

Feb. 8, 1938.

B. LIEBOWITZ

2,107,485

PROCESS AND APPARATUS FOR ADHESIVELY UNITING PLIES OF FABRIC MATERIAL

Filed July 11, 1936

2 Sheets-Sheet 1

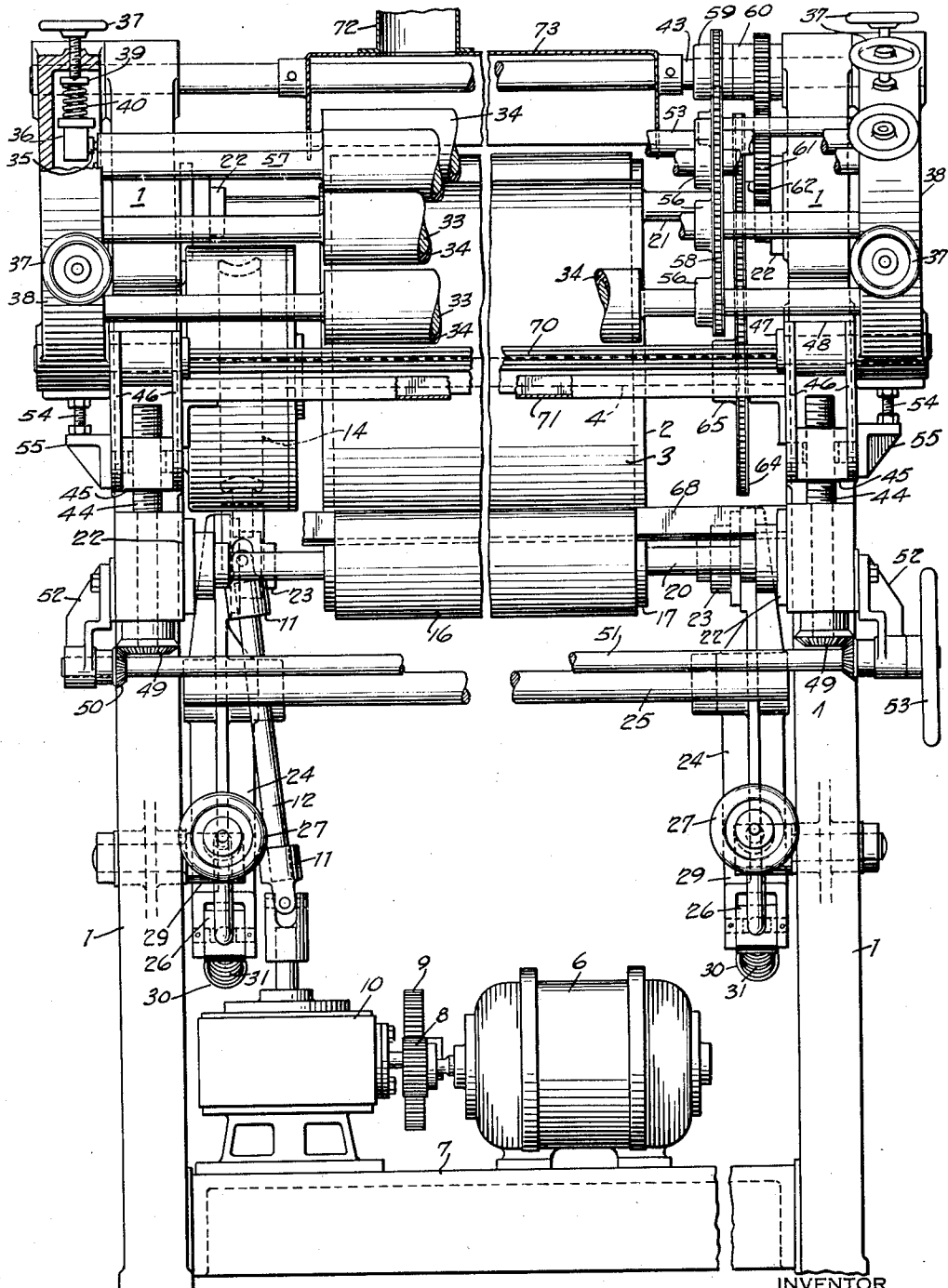


Fig. 1.

INVENTOR
Benjamin Liebowitz.
BY
Forster & Co.
ATTORNEY

Feb. 8, 1938.

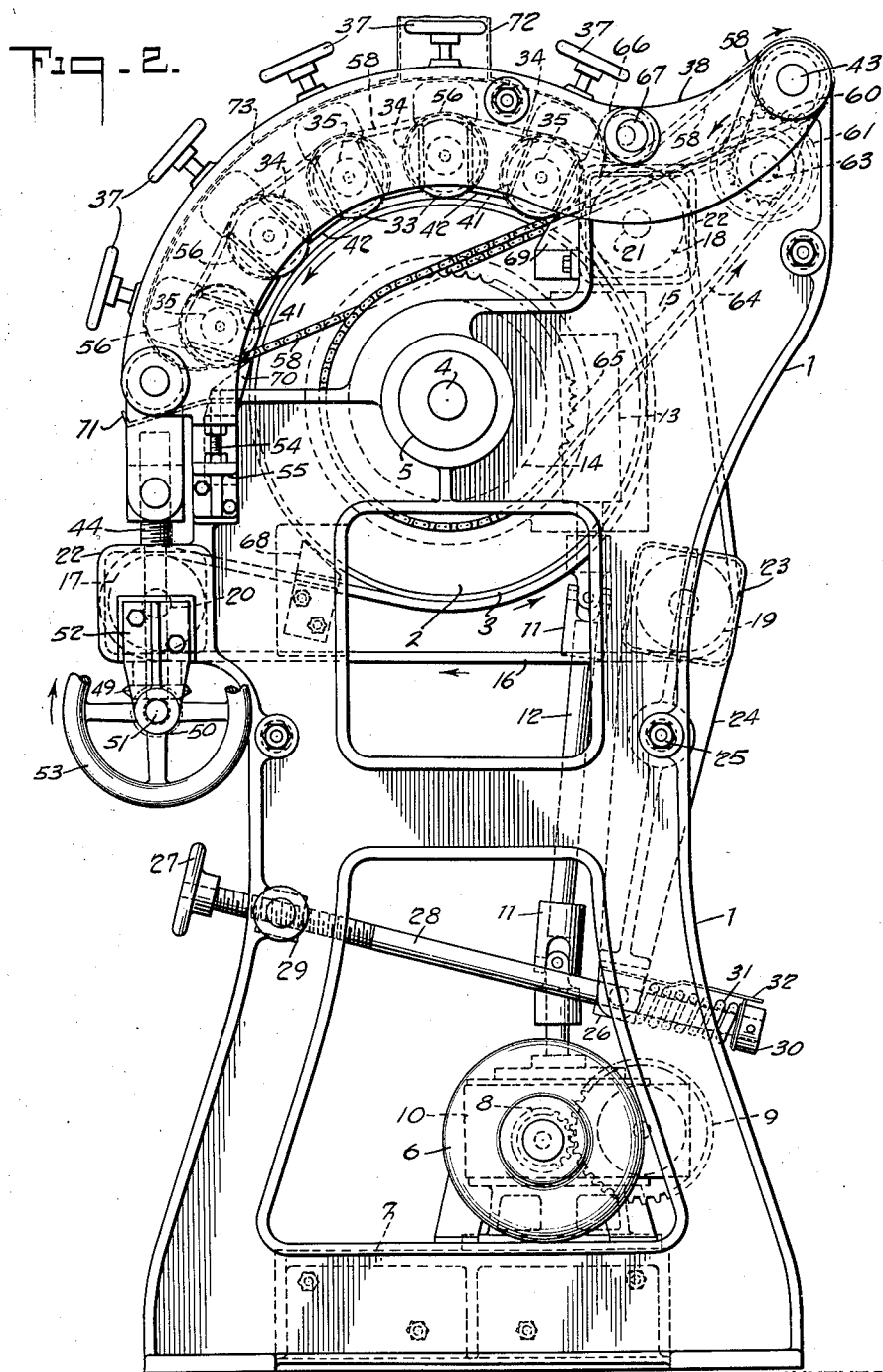
B. LIEBOWITZ

2,107,485

PROCESS AND APPARATUS FOR ADHESIVELY UNITING PLIES OF FABRIC MATERIAL

Filed July 11, 1936

2 Sheets-Sheet 2



INVENTOR
Benjamin Liebowitz.

BY
Fester & Liebowitz
ATTORNEY

UNITED STATES PATENT OFFICE

2,107,485

PROCESS AND APPARATUS FOR ADHESIVELY UNITING PLYS OF FABRIC MATERIAL

Benjamin Liebowitz, New York, N. Y., assignor to Trubenizing Process Corporation, New York, N. Y., a corporation of New York

Application July 11, 1936, Serial No. 90,233

3 Claims. (Cl. 154—1)

This invention relates to a process and apparatus for adhesively uniting plies of fabric material, and more particularly to uniting plies of fabric where the adhesive binder is contained in one or more of the plies to be united; for example, as disclosed in my Patents Nos. 1,968,409 and 1,968,410.

Extensive commercial experience with the process of these patents has brought out the desirability of certain improvements, particularly as regards speed and cost of production. It is an object of this invention to provide apparatus which will yield a higher output per operator. Another object is to eliminate tendency to form gloss which is often found in the method now in use. A further object is to improve the laundry life of the collars insofar as that can be achieved by the process and the apparatus of this invention. In the process as commercially used today, the article whose plies are to be united is made up generally of three plies of which the inner or lining ply contains a cellulose derivative adhesive material. The assembly is treated with a solvent for the adhesive material, and simultaneously mechanical pressure is applied. This part of the process is carried out in a "wetpress" and the time in the wetpress may be anywhere from about five to about fifteen seconds. It is this dwell in the wetpress which is largely responsible for the limited production. From the wetpress the collars are transferred to a warm press where the collar is again subjected to mechanical pressure and simultaneously to the action of heat at a temperature of about 250° F., which causes the solvent to evaporate and the adhesive material to set. In carrying out the foregoing process, the time in the wetpress determines the extent to which the adhesive material penetrates between the fibres of the yarns which comprise the external plies. To improve the adhesion, it is necessary to lengthen the time in the wetpress, but this results in a tendency towards filming over of the adhesive material in articles. Such filming over is objectionable since the articles are intended to be porous, and hence the time in the wetpress must be limited by considerations of porosity. It has been found that this limitation can be avoided, at least to a very great extent, by so treating the collar or other article with solvent that only the external plies are wetted, and after the treatment with the solvent, applying the mechanical pressure. By segregating the operations of wetting and cold pressing, the amount of solvent which has access to the adhesive material in the lining is limited, and hence the tendency

to film over is minimized, even when the duration of the cold pressing is substantially increased. A convenient method for treating the collar with solvent consists in spraying the solvent simultaneously onto both faces of the collar or other article, and so controlling the amount of wetting that only the external plies are materially wetted. Control of the amount of solvent is obtained by the speed with which the collar is passed through the sprays, and by the capacity of the jets which form the sprays.

In the interests of production it is desired that the first pressing (during which the article is subjected to a constant pressure without evaporation of solvent) shall be followed automatically by the second pressing operation in which the solvent is evaporated. The present commercial method involves a transfer by hand from the first to the second pressing operation, and, moreover, the evaporation of the solvent is accomplished by the application of heat as mentioned. In order to facilitate the provision for automatic transfer from one pressing operation to the other, it is desirable to eliminate heated pressing surfaces. Furthermore, application of heat tends to cause a lack of symmetry between the two faces of the collar, which results very often in a lack of equal adhesions on both sides of the collar. Moreover, drying the collar by the application of heat in this way tends to cause a gloss on the front face of the collar, particularly since this face is usually in contact with a metal surface, whereas the under face of the collar is usually in contact with a cloth surface. If heated pressing surfaces are not used in this second pressing operation, gloss does not appear. It has been found that excellent results can be obtained by evaporating the solvents at or near room temperature, without the use of heated surfaces. When the solvent is evaporated in this way, that is, at or near room temperature, the adhesive network, after setting, has better mechanical properties in accordance with the well-known phenomenon that rapid evaporation of a solvent from a gel, for example, cellulose acetate, causes the formation of minute bubbles.

However, if the solvent is merely allowed to evaporate from the article after the first pressing operation, the article would tend to be wrinkled, because of the stitching tensions, etc. It is an important part of this invention that the tendency to wrinkle is overcome by subjecting the article alternately to drying atmosphere and to mechanical pressure until sufficient of the solvent has been evaporated so as to at least par-

tially "set" the adhesive material. After the collar has once set, that is to say, after the adhesive material has become moderately hard, it can resist any further tendency to form wrinkles.

- 5 The drying atmosphere may consist merely of a blast of air at room temperature, or the air may be heated, but the temperature is to be kept below the boiling point of the solvent.

The process of the present invention consists
10 first in spraying the collar or other article with solvent in such a way as to wet the outer plies of the article only without materially wetting the lining ply containing the adhesive; secondly: subjecting the article to a steady mechanical
15 pressure for some eighteen to thirty seconds approximately; and, thirdly: subjecting the collar alternately to pressing and evaporating stages until sufficient solvent has been evaporated for the collar to set sufficiently to resist the formation of wrinkles. A further advantage of this
20 process consists in the fact that when the collar is wetted in the manner described, and when the interlining contains adhesive in the form of yarns, for example, cellulose acetate yarns, then
25 the solvent tends to wet the "knuckles" of these adhesive yarns more than any other portion of the interlining, because it is these "knuckles" which make direct contact with the outer plies. Consequently, the most useful part of the adhesive in the interlining, namely, the "knuckles" of
30 the adhesive yarns receive most of the wetting. This has the advantage that it tends to reduce lateral spreading of the adhesive material, and hence, tends to give better porosity.

- 35 An apparatus for carrying out the pressing operations described above, which provides an automatic transfer from the non-evaporative pressing operation to the evaporative pressing operation, is shown in the accompanying drawings, in which:

Figure 1 is a front elevation of the machine with parts broken away; and

Fig. 2 is a side elevation.

The essential elements of this machine consist
45 of a padded drum, a belt under tension, and a plurality of pressing rollers bearing against the padded drum. Due to the tension on the belt, the article to be processed, when it lies between the belt and the drum, is subjected to a normal mechanical pressure determined by the formula:
50 $P = T + R$, where P is the normal pressure in pounds per square inch, T is the tension on the belt per inch of width of belt, and R is the radius of the drum in inches. As the collar travels between the belt and the drum, it is subjected to a steady mechanical pressure given
55 by P in this formula. As the drum continues to rotate, the collar emerges from under the belt and is then pressed successively by a series of rollers. Between each of these pressing operations, the collar is exposed to air, or preferably to a blast of air, which evaporates some of the solvent. Any wrinkles which tend to form are immediately smoothed out by the subsequent
60 pressing operation by the roller. Sufficient rollers are provided and sufficient evaporative air and time is allowed so that when the collar leaves the last of the rollers, it is set sufficiently to resist formation of wrinkles.

- 70 A more detailed description of the machine is as follows:—

Frame 1 supports drum 2 which is fixed to shaft 4. The surface of drum 2 is covered with padding 3. Shaft 4 is journaled in ball bearings

- 75 5. The drum 2 has a radius of approximately

nine inches, and it is driven by the motor 6 mounted on the base 7 through gears 8—9, gear reducer 10, universal joints 11, and shaft 12, worm 13 and wormwheel 14, which is keyed to the shaft 4. Worm 13 and wormwheel 14 are
5 enclosed in a housing 15.

A belt 16 is carried on fixed idlers 17—18 and movable idler 19. Idlers 17 and 18 are mounted on shafts 20 and 21 which are supported in bearings 22 bolted to the frame 1. Movable idler 19
10 is journaled in bearings 23 which are bolted to levers 24. Levers 24 are pivotally mounted on the spacer bar 25. The belt may be multilayer fabric belt covered with synthetic rubber. The tension on the belt is approximately two hundred
15 pounds per inch of width.

Pivotally mounted on the lower end of levers 24 are trunnion blocks 26. Handwheel 27 is keyed to the threaded shaft 28. A nut 29 which is pivotally mounted on the frame 1 is threaded
20 on the shaft 28 and supports it at its upper end. The lower end of the shaft 28 is supported by passing through the trunnion block 26. At the lower end of the shaft 28 is pinned a collar 30. A spring 31 is supported on the shaft 28 between
25 the trunnion 26 and the collar 30. By turning the handwheel 27 the spring 31 can be compressed or extended thus varying the tension of the spring. This tension is transmitted through the lever 24 to the idler 19 and to the belt 16.
30 The tension on the belt 16 results in a radial pressure being exerted by the belt 16 on the drum 2. The pressure exerted on the drum by the belt is determined directly by the spring tension. By calibrating the index plate 32 the pressure can
35 easily be set to any desired quantity.

Planetary rollers 33 covered with an impermeable, elastic solvent resistant padding 34 of "Thiokol" or other suitable material are supported in bearings 35 and trunnion blocks 36 so
40 as to bear on the drum 2. Tension on rollers 33 is controlled individually by handwheels 37 threaded in the arm 38 and bearing on spring block 39 and springs 40. Trunnion blocks 36 slide in slots 41 in arm 38. Their downward motion
45 is limited by stop plates 42 attached to the arm 38. The arm 38 is pivotally mounted on tie rod 43 on frame 1. The motion of the arm is controlled by screws 44 which fit into the threaded trunnion block 45. Links 46 connect
50 the trunnion block 45 and arm 38 through pin 47 and spacer block 48. The screw 44 is rotatably mounted in the frame 1, pinned to the lower end of the screws 44 are the bevel gears 49 meshing with bevel gears 50 which are keyed to cross
55 shafts 51. Shaft 51 is supported in pillow blocks 52 bolted to frame 1 at one end is keyed handwheel 53. By turning the handwheel 53 in a clockwise direction the trunnion blocks 45 are raised, through links 46 the arms 38 are raised
60 carrying with them rollers 33 and removing them from contact with the drum 2. By turning the handwheel in a counter-clockwise direction, the rollers are lowered. A stop screw 54 in arms 38 limits the downward motion by striking against
65 the stops 55 bolted to the frame 1.

The rollers 33 are driven through sprockets 56 keyed to the roller shafts 57 by sprocket chain 58. Sprocket chain 58 is driven by sprocket 59 which is riveted to spur gear 60. Sprocket 59
70 and spur gear 60 are rotatably mounted on the tie rod 43. Spur gear 60 meshes with gear 61 to which is riveted sprocket 62. Gear 61 and sprocket 62 are rotatably mounted on stub shaft 63. A sprocket chain 64 drives sprocket 62 from
75 63. A sprocket chain 64 drives sprocket 62 from

sprocket 65 keyed to shaft 4. Slack in the chain 58 is taken up by sprocket 66 which is rotatably mounted on an eccentric stub shaft 67.

The operation of the machine is as follows:—

After moistening the collar in a suitable spray chamber, the collar is placed on the exposed surface of the belt 16 in front of the machine. The belt 16, being driven by the slowly rotating drum 2, carries the work forward. A guard bar 68 protects the worker from getting caught in the machine. The collar is pressed between the belt 16 and the drum 2. The speed of the belt is such that the time of passage through this pressing area requires approximately twenty seconds.

When the collar leaves the belt covered portion of the drum 2, a stripper blade 69 strips it from the belt. The collar is then carried successively under the series of planetary rollers 33. As it passes from under the last roller a strip blade 70 strips the collar from the drum 2 and delivers it to the tray 71.

A duct 72 is connected to an outside exhaust system and draws air through the openings between the ends of the rollers 33. A hood 73 encloses the rollers and directs the air flow. If desired air may be blown through the duct 72 and hood 73 under pressure instead of drawing the air out. In either case there results a moving current of air across the face of the drum 2 between the rollers 33 which serves to accelerate the rate of evaporation of the solvent.

What I claim is:—

1. In a process for uniting plies of fabric, at

least one of which contains adhesive material in a dry state, the steps of moistening with a solvent for the adhesive material, subjecting the plies to a sustained steady pressure, and then 5
subjecting the plies to intermittent pressure, alternating with exposure to air to evaporate the solvent.

2. In a process for uniting one or more external plies which do not contain adhesive material to one or more plies which contain adhesive material in a dry state, the steps of wet- 10
ting with a solvent for the adhesive material the ply or plies which do not contain adhesive material, subjecting the assembly to a sustained steady mechanical pressure, and then subjecting 15
the plies to intermittent mechanical pressure alternating with exposure to air to evaporate the solvent.

3. In apparatus for adhesively uniting an assembly of fabrics which has been treated with 20
a solvent, a rotary drum, an endless belt having a reach bearing under tension against the face of the drum throughout an arc of the path of movement thereof, the relationship between the belt tension and the drum radius being such as 25
to cause a normal pressure of the order of twenty pounds per square inch, and a plurality of rollers bearing on the face of the drum at spaced intervals through a succeeding arc of the rotary path of movement of the drum. 30

BENJAMIN LIEBOWITZ.