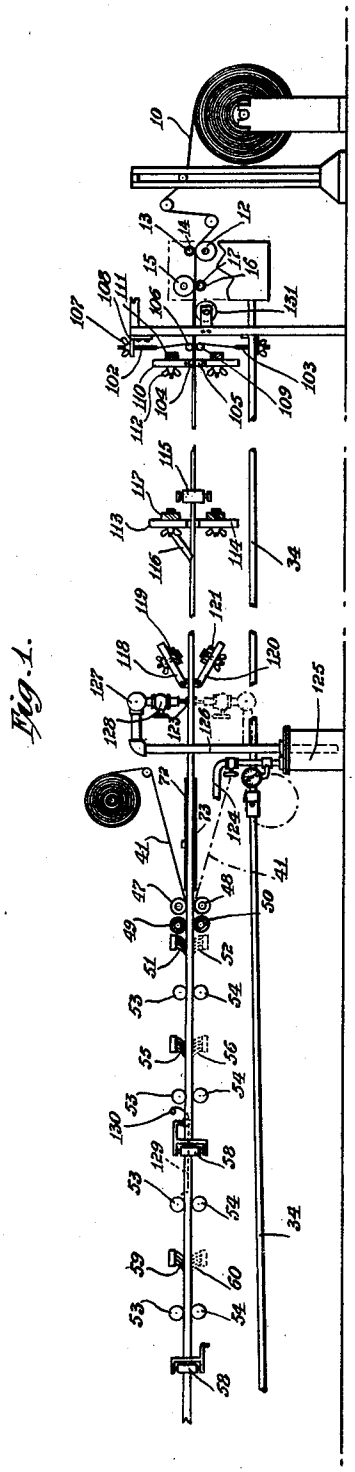


Fig. 1.

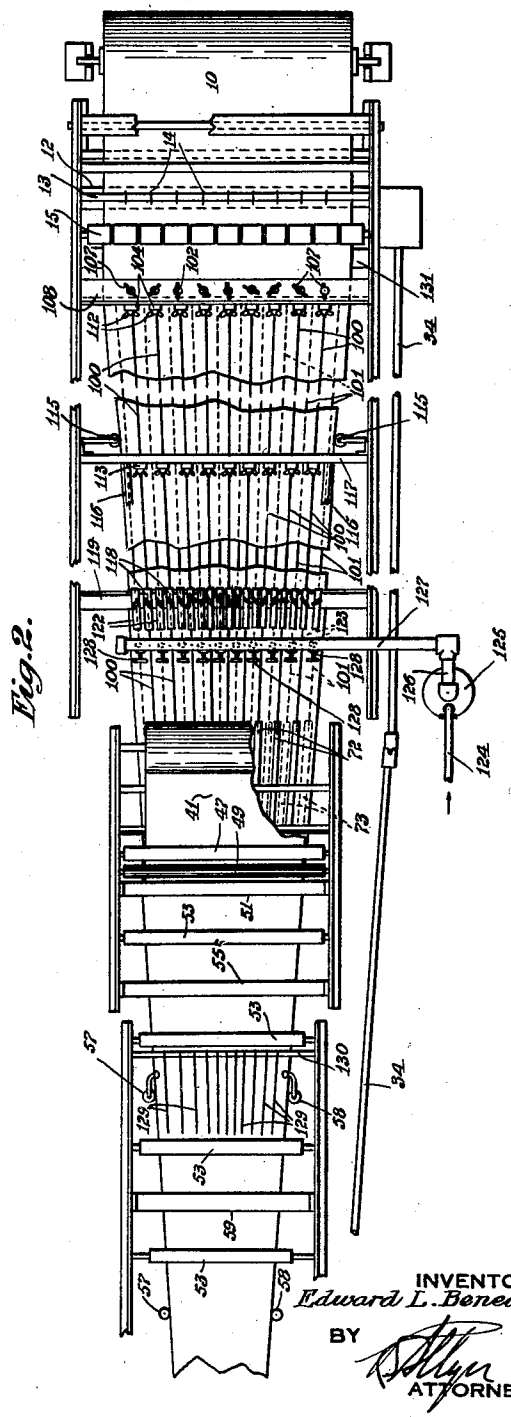


Fig. 2.

INVENTOR
Edward L. Benedict
BY
ATTORNEY

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Fig. 3.

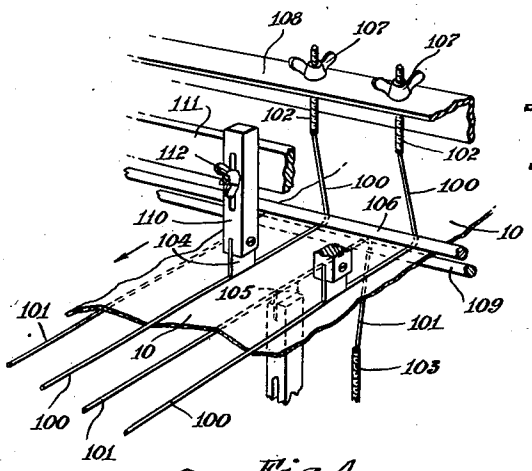


Fig. 6.

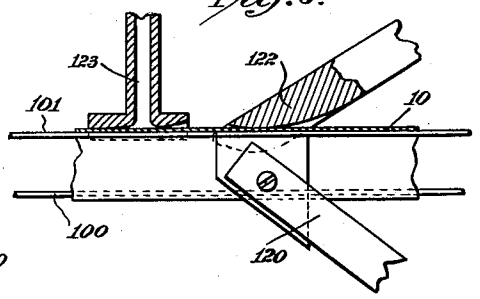


Fig. 7.

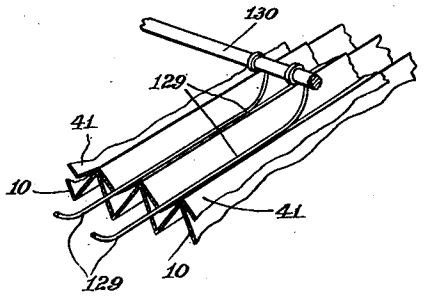


Fig. 4.

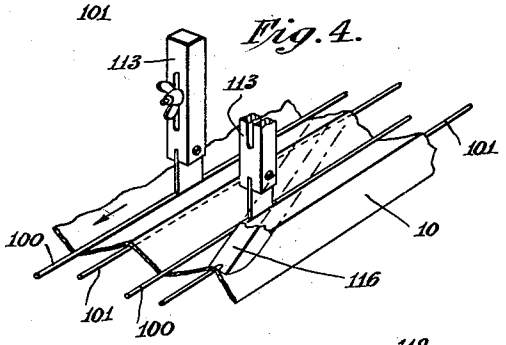
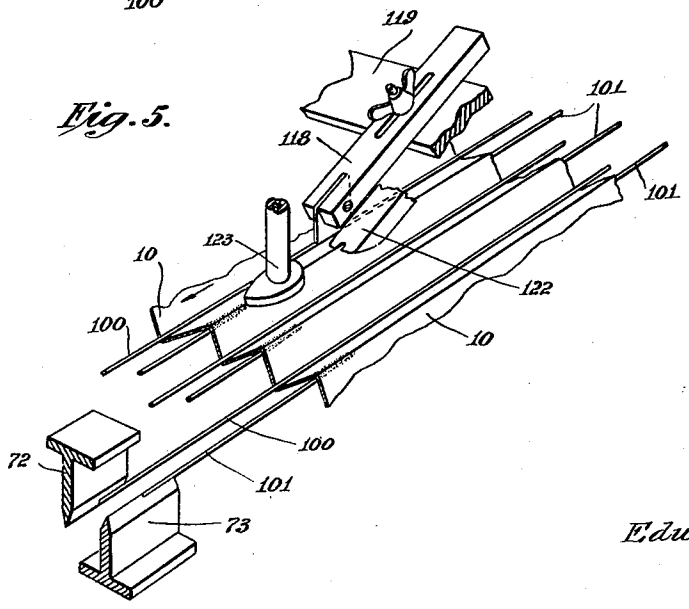


Fig. 5.



INVENTOR
Edward L. Benedict
BY
ATTORNEY

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UNITED STATES PATENT OFFICE

2,314,757

MACHINE FOR PLAITING

Edward L. Benedict, New York, N. Y., assignor to Elb Products, Inc., New York, N. Y., a corporation of New York

Application February 19, 1940, Serial No. 319,640

1 Claim. (Cl. 154—31)

This invention relates to a machine and process for forming units comprising preferably two or three layers of plaited flexible sheets secured together at at least some of their folds and in which one of the sheets has plaits of greater depth than another.

An object is to facilitate the operation of such a machine and minimize delays incident to starting operation at the beginning of each work day.

Another object is to simplify the machine and the method of forming such units.

A further object is to reduce friction and danger of breakage as well as obtain greater precision in setting the plait forming members or dies.

Referring to the drawings—

Fig. 1 is a side elevation of one embodiment of this invention.

Fig. 2 is a top plan view of the device of Fig. 1.

Fig. 3 is a perspective detail showing the forward connection or mounting of the plait forming members.

Fig. 4 is a view showing the plait forming members and a creasing finger after the plaits have been formed.

Fig. 5 is a detail showing the adhesive applying jet after the plaits have been more deeply formed.

Fig. 6 is a cross section through one of the adhesive jets and creasing fingers shown in Fig. 5.

Fig. 7 shows a detail of some of the yieldable fingers for the backing sheet.

This invention is a continuation in part of application Serial Number 179,134 filed December 10, 1937, for Machine and process for plaiting which has eventuated into Patent 2,196,006 dated April 2, 1940. The numerals below 100 refer to substantially the same parts as have been described in this prior application.

As shown in Fig. 1 the paper or other flexible sheet material for the foundation 10 is wound upon a supply roll and after passing through the usual tensioning devices may travel between the scoring rolls 12 and 13 for the purpose of slightly stretching the paper laterally along lines only wide enough to give the sheet an increased tendency and ease for being folded in forming the plaits. These scoring rolls comprise the roll 12 having peripheral depressions into which the paper or other material is pressed by the cooperating roll 13 having projecting ribs 14 which press portions of the paper into depressions of the roll 12. The foundation sheet then passes to another set of scoring rolls 15, 16 similarly but oppositely constructed so as to provide opposite folds in the sheet midway between those formed by the preceding rolls. In this second set of scoring rolls the grooved roll 15 is located above the cooperating roll 13 carrying projecting ribs 17.

After leaving the scoring rolls the foundation sheet travels to the plait forming dies which in this case include a plurality of stationary wires 100 and 101 longitudinally inclined in the manner described for the moving wires in the aforementioned application. The tapered arrangement of these wires as shown in Fig. 2 is preferably such as to provide a substantially uniform narrowing of the foundation sheet from the time the sheet enters the plait forming dies until it is tightly compressed in the pull out device at the opposite end of the machine. This pull out device has not been shown in this application as it was illustrated in the previous application referred to. The wires 100 and 101 are also arranged to gradually overlap one another in a direction normal to the travel of the sheet. In other words, the wires 101 are not all in the same horizontal plane nor are the wires 100 in the same plane but they overlap one another in the vertical plane a gradually increasing amount from the edges of the foundation to the center as was referred to in the aforementioned application.

The drive shaft 34 is geared to actuate the scoring rolls at the precise linear travel of the foundation sheet, said shaft being driven from a motor at the pull out end of the machine.

After the foundation has been plaited it is contemplated attaching a flexible backing sheet 41 to one or both sides of the foundation folds. In Fig. 1 only one such backing sheet is shown in full lines but it should be understood that a similar roll may also be applied to the lower folds of the foundation as indicated by the dotted lines in Fig. 1, or either alone may be used.

After the foundation sheet or the backing or both have been coated with the requisite adhesive, a roll 47 applies the backing to the foundation while the foundation is supported by T-shaped mandrels 72 and 73 previously described more in detail. A subsequent roll 49 of soft rubber presses the backing 41 against the foundation. The rolls 48 and 50 serving a similar purpose of rolls 47 and 49 respectively may not be used unless the flexible sheets are applied to both sides of the foundation. After passing through these rolls the backing is brushed or ironed against the foundation by the brushes 51, 55 and 59, the corresponding brushes for the opposite sides being numbered 52, 56 and 60. To insure the two plaited layers of paper being properly

guided, rolls 53 and 54 are provided along the travel of the sheet. Lateral guide rolls 57 and 58 may also be applied for guiding the plaited sheets after they have been stuck together.

The plait forming wires 100 are at their forward end secured to adjustable screws 102, the wires 101 being attached to corresponding screws 103 as shown in Figs. 1 and 3 so that the tension in these wires may be adjusted to the desired amount to take out any slack. For more accurately positioning these wires additional stationary supports 104 and 105 are provided. The wires pass around the transversely rounded stationary bars 106 and 109 before being secured to their adjusting screws. These screws are each provided with wing nuts 107 engaging the machine frame 108.

The supports 104 and 105 are preferably thin metal plates no wider than the diameters of the wires and to which the wires are soldered. These plates are clamped in the bifurcated end portions of a wood or metal support 110 carried from cross bars 111. Each support 110 is slotted as indicated in Figs. 3 and 4 so as to be accurately adjusted in height and held there by tightening the wing nuts 112.

Spaced a few feet more or less from the forward end of the plait forming members are additional supports 113 and 114 for the wires 100 and 101 respectively. Each such support is adjustably mounted to a horizontal cross bar 117 as shown in Fig. 1. Along each lateral edge of the foundation strip is provided a creasing finger 116 for preliminarily creasing the edges in order to better guide the material. The finger 116 is located close to the support 114. Lateral edge guide rolls 115 assist in bending the edges of the paper down early in the plait forming operation to assist in guiding the foundation and prevent its being shifted laterally during travel through the plait forming members. A little further on additional supports 118 similar to those previously described, except that they are inclined, enable the wires to be accurately adjusted in height and spacing. Each of these supports is of the same general type construction having a metal plate clamped therein and soldered to one of the wires. The supports 118 are clamped to a cross bar 119 by the same type wing nuts.

Corresponding supports 120 and cross bar 121 are provided on the underside of the plait forming dies. On the side of the foundation sheet opposite each of its supports 118 or 120 are provided creasing fingers 122 which iron or smooth the foundation sheet over the supporting wires. These creasing fingers 122 and 116 comprise preferably wood, slotted as shown in Figs. 4, 5 and 6. The natural wood resins give the sides of the creasing slot a high polish so as to offer a minimum amount of friction or drag on the paper. Each of these creasing fingers 122 and 116 is preferably slotted as are the supports 110, 113 and 118 and clamped in the same way so that they may be accurately adjusted in height and spacing for the thickness of paper used. These creasing fingers should press on the foundation sheet just enough to crease the sheet over the wire. The adjustment of these fingers can be made with sufficient precision so that no spring or other yieldable mounting may be needed though if desired it will be understood that leaf springs or other resilient means may be used to control the degree of pressure of the creasing fingers against the paper.

Located close to the supports 118 and 119 are the adhesive applying jets 123, one such jet being mounted adjacent each wire so that the paper may be coated. These jets or nozzles are of the shape illustrated in Figs. 5 and 6 and are slightly grooved so that the adhesive may be supplied to not only the crease but, if desired, slightly down the sides of the foundation sheet on each side of the crease or fold.

Adhesive is supplied to these nozzles 123 by pressure, an air compressor supplying the desired amount of compressed air through the pipe 124 to the adhesive containing tank 125. The air pressure on top of the adhesive in the tank 125 forces the adhesive out through the discharge pipe 126, which pipe should extend to adjacent the bottom of the tank 125. From the riser 126 the adhesive passes to a header 127 extending across the foundation and then through a number of supply pipes to each jet 123, a valve 128 being preferably located above each jet. When a flexible sheet is to be attached to the lower side the same arrangement of nozzles is provided for the folds on the lower side of the foundation, the same being shown in Fig. 1 only in dotted lines. The rear end of the plait forming wires 100 and 101 is soldered to the T-shaped mandrels 72 and 73 by having the mandrels recessed enough to allow the wires to be attached and soldered in place without imposing any excessive friction on the paper as it passes through the wires and mandrels. As the foundation passes between the mandrels, the outer or backing sheet or sheets 41 are attached, the same being done by the applying rolls 47 in the manner described in the prior application. In addition to the brushes, or in place of some of them, it has been found convenient to use a number of wire fingers 129 of the general shape illustrated in Fig. 7 carried by a cross bar 130, each of these yieldable wire fingers having just enough resiliency to hold the backing sheet in between the foundation folds but not enough resiliency to be in danger of breaking the backing sheet which is generally of less strength than the foundation.

The plait forming wires are preferably polished to reduce friction and those used were of bronze about $\frac{3}{64}$ of an inch in diameter though of course other sizes and materials may be used for the wires. These stationary wires have been found more desirable as plait forming members because of the greater precision possible in setting them, which results in a more uniform product being formed. These wires are freer from vibration and sag and also offer less friction to the travel of the foundation. The flexible wires contemplated in the prior application were subject to more vibration and in order to make them flexible they were formed of strands. In practice it was found these wires might cease to travel with the foundation sheet with the result very substantial friction was offered to the foundation by the strands. When the scoring rolls are used as shown in Fig. 1 the preliminary narrowing or forming of the plaits occurs as early as over the supporting roll 131 under the travel of the foundation sheet at commercial speeds. Although not all folding occurs in this area, some portions of the paper may be initially folded or plaited after the foundation has passed into the plait forming wires.

An important feature of this invention is the ease with which the adhesive applying jets may be placed in condition for use after having been out of use during a night or longer. The adhesive used is a casein type made flexible with

latex. When the machine is shut down at night the operator needs only to place a small bit of wax paper between each jet and the foundation sheet. In the morning the wax paper can be removed and each jet either opened with a pin or if not satisfactory each jet may be removed and washed with warm water and soap until clean.

The adhesive jets should be preferably of stainless steel, or iron or some other material not affected by the adhesive. If the adhesive jet is spaced too far from the foundation sheet the adhesive will be found to be applied in the form of separate drops. On the other hand if too close to the foundation sheet the adhesive may spread too much and be too thin. The amount of adhesive applied to the foundation sheet can be controlled by the valve opening as well as by the spacing of the jet from the sheet. The separation of the adhesive applying jet from the backing applying roll 47 by a few feet or more enables the adhesive to have time to take hold of the paper before it is contacted with the backing, although of course this distance may be varied.

The creasing fingers should be notched so that the angle of the sides of the notch is about that desired for the paper. While the creasing fingers have been used only in conjunction with the scoring rolls, it is believed the use of creasing fingers should enable the scoring rolls to be eliminated, especially if used more frequently than has been indicated in Figs. 1 and 2.

Where the backing sheet is to be secured to one of the slat-like portions of the foundation for a substantial width, a different type of jet than that shown may be used as is known in the art to include a slot extending transversely of the travel of the foundation so that the adhesive may be applied simultaneously over a substantial area.

The use of creasing fingers and adhesive jets reduces the danger of lint piling up behind the doctor blade as could occur with a device of the previous application. The moistening of portions of the foundation with a hydrated paper stock such as sulphite, sulphate or kraft pulp beaten in a Hollender beater causes the paper to become stiffened almost as though it had been starched when dried. The creasing fingers instead of being located where shown may of course be located to cooperate with the paper as it passes along the mandrels. After the adhesive is set it becomes water insoluble. It is believed the distance between the pull-out of and the soft rubber roll 49 can be substantially shortened by the use of more horizontal as well as vertical guide rolls and spring fingers of the type shown in Fig. 7, although this has not yet been tried out.

A product of this invention may be that shown and described in pending application Serial Number 213,841, filed June 15, 1938, for Decorative plaited unit. Instead of paper of the weights indicated in said product application, the foundation may be of fabric, or of metal foil or various other flexible sheet materials including leatherette and the like. The stem of the adhesive jet should be slightly flexible so that it may be bent laterally a little when necessary to exactly position the center of the jet over the foundation fold.

The preliminary bending of the lateral edge portions of the sheet during the plait forming operation is believed advantageous as has heretofore been mentioned. In the embodiment illustrated with the exception of the scoring rolls the foundation and its attached sheet or sheets is pulled through the machine entirely by the pull-out device. The ironing fingers referred to in the prior machine and process application are used. The folds in the foundation sheet are more precisely and uniformly formed by the creasing fingers.

I claim:

In a machine for forming a unit comprising at least two sheets of flexible plaited material connected along at least some of their folds and one of said sheets having plaits of less depth than the other, the combination with means for gradually plaiting the sheet having the deeper plaits, of means for applying adhesive along and slightly away from the folds on at least one side, and means for applying the other sheet to the adhesive coated portions of the first sheet, said first mentioned means including a stationary support for the folds to be coated, and a stationary grooved adhesive applying nozzle closely adjacent each fold to be coated, and means for supplying adhesive under pressure to said grooved nozzle.

EDWARD L. BENEDICT.