United States Patent

Don

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[54] **APPARATUS FOR FORMING A STACK**

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[52] **U.S. Cl.** .....**271/72**, 156/556, 214/6 DK, 271/73

[51] **Int. Cl.** **B65h 29/36**, B65h 29/40

[58] **Field of Search** .....156/556, 538, 539; 271/70, 271/66, 72, 73; 214/60 K; 270/58

[56] **References Cited**

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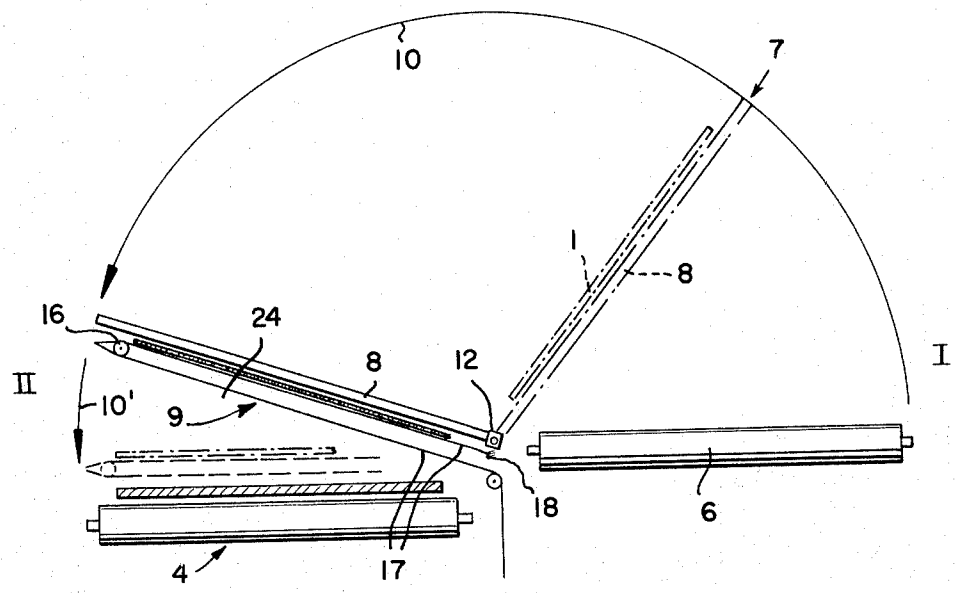
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[57] **ABSTRACT**

An apparatus for applying an adhesive-coated cover sheet or lamina to a substrate, such as a particulate or fibrous core, has a pair of substantially parallel surfaces which lie next to each other and form beds for the sheet and the substrate, respectively. Pivoted between these surfaces is a fork which can swing through an arc of close to 180° and has tines for lifting the adhesive-free underside of the sheet so that it can swing this sheet to a position above the substrate. A depositing arrangement is pivotal about an axis close to the fork pivot axis through the balance of the 180° arc so that it receives the sheet from the fork and moves it to immediately adjacent the substrate; the depositing device is displaced transversely to the pivot axis to the side, gently placing the sheet on the substrate. The surface of this placing arrangement is formed by a plurality of parallel cables which are spanned over a transversely displaceable guide.

10 Claims, 4 Drawing Figures



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SHEET 1 OF 3

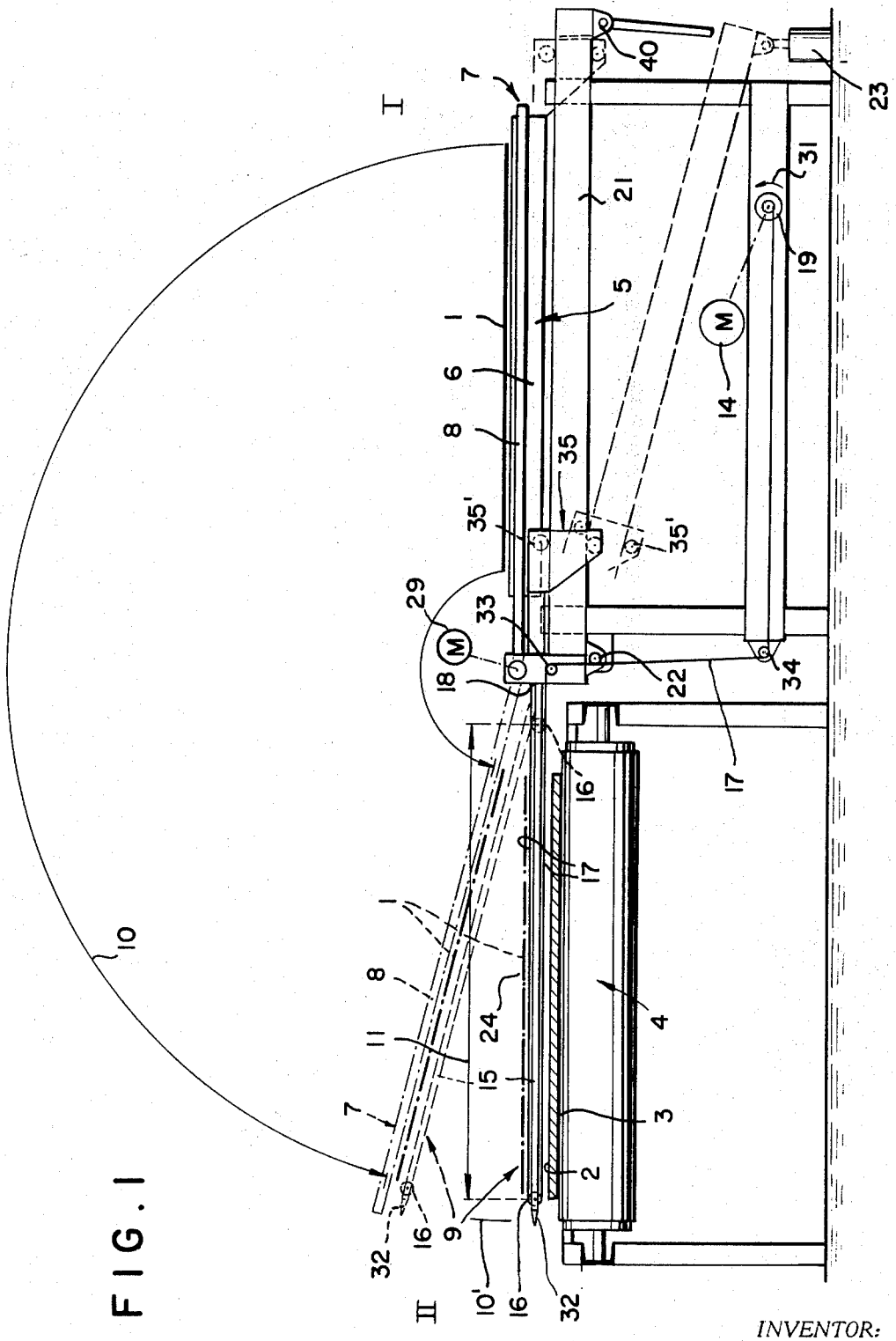


FIG. 1

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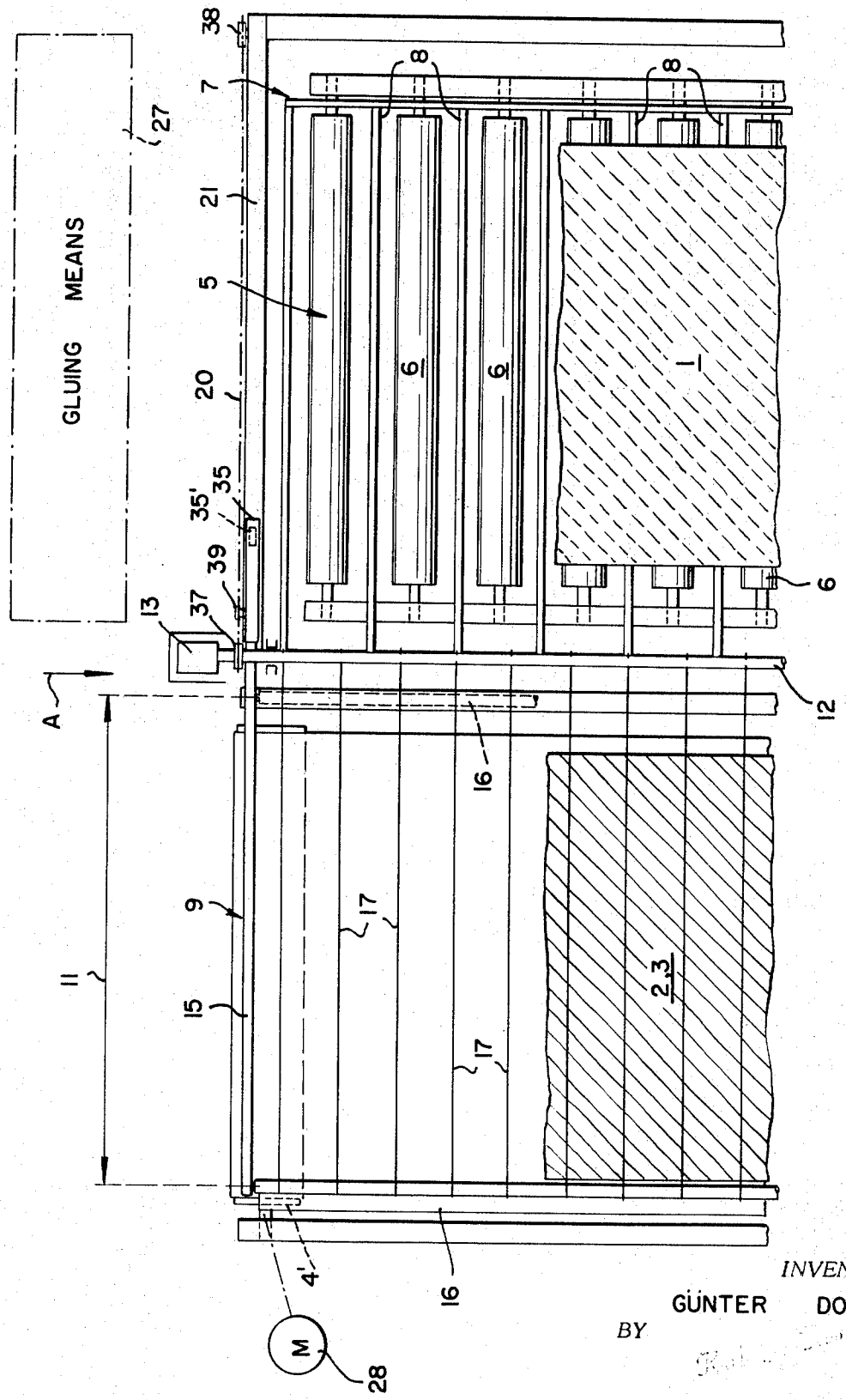
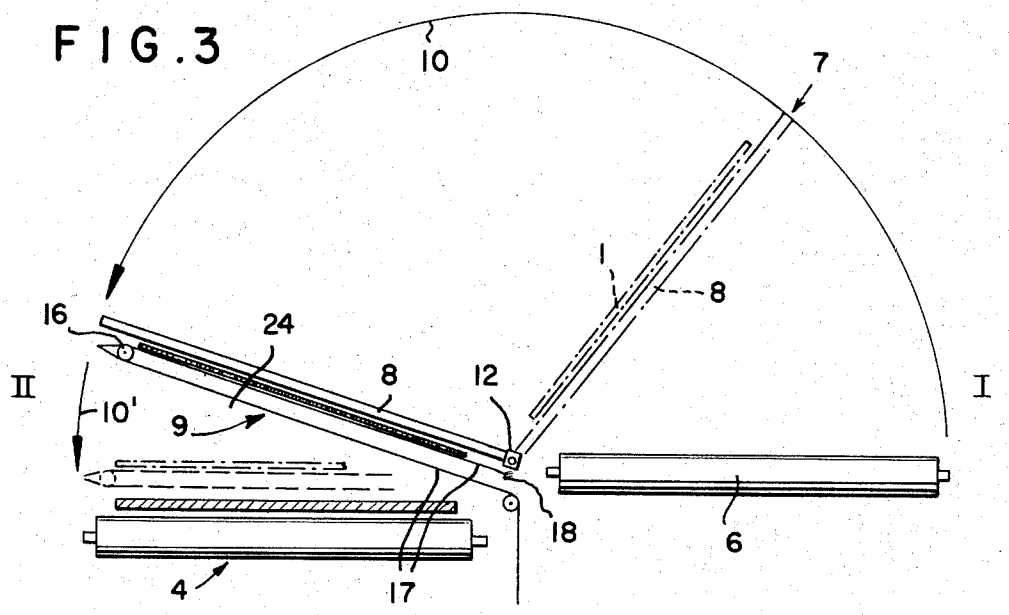


FIG. 2

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FIG. 3



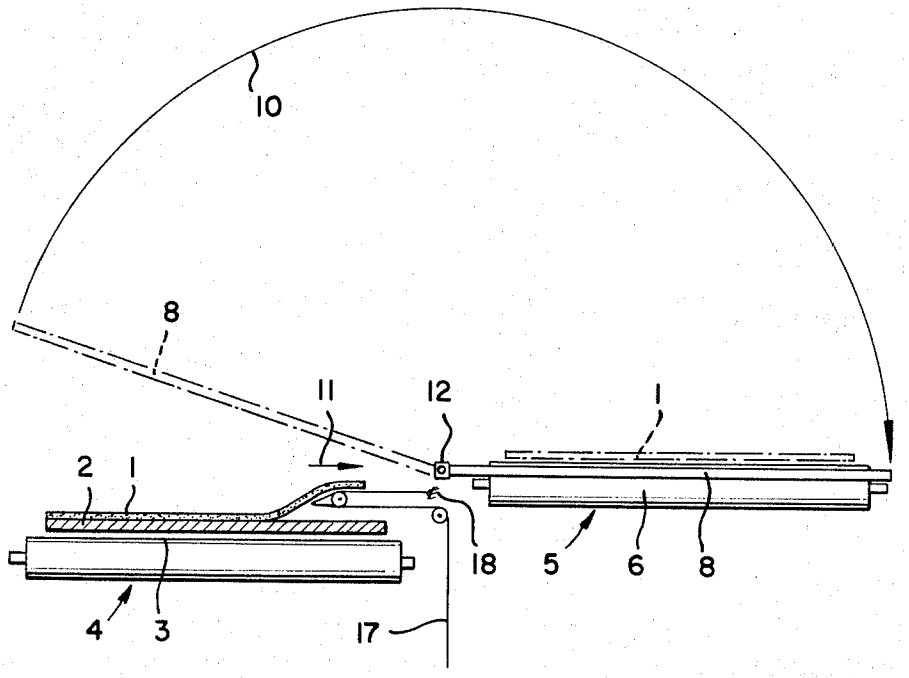


FIG. 4

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APPARATUS FOR FORMING A STACK

FIELD OF THE INVENTION

The present invention relates to an apparatus for applying a sheet to a substrate and, more particularly, to an apparatus for applying an adhesive-coated lamina to a noncoherent or only slightly coherent core.

BACKGROUND OF THE INVENTION

In the manufacture of many types of surface-finished pressed laminates and various types of paneling, a thin decorating, sealing or finishing lamina or sheet of wood, synthetic resin, paper or metal foil, is bonded to a relatively thick core. The lamina can be a synthetic-resin foil intended to impart heat-resistance and waterproof qualities to the core, or it can be a very thin veneer of high-grade hardwood adapted to mask a core of low-grade wood chips or fibers to give it the appearance of fine paneling. The core is of only limited coherency or of low-grade material; for example, it may consist of incompletely bonded or unbonded fibers, particles or chips of wood or cellulose. When a noncoherent core is described herein, the aforementioned structure is intended.

It has been the practice to fully press the core and then coat its upper face with adhesive so that the lamina need merely be laid on it. This can be carried out by a simple reciprocating roller arrangement or by means of vacuum lifters.

In more recent times it has been found, however, that it is possible to form a core of very regular cross-sectional dimensions, so that elimination of the prepressing step seemed possible. This requires application of the glue or adhesive to the underside of the lamina, so that significant problems have arisen. For example, many kinds of laminae lose much of their strength when so coated, thereby making it difficult to simply spray the underside of a sheet held by a vacuum lifter. In addition, suction handling of laminae having one gluey side is difficult and the core cannot simply be sprayed, since a heavy local application of adhesive is required just at the core-lamina interface.

OBJECTS OF THE INVENTION

It is therefore an object of the present invention to provide an improved apparatus for applying a sheet to a substrate.

Another object is to provide an apparatus that can apply a sheet having one adhesive-coated face to a noncoherent or only slightly coherent plate-like core and which does not exhibit the above-given disadvantages.

Still another object of the present invention is to provide an improved method of forming a laminate or stack in a convenient manner using thin glue-coated cover sheets.

SUMMARY OF THE INVENTION

The above objects are attained, according to the present invention, by an apparatus having means defining a first surface adjacent the substrate for supporting the sheet and means defining a second surface immediately above the substrate. A fork has tines engageable with the sheet and is pivotal about a horizontal axis disposed between the first surface and the substrate; means is provided for pivoting the fork about its axis

between a first position with the tines below the first surface and a second position adjacent and above the second surface. Means (depositing means) is also provided for displacing the second surface out from between the substrate and the sheet transversely to the fork pivot axis. In this manner the fork picks the sheet up off the first surface, turns it over, and deposits it on the second surface which in turn retracts laterally depositing the sheet on the substrate.

Such an apparatus allows the application of a sheet having its upper side coated with glue to a nearby substrate, the gluey side of the sheet being brought into engagement with the core. The pivot speed of the fork should be considerable whereby the sheet is held against the fork by its air-resistance force as much as possible. To this end, according to another feature of the present invention, the first surface and the substrate are disposed in respective parallel planes, possibly a common plane, while the fork pivots through a major arc α, in excess of ninety degrees and preferably close to 180°, and means is provided to pivot the second surface about an axis parallel to or coinciding with the fork pivot axis through a minor arc β where $\beta \approx 180° - \alpha$. In this case the pivot speed of the second surface is much less than that of the fork, since a careful placement is necessary and wind resistance is no longer used.

This second surface, in accordance with another feature of the invention, is formed by a plurality of parallel cables spanned with a relatively constant tension over a guide displaceable transverse to the axes, with the upper cable stretch being anchored at one end e.g. to the frame defining the pivotal second surface) and the lower cable stretch being retracted as the guide is moved back

DESCRIPTION OF THE DRAWING

The above and other objects, features and advantages will become apparent from the following description, reference being made to the accompanying drawing, in which:

FIG. 1 is a cross-section through the apparatus according to the present invention;

FIG. 2 is a top view of the apparatus; and

FIGS. 3 and 4 are diagrammatic views similar to FIG. 1 and showing the apparatus in two different work positions.

SPECIFIC DESCRIPTION

As seen in FIGS. 1 and 2 the apparatus serves in the application of a foil 1 to a substrate 2, 3. The foil 1 can be an synthetic-resin sheet, such as of the melamine-formaldehyde type, to make hard heat-resistant panels. The substrate 2, 3 consists of a hard sheet 3 on which has been deposited a core 2 of comminuted, fibrous or chipped material. This core 2 is not coherent, but merely has been carefully deposited on the sheet 3 by methods such as the one described in the commonly assigned patent application Ser. No. 737,465 filed 17 June 1968 by Gerhard Hütz and entitled METHOD OF AND PLANT FOR THE PRODUCTION OF INTEGRATED LAMINATES, wherein a plurality of hoppers filled with differently graded material continuously deposit on a transport band a very even carpet that is subsequently subdivided into individual mats. Each of the sheets 1 is, further, coated on its upper sur-

face with an adhesive by gluing means **27** located upstream in the direction of travel of the sheets **1** as indicated by arrow A.

The sheets **1** rest on a bed **5** formed by a plurality of parallel rollers **6** extending perpendicular to the transport direction A and defining a horizontal planar surface onto which the sheet **1** is rolled. The substrate **2, 3** is received on an endless belt **4** spanned over a pair of rollers **4'**, one of which is intermittently driven by a motor **28** to advance the upper surface of the belt in the transport direction A.

It is, of course, necessary to place the sheets **1**, glue side down, on the substrate **2, 3**. This requires turning over the sheet **1**. A transfer fork **7** cooperating with a placing apparatus **9** carries out this function. It must be recognized that the sheet **1** has to be pivoted through 180°, but that it cannot simply be dropped onto the noncoherent mat **2** since this would blow away some of the material forming this mat and would result in an inaccurate placement. Slowly flipping the sheet **1** is impossible without gripping it on both faces. The form **7** here operates rapidly, as will be described below, to flip or turn over the sheet **1** so that wind resistance holds it against the fork, while the arrangement **9** serves to place the turned-over sheet **1** carefully on the substrate **2, 3**.

The form **7** comprises a pair of parallel tines **8** which are engageable between the rollers **6** and below the surface **5** formed thereby. These tines **8** are all connected at one end to a pivot shaft **12** which defines a straight pivot axis in line with the transport direction A and parallel to and slightly below the planar surface **5**. The other ends of the tines **8** are optionally interconnected by a rod **12'**, and a motor **29** is intermittently actuated to sweep this fork **7** back and forth through an arc **10** of $\alpha = 165°$ to 170°. The tines **8** are very light and do not come into contact with the gluey face of the sheet **1**.

The placing device (depositing means) **9** includes a plurality of cables **17** which define a planar surface **24** adapted to receive the sheet **1** from the fork **7**, gluey face down, and thereafter displace itself out of the transverse to the axis **12** way under the sheet **1** to lay this sheet **1** gently on the substrate **2, 3**. These cables **17** are all anchored securely on the machine frame at **18** (or to a frame formed by arms **15**) and at their other ends they are wound up on a plurality of coaxial windlass pulleys **19** (one shown) mounted on a common shaft connected to a torque motor **14** which is constantly energized to rotate the drums **19** in the direction shown by arrow **31** to hold these cables **17** very taut. The cables pass over a roller **16** adjacent to which is provided an elongated wedge-shaped nosepiece **32** similar to that provided in the commonly assigned U.S. Pat. No. 3,482,675 issued 9 Dec. 1969. Either the nosepiece **32** or the roller **16** can be dispensed with. Thence they are spanned over a pair of rollers **33** and **34**. This provides a surface of large effective surface area but very small actual surface area so that the glue on the sheet **1** is not stripped off, not can a cushion of air form between the sheet **1** and the surface **24**. The cables **17** are spaced, to this end, as far apart as possible while sufficiently supporting the sheets **1**. Since the roller **16** and nosepiece **32** are not of great thickness and since the roller **33**, which like the roller **34** is a long freely rotatable cylinder provided with circumferential grooves, is only a few centimeters below the attachment points **18**, the effective height of the arrangement **9** being small.

The roller **16** is journaled in a pair of rigid arms **15** which also carry the nosepiece **32**. Each arm **15** is displaceable transversely to the axis of the traverse **12**. To this end, the end of each arm **15** remote from the roller **16** is received on a carriage **35** which rides by means of rollers **35'** on a normally horizontal beam **21**. Each beam **21** carries at one end a motor **13** whose shaft is provided with a sprocket **37** over which is engaged a chain **20** also passing around a sprocket **38** at the other end of the beam **21**. The chain **20** is attached to the arm **15** at **39** so that rotation of the motor **13** in one sense moves the carriage in one direction on the beam **21** and in the other sense moves it in the opposite direction. This allows the arrangement **9** to be pulled out from between a sheet **1** and substrate **2**, with the cables **17** being wound up on the pulleys **19** advantageously placed far enough from the arrangement **9** so that no part of the cables **17** which engaged the gluey face of the sheet **1** reaches the pulleys **19**.

The beams **21** are pivoted under the axis **12** about an axis **22**, and are connected at **40** at their opposite end to respective hydraulic cylinder arrangements **32** to pivot the arrangement **9** through an arc **10'** of $\beta = 20°$ to 25°.

The apparatus operates as follows, with particular reference to FIGS. **3** and **4**.

A substrate **2, 3** and a sheet **1** are fed into their respective surfaces **4** and **5**, with the fork **7** down in the position shown in FIG. **2** and in the region I of FIG. **3**. The cylinders **23** are contracted to lift the end of the surface **9** and the motor **13** is driven to fully extend this surface. Then the motor **29** is actuated to swing the fork **7** through the arc **10** and deposit the sheet **1**, glue side down, on the cables **17** (position II in FIG. **3**). The motor **29** is subsequently reversed and the cylinders **23** are extended to move the surface **9** into a plane parallel and between the two parallel but vertically offset planes **4** and **5**. Thereupon the motor **13** is actuated to retract through a distance **11** the roller **16** to the right, as shown in FIG. **4**, thereby depositing the sheet **1** gently on the mat **2**. The various movements can be controlled by limit switches and photoelectric cells.

Thereafter the sandwich can be pressed by, for example, a platen press as described in the above-identified patent.

The speed at which the arrangement **9** is pivoted is much less than that at which the fork **7** is pivoted, this being possible since, from the position II, the arrangement **9** need merely pivot through 20° to 25°, retract, pivot back, and extend again, while at the same time the fork **7** must swing through 165° to 170°, a sheet must be rolled over this fork, and it must swing back. Thus a gentle deposition is possible along with a very high overall production speed. The sheet **1** is only moved slowly immediately adjacent the substrate **2, 3** since only in this region could overly rapid handling lead to difficulties. Conventional limit switches, light-beam/photocell arrangements and the like may be used to control fork swing and cable retraction.

The only part of this apparatus which comes into contact with the glue on the upper side of the sheet **1** is the cables **17**, which are easily cleaned.

I claim:

1. An apparatus for applying a sheet to a substrate, said apparatus comprising:

means defining a first surface adjacent the substrate for supporting the sheet;

a fork having tines engageable with said sheet and being pivotal about an axis parallel to said first surface and disposed between said first surface and said substrate;

means forming a second surface immediately above said substrate;

means for pivoting said fork about said axis between a first position with said tines below said first surface and a second position adjacent and above said second surface and thereby picking said sheet up off said first surface, turning it over, and depositing it on said second surface;

means for displacing said second surface out from between said substrate and said sheet transversely to said axis to lay said sheet on said substrante; and

means for pivoting said second surface about an axis parallel to said substrate.

2. The apparatus defined in claim 1 wherein said first surface is parallel to said substrate, said means for displacing said second surface including a guide displaceable transversely to said axis.

3. The apparatus defined in claim 1 wherein said means forming said second surface includes a plurality of nonrigid elongated elements passing over said guide, each of said elements having one end fixed relative to the substrate and another end displaceable away therefrom, said means forming said second surface also including means connected to said other ends of said elements for making same taut to pull same over said guide on retraction of said guide toward said axis.

4. The apparatus defined in claim 1 wherein said elements are flexible cables.

5. The apparatus defined in claim 1 wherein said substrate and said first surface are substantially parallel, said fork being pivotal through a major arc and said second surface being pivotal through a minor arc, said arcs together extending over substantially 180°.

6. The apparatus defined in claim 1 wherein said major arc extends over between 165° and 170°.

7. The apparatus defined in claim 1 wherein said means for pivoting said second surface includes at least one upright hydraulic cylinder.

8. The apparatus defined in claim 1 wherein said means defining said first surface includes a plurality of rollers, said tines being engageable between said rollers.

9. The apparatus defined in claim 1 further comprising transport means forming a surface receiving said substrate for conveying said substrate into and out of said apparatus.

10. A method of forming a laminate comprising the steps of:

advancing a sheet in a transport direction to a position alongside a substrate;

pivoting said sheet through an angle between 90° and 180° about an axis substantially parallel to said transport direction and laying said sheet on a surface above said substrate;

moving said surface downwardly toward said substrate; and

withdrawing said surface out from between said sheet and said substrate in a direction transverse to said axis to deposit said sheet on said substrate.

* * * * *