APPARATUS FOR FASTENING ARTICLES

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ABSTRACT

A fastening tool for driving adhesive through a solid workpiece into the interface thereof with a base member includes a chamber for liquid adhesive having a smaller chamber or bore terminating in an exit nozzle. A plunger movable in the bore is impacted by a piston driven member to propel adhesive from the exit nozzle at high speed to drive the adhesive through the workpiece. The chamber is heated to permit use of hot melt adhesives.

2 Claims, 7 Drawing Figures
APPARATUS FOR FASTENING ARTICLES

This application is a continuation of application Ser. No. 172,980, filed Aug. 19, 1972, now abandoned, which is a division of application Ser. No. 776,712, filed Nov. 18, 1968, now U.S. Pat. No. 3,616,034.

The present invention relates to a new and improved apparatus for adhesively fastening two members. More specifically, the present invention is directed to an apparatus for driving an adhesive material through a solid workpiece to spread at the interface thereof.

Accordingly, one object of the present invention is to provide a new and improved fastening device.

Another object is to provide a new and improved fastening device for providing the adhesive fastening of members.

A further object of the present invention is the provision of a new and improved fastening device capable of driving an adhesive material through a solid workpiece.

Another object is to provide a liquid adhesive applying tool capable of driving a free body of adhesive through a solid workpiece and into an interface, which tool includes a liquid adhesive containing bore, a plunger movable in the bore, and a fluid powered impact member for applying an impact force to the plunger to discharge adhesive from an exit nozzle communicating with the bore.

Further objects and advantages of the present invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of the specification.

In accordance with these and other objects, there is provided an improved fastening device for driving adhesive through a solid workpiece, including an adhesive chamber communicating with a cylinder terminating in a nozzle. A plunger is provided in the cylinder for ejecting adhesive with great force and velocity. It has been found that the adhesive can be ejected with sufficient force to penetrate through a solid workpiece. The adhesive will spread at the interface of the members to provide the adhesive fastening of the members.

Many suitable drive devices may be provided for operating the plunger; however it has been found that a pneumatically operated piston and drive member engageable with the plunger function advantageously to provide the desired force and velocity for the adhesive.

The present invention is also directed to a new and improved method of fastening members together. Briefly the method consists of driving an adhesive through a solid workpiece by its own inertia, being ejected with sufficient force and velocity to penetrate the solid workpiece. The adhesive is then spread at the interface of the members to provide an adhesive bond.

Advantageously it has been found that the adhesive will penetrate through a workpiece, to the interface between a workpiece and a base member, and will spread at the interface whether or not the materials of the workpiece and base member are similar or dissimilar. Thus the method and apparatus according to the present invention may be useful for many purposes such as securing furring strips to concrete or block bases; securing dry wallboard or paneling directly to concrete or block surfaces without the use of furring strips; securing paneling or other veneer to base structures, and many other uses.

For a better understanding of the present invention, reference may be had to the accompanying drawings wherein:

FIG. 1 is a fragmentary view of a fastening device according to the present invention;

FIG. 2 is a fragmentary view illustrating a method of use of the fastening device of FIG. 1;

FIG. 3 is a fragmentary view, similar to FIG. 2, illustrating another mode of use of the fastening device of FIG. 1;

FIG. 4 is a cross sectional view of a typical adhesive joint, taken along line 4--4 of FIG. 3;

FIG. 5 is a fragmentary view illustrating the adhesive fastening of a workpiece to a glass base member;

FIG. 6 is a fragmentary view illustrating the securing of furring strips to a concrete wall; and

FIG. 7 is a cross sectional view of the furring strips and wall structure of FIG. 6.

Referring now to the drawings, and particularly to the embodiment of FIG. 1 thereof, there is illustrated a fastening device 10 for ejecting adhesive with sufficient force and velocity to cause the adhesive to penetrate through a solid workpiece. More specifically the fastening device 10 includes a nose portion 12 having a chamber 14 for adhesive material. A nozzle 16 communicates with the chamber 14, and includes a cylinder 18 having one end 18a open into the chamber 14, and having a restricted exit 18b of substantially reduced cross section at its other end. The nozzle structure 16 is shown as being threadedly or removably mounted on the nose portion 12 to permit nozzle 16 having different openings or exits 18b to be used. A plunger 20 is provided for reciprocal movement within the cylinder 18, and a spring 22 is provided for returning the plunger to its normal or at rest position as illustrated in FIG. 1. Projections 16a extending upwardly from the body of the nozzle 16 guide the plunger 20 into the cylinder 18, and further serve to provide passageways for the adhesive to fill the cylinder 18 after the plunger 20 has been returned to its normal position.

Although different types of adhesives with different compositions and characteristics can be used to carry out the present invention, an additional advantage is obtained using adhesives which have a rapid set or quickly attain "green strength" to permit the joined parts to be self-supporting. As an example, epoxy adhesives and hot melt adhesives are satisfactory and are well known. Hot melt adhesives, for instance, become viscous when heated to a temperature which may, with different compositions, be in the range of 250°F. to 400°F. To this end, the chamber 14 is surrounded by a suitable electrical heating jacket 24 which may, if desired, be thermostatically controlled to provide the required temperature. The material forming the nose portion 12 preferably is a good thermal conductor and provides a heat source for maintaining the adhesive at the desired temperature or viscosity.

If desired, means may be provided for insuring that the cylinder 18 is maintained full of adhesive when the plunger 20 is withdrawn. To this end there is provided a fluid connection 26 for admitting pressurized fluid such as compressed air to the chamber 14 to maintain a slight pressure above atmospheric within the chamber 14.

The plunger 20 may be driven through its drive stroke in any suitable manner. In the illustrated embodiment a standard commercial pneumatic fastener
It has been found by experimentation that the positioning of a tool in accordance with both the embodiments of FIGS. 2 and 3 provides a satisfactory bond with a minimum visual opening in the workpiece 44 by the penetration of the adhesive 48. However, in certain applications and with certain materials the spacing of the nosepiece 12 above the workpiece 44 may provide a better appearing and less noticeable opening through the workpiece 44.

FIG. 5 illustrates the fastening of a strip onto hard material such as glass. More specifically there is illustrated a furring strip 52 which is secured to a glass base member 54 by use of the present method. Adhesive is directed through the furring strip 52 at a plurality of spaced points 56 so that the adhesive spreads at the interface between the strip 52 and the base member 54 as illustrated at 58.

FIGS. 6 and 7 illustrate the connection of workpieces 62 such as furring strips to a base member 64 here illustrated as a concrete wall. Each of the furring strips 62 is adhesively fastened in a plurality of spaced apart points by the penetration of suitable adhesive 66 through the furring strips.

In accordance with the method of the present invention, it has been determined that it is possible to control or achieve the spreading of the adhesive at the interface between the elements to be joined together. Although the phenomenon is not fully understood, it appears as if the controlled dispersion of the adhesive at the desired point is related to the nature of the discharged stream of adhesive and the nature of the workpieces to be joined. The nature of the adhesive stream is dependent on or varies with, for instance, the viscosity of the adhesive, the area of the discharge orifice, and the velocity of the discharged adhesive. Certain of these factors are interdependent and further dependent on, for example, the pressure applied to the adhesive 48 in the chamber 18 during the driving stroke. For instance, the force applied to the adhesive in the chamber 18 and the size of the exit opening of the nozzle tend to change the temperature of the adhesive, and the change in temperature varies the viscosity of the adhesive in the discharged column.

By properly correlating the factors referred to above, it has been determined that the controlled dispersion of the adhesive at a desired interface between elements to be joined can be achieved. As an example, with two wooden workpieces to be joined, it has been determined that using hot melt adhesive at a given temperature and viscosity with a given air pressure for driving the piston 34, the stream of adhesive discharged from the tool 10 passes completely through both of the wooden workpieces by reducing the air pressure for driving the piston 34 or by reducing the viscosity of the liquid adhesive, the adhesive stream discharged from the tool 10 passes through only the first of the two wooden workpieces and is dispersed or spread at the interface between the two workpieces to join them together. A variation in the nozzle orifice size can also be used to effect this control by increasing orifice area to reduce the workpiece penetration.

With more than two workpieces or laminae disposed adjacent each other to form a number of spaced workpiece interfaces, the nature of the liquid adhesive column can be controlled as described above to select the one of the interfaces at which spreading of the adhesive occurs. This permits the workpieces to be secured with
What is claimed is:

1. Apparatus for driving adhesive through a solid workpiece to the interface thereof with a base member, said apparatus comprising in combination:
   a portable hand-held tool including a housing and a handle;
   a nose portion supported on said housing in a fixed position relative to said housing and adapted to be placed adjacent the workpiece;
   a pneumatic cylinder in said housing and a piston in said cylinder movable toward and away from said nose portion;
   control means including a trigger disposed adjacent said handle for moving said piston in a drive stroke toward said nose portion;
   said nose portion including a first chamber for containing a body of liquid adhesive;
   heating means mounted on said nose portion for heating said adhesive to a temperature sufficient to maintain said adhesive in a viscous condition;
   an elongated second chamber in said nose portion substantially smaller than said first chamber, said second chamber having an inlet communicating with the first chamber at one end to permit liquid adhesive to flow from the first chamber into the second chamber;
   a plunger supported in said nose portion extending through the first chamber and mounted for reciprocating movement along a path between a first position substantially removed from the second chamber and a second position at least partly in said second chamber;
   a nozzle including a restricted orifice leading from said second chamber to the exterior of said nose portion;
   means for normally urging said plunger toward said piston and out of said second chamber; and
   a drive member supported by said piston and normally spaced from said plunger;
   said drive member striking said plunger during said drive stroke for driving said plunger into said adhesive cylinder to propel said viscous adhesive from said nozzle at high speed in order to drive said adhesive through the solid workpiece by its own inertia and into the interface between the workpiece and the base member.

2. The tool set forth in claim 1 in which the second chamber comprises an elongated cylinder,
   said end portion of the plunger means includes a cylindrical portion slidable within the elongated cylinder of the second chamber,
   and the first chamber is disposed above the first end of the second chamber intermediate the second chamber and the drive member.