A New Concora Instrument for Forming Hot Melt Adhesive Bonds on Container Boards

R. G. TAUS and G. G. MALTENFORT

A new instrument has been developed for forming hot melt adhesive bonds on container boards, called the Concora Glulab. This device simulates under laboratory controlled conditions all the parameters in hot melt sealing during the manufacturing process. This method for the reproducible preparation of hot-melt-adhesive-mated substrates permits the study and evaluation of the performance characteristics of adhesives, their compatibility with various coated and uncoated substrates, and the development of realistic specifications.

Keywords: Hot melt adhesives · Container boards · Testing equipment · Concora test · Adhesives · Coatings · Curtain coating · Compatibility · Sealing

Hot melt adhesives have been the subject of extensive study and development, and the technology of their application in our industry has grown apace. As is so often the case in the packaging field, formulation and usage develop more quickly than testing methods. In time, however, the ability to formulate new materials and find new areas of application depends on the availability of test equipment to evaluate the suitability of new products for new end uses.

In the corrugated industry, hot melts are used to make manufacturer's joints and to case-seal boxes. Moreover, boxes themselves are coated in various ways, for example by curtain coating. This creates problems of compatibility. Some adhesives are entirely incompatible with some coatings and form no bonds at all. In other cases bonds may be good initially under ambient conditions, but fail over a period of time because of migration of coating components, other causes, or failures may occur as a result of exposure under extreme conditions of temperatures and relative humidity which the package may encounter in the transportation environment. A laboratory instrument is needed for forming hot melt adhesive bonds on container boards under controlled and reproducible conditions, incorporating the parameters encountered in production, and such a device is described in this article.

CONCORA GLULAB MACHINE

The essential features of the Concora Glulab[1] machine are as follows:

A. A Nordson Versa Melt II Adhesive Applicator: this portion of the instrument controls the temperature of the adhesive, the spacing of the beads (if more than one), the number of beads (one, two or three, depending on the nozzle used), the pressure with which the adhesive is forced through the nozzle, and the amount of adhesive applied.

B. A frame supporting the applicator and provided with means to:
   (1) firmly hold in place a sample of container board;
   (2) transport this sample at a controlled speed underneath the adhesive applicator and onto the mating station;
   (3) time the period between the application of adhesive and contact with the mating surface (open time);
   (4) time the period during which the surfaces are held in contact under pressure;
   (5) control the amount of pressure applied to the mated samples.

The range within which parameters can be controlled are:

Machine speed (sample travel): 14–300 fpm (0.07–1.5 m/sec)

Adhesive temperature: Gage settings to nearest 10°F or 5°C.

Air pressure: Up to 120 psi, (8.2 atm)

Hydraulic pressure: Up to 1700 psi, (115.7 atm)

Open time: 0–15 sec.

Compression time: 0–60 sec.

Compression (mating) pressure: 0–35 psi, (0–2.3 kg/cm²)

A schematic drawing illustrating the steps performed by the Concora Glulab is shown in Fig. 1.

Operation

In the context of our work, "container board" refers to corrugated and solid fiberboard. The instrument also accommodates other packaging papers, for example folding carton grades. It is also possible to mate board to films and foils, and one such application is described below.

The specimen size is 6 × 6 in. (15.24 × 15.24 cm). The lower sample to which the adhesive is to be applied is placed in the sample holder or transport. The upper sample is placed under the air cylinder pressure shoe, activating a vacuum switch which holds it in position. Travel is initiated by pushing the "Forward" button. As the sample travels underneath the applicator head, it triggers the adhesive applicator and activates Timer 1 ("Open Time"). When the specimen comes to a stop underneath the upper sample, the latter is pressed down to contact or mate with the lower sample at the moment in time set on the "Open Time" clock. This in turn starts the "Compression Time" preset in Timer 2. At the end of this time cycle, the air cylinder is spring-returned to the upper position, permitting the removal of the mated specimen. The transport is returned to its starting position by pressing the "Reverse" button. A general view of the Concora Glulab is shown in Fig. 2. The various steps in the operation just described are illustrated in Figs. 3–10.

The alignment of the upper and lower samples is intentionally such that there is a 1-in. offset—as shown on the schematic, Fig. 1. This permits a visual examination of the adhesive beads and facilitates identification of adhesives when many are under study. Moreover, it makes it possible to prepare test specimens for evaluation in peel and in shear as described recently.[2]

In order to obtain valid comparisons between adhesives, it is necessary to be certain that the quantity or amount of

[1] Manufactured by Kotov and Associates, P. O. Box 185, Riverside, Ill. 60546, under an exclusive license from Container Corporation of America. Patents are applied for. The word "Concora" is a registered trademark of Container Corporation of America. The application for similar registry of the word "Glulab" is on file at the U. S. Patent Office, Washington, D. C.

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[2] Taus, R. G., *Tappi* **51** (6): 1064 (1969).

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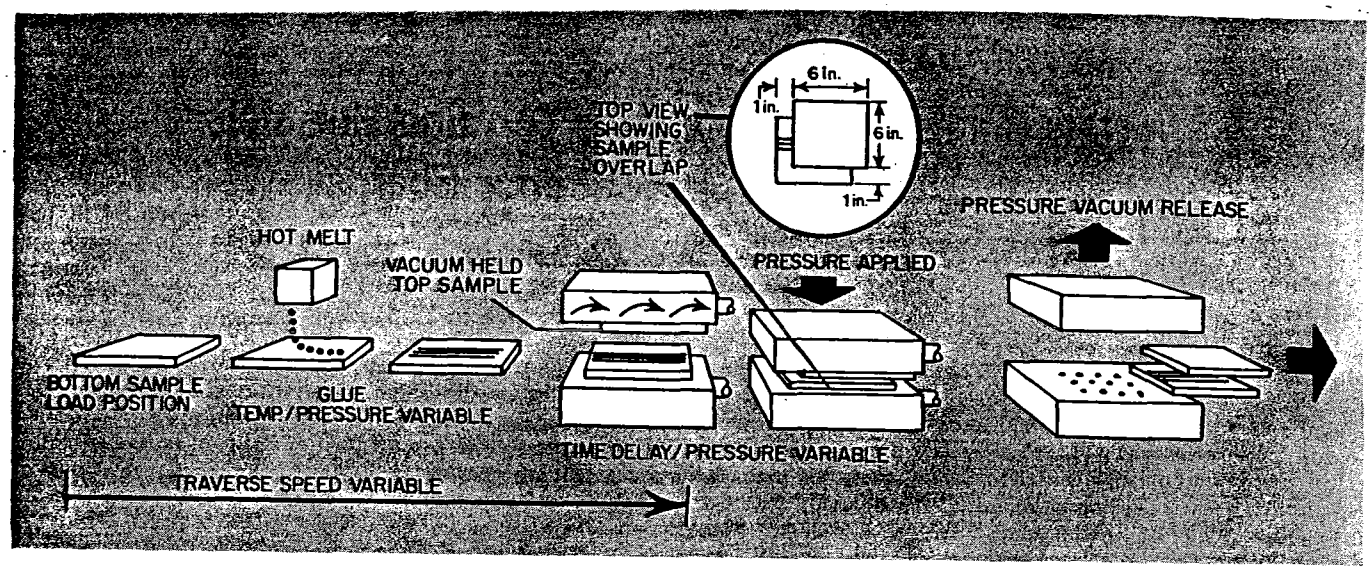


Fig. 1. Schematic of Concora Glulab.

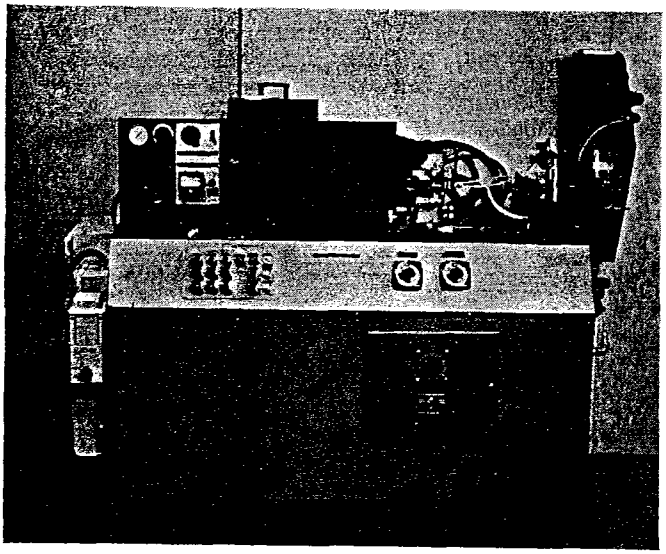


Fig. 2. Concora Glulab overall view.

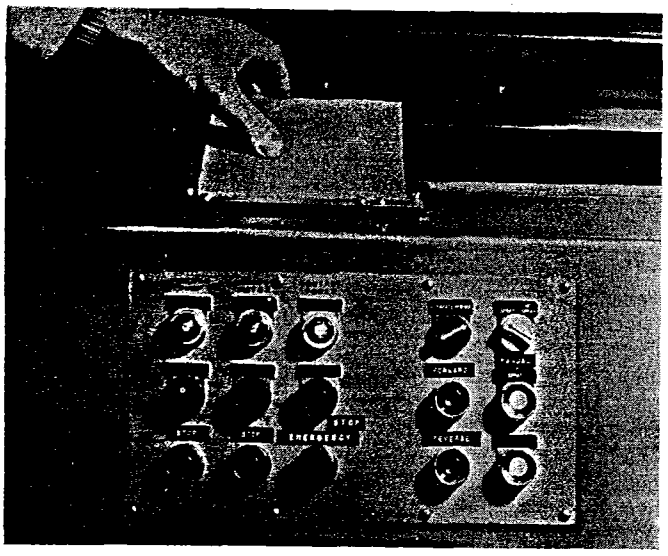


Fig. 3. Sample placed on holder.

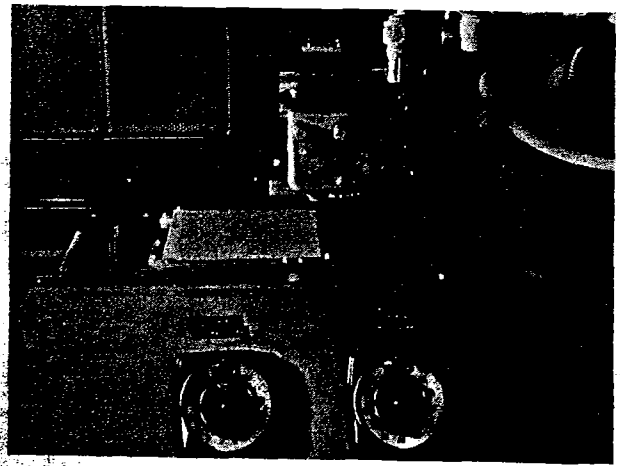


Fig. 4. Enter underneath nozzle.

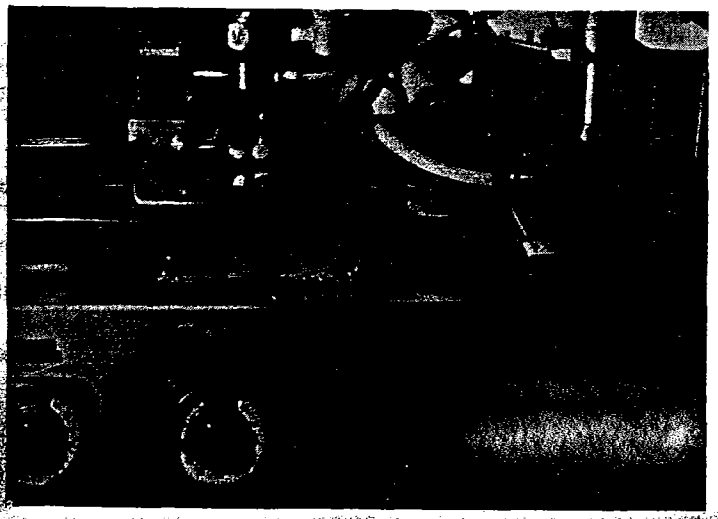


Fig. 5. Emerging. Adhesive applied.

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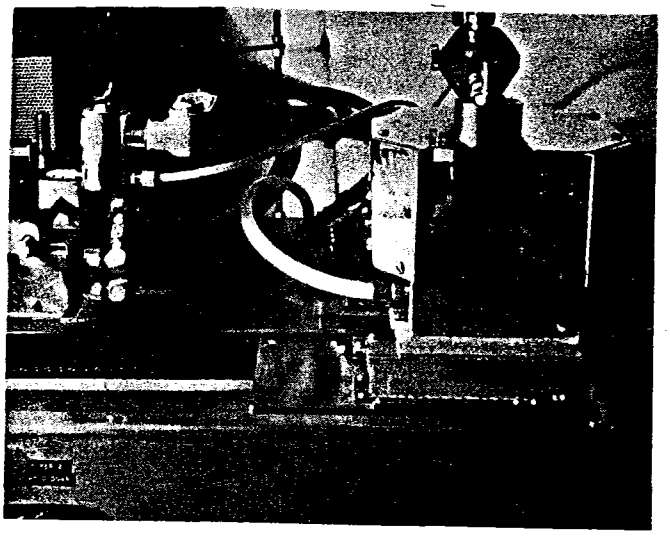


Fig. 6 Arriving at mating station.

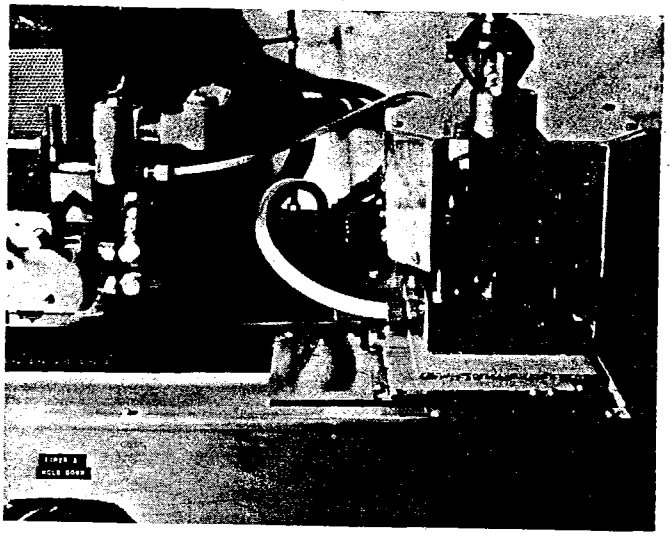


Fig. 7. Mated samples under pressure.

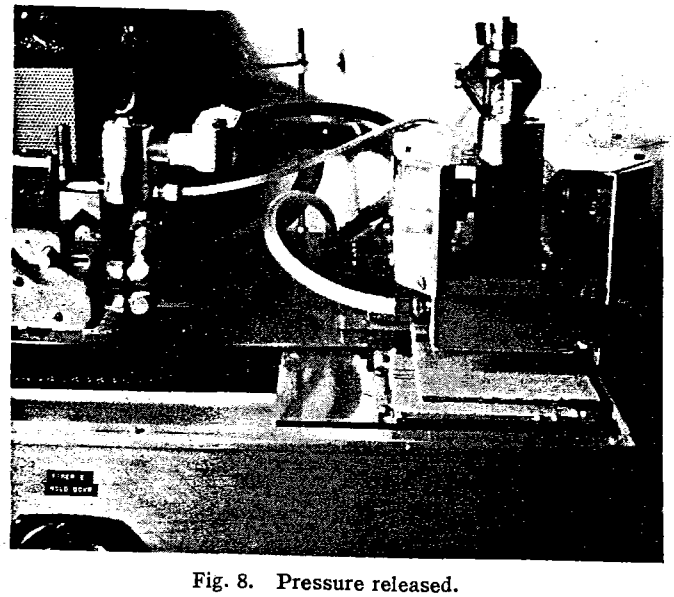


Fig. 8. Pressure released.

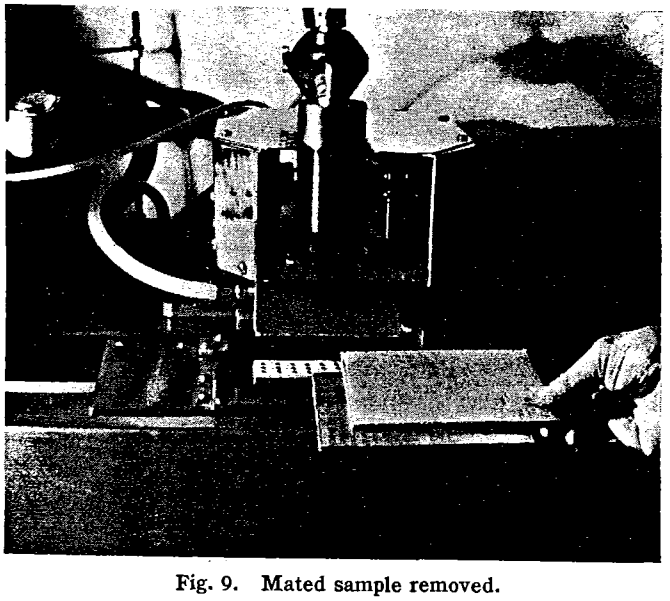


Fig. 9. Mated sample removed.

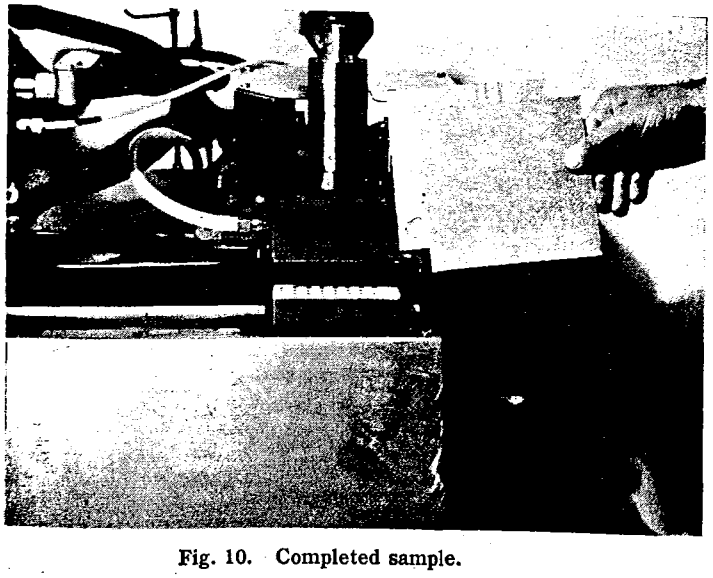


Fig. 10. Completed sample.

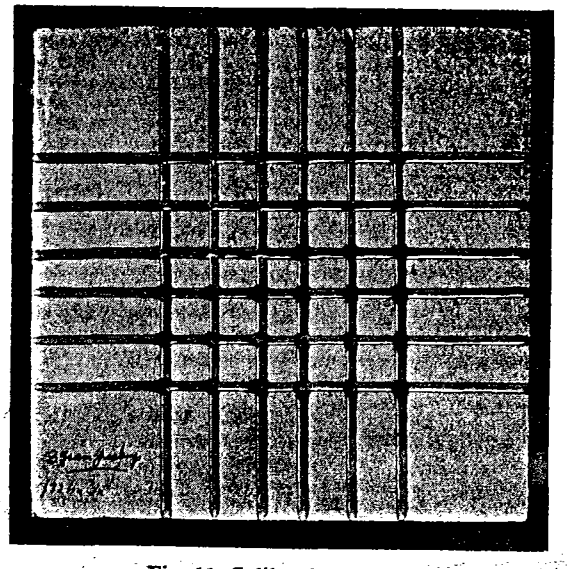


Fig. 11. Calibration sample.

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adhesive per lineal inch of bond be carefully controlled. The procedure for obtaining the correct settings is both simple and fast. A 6 × 6 in. sample is weighed, preferably on an accurate, instantaneous reading balance. The sample is then passed under the applicator head applying three strips of adhesive. This is repeated three more times, each time turning the specimen 90°. The result will be six strips of adhesive in the "machine" direction, and six strips in the "cross" direction (Fig. 11). The sample is then weighed again. Individual investigators may develop their own preferences, but we try to obtain 3 g of adhesive pickup per 72 lineal inches. Repeated adjustments on the Concora Glulab are made until the desired amount is obtained, using a fresh specimen each time. Four test specimens usually suffice.

Settings will maintain the calibrated amount as long as the cycling of the adhesive is not interrupted. If for any reason it is necessary to interrupt it—for example to shut down overnight—it is necessary to come back to the original temperature and degree of cycling, at which point the set amount of pickup in grams per 72 lineal inches will again be reproduced.

It is frequently of interest to get some idea of squeeze-out and adhesive penetration into the board surface. In that case, cellophane or a 6 × 6 in. sample of Plexiglas is substituted for the upper sample. The result will be a mated specimen with one surface transparent for ready observation.

APPLICATION

A few words concerning the place of Concora Glulab in the testing technology of our industry might be in order.

Suppliers of Coatings

It would seem to be in the interest of the coating supplier to know something about the adhesives compatible with his coating. It is unreasonable to expect the boxmaker to undertake the burden of judging the suitability of the coating supplier's product, particularly (as is generally the case) if this has to be done by using the ultimate consumer or box user—our customer—as the guinea pig.

Suppliers of Adhesives

In most cases (though not in all) the suppliers of coatings, particularly hot melt coatings, are also suppliers of hot melt adhesive. Just as the coating materials supplier should be familiar with what adhesives are compatible with his product, so should the adhesive supplier know before he ever calls on a boxmaker whether his product is compatible with and will work on the coatings in commercial use, and particularly of that particular box manufacturer.

Box Manufacturers

Box manufacturers can reasonably expect their suppliers to know whether the materials they offer do a job or not. In fact, they may well take the position that a given coating and adhesive should maintain a fiber-tearing bond under well defined temperature conditions and time periods, and the supplier should be able to tailor-make or in any case offer the combination of materials which will be in compliance with such a set of specifications. In order to police such compliance, boxmakers with extensive markets using hot melts and coatings must be able to perform these tests themselves.

Situations often arise in the development of new packages, package systems, or markets, when new formulations are called for, either in the coating, adhesive, or both. The ability to subject these formulations to testing makes it possible to keep them proprietary.

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