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(54) Title: METHOD OF ADHERING SHEET GOODS TO A WORK SURFACE

(57) Abstract

A clean, neat and effective method for adhering sheet goods to a work surface entails placing adjacent to the surfaces to be joined a device which comprises: a target element contiguous with a heat activatable adhesive material, said target element being absorbent of electromagnetic waves which are convertible to heat energy to activate said adhesive material, holding said surfaces together, and exposing said device to electromagnetic waves to produce heat sufficient to activate the adhesive material to effect a bonded relationship between the sheet goods and the work surface.

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METHOD OF ADHERING SHEET GOODS TO A WORK SURFACE

CROSS REFERENCE TO A RELATED APPLICATION

This application relates to U.S. Patent Application Serial No. filed on even date herewith and entitled "Adhesive Device" by Shomler et al. Said application and its disclosure are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

This disclosure relates to the installation of sheet goods by adhesive attachment. "Sheet goods" is the term used in the construction industry to describe panels, plastic counter laminates, gypsum board drywall, plywood, oriented strand board (OSB), particle board, asphaltic shingles, insulation board and exterior siding panels. These sheet goods are generally employed to construct subfloors, roof sheathing, walls sheathing, sheer walls, roof and wall shingle, insulate walls and floor underlayment. On the job, sheet goods are attached to conventional structural framing material which is usually wood or steel. The sheeting is also frequently attached to itself and to steel framing members of various gauges and strengths. It is envisioned that the practice of the disclosed method would occur both at in-plant and construction sites.

Sheet goods are usually attached to a structural work surface which, as mentioned above, is usually a 2x or 4x material of wood, composite material or a steel framing member. It is also important to note that sheet goods may also be attached to another

piece of sheet goods which, in that case, would also be a work surface. The attachment of sheet goods to the work surface is typically effected by employing mechanical fastening devices such as nails, staples, tacks and brads. However, these power or hand driven fastening devices are labor intensive and are rapidly falling into disfavor as new adhesives are developed which are safer to work with and produce attachments that are actually more secure than the traditional fastening methods. However, the use of new adhesives alone is not the final answer. Adhesives are messy and difficult to apply to "hidden" or inaccessible places. It is apparent, then, that inventions are waiting to be made which address the placement of adhesive material in a neat, clean, safe and effective manner that can be used beneficially in manufacturing and construction, and especially with regard to the placement or sheet goods to a work surface.

Not surprisingly then, others have experimented with alternatives to traditional fastening devices for attaching sheet goods to a work surface.

DESCRIPTION OF THE PRIOR ART

United States Patent 4,038,120 to Russell describes the use of an energized heating element or wire to heat a hot melt glue resulting in adhesion between contiguously assembled panels. The reference method involves heating a glue-coated wire to liquefy the glue producing a cohesive state and facilitating the assembly of panels. This method is particularly useful for introducing a cohesive material (glue) to an area of limited accessibility (groove), but the heating element (wire) requires the direct application of energy (electricity) to provide the heat to melt glue.

United States Patent 3,574,031 to Heller et al. describes a method and material for

welding thermoplastic bodies by using a susceptor between the bodies to be joined. The susceptor sealant is characterized by having particles, heatable by induction, dielectric or radiant energy, dispersed in a thermoplastic carrier compatible with the thermoplastic sheets to be welded. The welding of the thermoplastic sheets is effected by exposing the susceptor sealant to heat energy, softening the carrier material and joining all thermoplastic materials.

United States Patent 3,996,402 to Sindt relates to the assembly of sheet materials by the use of a fastening device utilizing an apertured sheet of eddy current-conducting material sandwiched between coatings of hot-melt glue. An induction heating system is activated causing eddy current heating in the EC-conducting material with consequent melting of the hot-melt glue thus resulting in fusion and, ultimately, bonding of the sheet materials in accordance with the desired construction.

SUMMARY OF THE INVENTION

The presently disclosed method of adhering sheet goods to a work surface is distinguished from, and improves upon, the prior art by utilizing a device to be placed adjacent to the surfaces to be joined which comprises a target element contiguous with a heat activatable adhesive material said target element being absorbent of electromagnetic waves which are convertible to heat energy for activating the adhesive material, holding said surfaces together, and exposing said device to electromagnetic waves to produce heat sufficient to activate the adhesive material to effect an adhesive bond between the sheet goods and the work surface.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Sheet goods comprising, for example, gypsum board drywall, plywood, insulation board, plastic or metal laminates, oriented strand board, particle board, asphaltic shingles and exterior siding panels can be adhesively joined effectively and efficiently to a work surface such as a joist, stud, plate, header, truss or rafter typically fashioned from a 2x or 4x wood, steel or composite material by employing the method herein described.

A typical procedure for the attachment of sheet goods to a work surface would entail little more than placing the devices disclosed herein in such a manner that when activated they would adhesively join a piece of sheet goods material to the intended work surface.

At the risk of stating the obvious by describing the ease of performing the disclosed method, consider the simplicity of installing a subflooring or a roof sheathing using four feet by eight feet plywood panels. The method entails little more than simply placing, or perhaps securing, units of the disclosed device on the edge surfaces of the rafters, wall studs or floor joists where the plywood panel is to be attached, putting the panel in place and then activating the adhesive device with electromagnetic waves to adhesively join the panel to its work surface.

In the case of asphaltic shingles, the roof and wall sheeting materials would, in turn, be the work surface for the next layer of sheeting material, viz., the asphaltic shingle. Shingles are particularly well suited for installation according to the disclosed method. Shingles are widely used as roof coverings and frequently for siding as well. Shingles are applied in overlapping courses or rows, and the degree of overlapping is

determined by the pitch of the roof or aesthetic concerns. In either case, one shingle will be the work or attaching surface of the overlapping shingle. In these cases, almost the entire construction of the dwelling or edifice would be effected by adhering one sheeting material to another and to a third layer, all using the adhesive device of the disclosed method.

Looking at the adhesive device employed in the disclosed method in greater detail, we see that the target element must, for the most part, be fashioned from materials or substances that are not transparent to electromagnetic waves. Indeed, the target element will necessarily be constructed of a composition that will absorb electromagnetic waves. Once absorbed by the target element, these waves will produce magnetic hysteresis and eddy currents resulting in heat energy which will melt or activate the contiguous adhesive material.

Typically, the target element will be fashioned from metallic materials such as steel, aluminum, copper, nickel or amalgams thereof which have proven utility and are readily available; although, some semi-metallic materials such as carbon and silicon are also known to be suitable for the absorption of electromagnetic waves.

The target element can assume any form or shape consistent with the overall configuration of the adhesive device. Frequently, the target element will be presented as a metallic foil, mesh or strip, and, in some instances, it will be more effective to present the target element in the form of a fiber, chip or flake of an electromagnetic absorbable material. The point to be made is that the target element need only be fashioned from a material reasonably impervious to, and absorptive of, electromagnetic waves.

In use, the adhesive device needs to be situated adjacent to the sheet goods and the work surface. Typically, the sheet goods will be wood, fiber board, insulation board, plastic or any of a variety of composite materials. As a practical matter, of course, the sheet goods need to be transparent to electromagnetic waves. Some materials will be more transparent than others, and empirical adjustments can and will be made to modulate the quantity and intensity of electromagnetic wave energy needed to optimally activate the adhesive material.

In many instances, it will be sufficient for the adhesive device simply to be placed adjacent to the sheet goods and the work surface. In other construction or assembly situations, it will be necessary to make some arrangements or take additional steps to make sure the adhesive device remains in place prior to activation. Such an additional step need be little more than introducing an additional attachment element such as a small pressure sensitive adhesive area on the surface of the device . Simpler means for positioning the device prior to activation might entail clamping, tacking, stapling or spiking to make sure the adhesive device is situated and activated in the most effective and, therefore, most desirable location. But these measures, of course, would be optional procedures and in no way essential to the performance of the device in its broadest typical and routine applications

When desirably situated adjacent to the sheeting materials and the work surface, the adhesive device is ready to be exposed to electromagnetic waves, produced by and emanating from a generator powered by a source of alternating electric current. The generator can be held in a fixed position for assembly-line production or designed to be

manipulated so as to quickly and easily pass over, around or near the strategically "hidden" device while emitting electromagnetic waves which will penetrate the "transparent" sheet goods, be absorbed by the target element, be converted to heat energy, activate the adhesive material resulting in a bonded relationship between the sheet goods and the work surface.

To elaborate, somewhat, heat is produced in the conductive target element by two mechanisms: eddy current resistive heating and magnetic hysteresis. Eddy current resistive heating applies to all conductive materials and is produced in the target element by the electromagnetic waves emanating from the generator. The heat resulting from magnetic hysteresis is observed only in magnetic materials. As the electromagnetic field produced by the generator reverses polarity, the magnetized atoms or molecules in the target element also reverse. There is an energy loss in this reversal which is analogous to friction: This energy loss is magnetic hysteresis. The "lost" energy is quickly converted to heat and conducted by the target material to the contiguous, and frequently enveloping, heat-activatable adhesive material to initiate adhesion.

When heated to the necessary temperature, the adhesive material will liquefy or become heat-activated, attach itself to the work surface and, on cooling, create an adhesive relationship between the sheet goods and the work surface.

Two adhesion mechanisms, hot-melt and heat-activated cure, are proposed for use with the disclosed device. Both mechanisms are initiated by heat emanating from the target element. Hot-melt adhesives are solid at ambient temperatures, but melt or liquefy when the temperature is elevated by, for instance, heat accumulating in the target

element. The melted adhesive "wets" the adherends and, in the case of porous or fibrous adherends, penetrates the surface of the pieces to be bonded. As the adhesive cools, the adherends and adhesive are bonded by the electrostatic attraction of polar molecular groups. In the case of porous or fibrous adherends, mechanical interlocking can contribute to bond strength. Note that for the hot-melt mechanism, the bonding is reversible. Thus by repeating the induction heating procedure, the bond can be undone and the adherends separated. The ability to reverse the adhesion and separate fixed millwork is not a trivial attribute. In addition to the obvious advantage of being able to reassemble or repair misaligned sheet goods, it may also desirable to be able to disassemble affixed sheeting material to facilitate serviceability and repair.

Heat-activated curing adhesives are also solid and easy to manipulate at ambient temperatures, but when the adhesive temperature is elevated by, for example, the heat emanating from the target element, a chemical reaction is initiated. This reaction involves a cure or crosslinked bonding either within the adhesive or between the adherends. Such bonds are typically irreversible. Frequently, a heat-activated curing adhesive bond will demonstrate an electrostatic attraction between the adhesive and the adherends and a crosslinked bond within itself.

While the foregoing is a complete description of the disclosed method, numerous variations and modifications may also be employed to implement the purpose of the invention. And, therefore, the elaboration provided should not be assumed to limit the scope of the invention which is intended to be defined by the appended claims.

What is claimed is:

1. A method of adhering sheet goods to a work surface which comprises placing adjacent to the surfaces to be joined a device which comprises: a target element contiguous with a heat activatable adhesive material, said target material being absorbent of electromagnetic waves which are convertible to heat energy to activate said adhesive material, holding said surfaces together, and exposing said device to electromagnetic waves to produce heat sufficient to activate the adhesive material to effect a bonded relationship between the sheet goods and a work surface.

2. An article of sheet goods including an adhesive device which comprises: a target element contiguous with a heat activatable adhesive material, said target material being absorbent of electromagnetic waves which are convertible to heat energy to activate said adhesive material.

INTERNATIONAL SEARCH REPORT

Inter. nal Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C09J5/06 //E04D5/02,E04F13/00,B29C65/36

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C09J B29C B27H E04F E04D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	AT 321 432 A (H.LEINFELLNER) 25 March 1975 see the whole document ---	1,2
X	PATENT ABSTRACTS OF JAPAN vol. 012, no. 372 (C-533), 5 October 1988 & JP 63 120786 A (MICHIE MIYAMOTO), 25 May 1988, see abstract; figures ---	1,2
X	US 3 996 402 A (SINDT MELVIN R) 7 December 1976 cited in the application see column 2, line 33 - line 36; figure 11 --- -/--	1,2

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 013, no. 095 (C-573), 6 March 1989 & JP 63 273682 A (MICHIE MIYAMOTO), 10 November 1988, see abstract; figures	1,2
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