

PAOLI LABORATORYRESEARCH AND DEVELOPMENT REPORTPeriod of July 1962 through December 1962TABLE OF CONTENTS

Page 1	R & D Organization
Page 2	Market Performance of New Products July 1962 - December 1962
Page 3	Projects Completed
Page 7	Projects Nearing Completion
Page 9	Projects On Which Work Is Underway
Page 16	Photographs of Rib Panel Fabrication

SGP 0014807

R & D ORGANIZATION

In August of 1962, a recent graduate chemical engineer was hired. Our Research Group now consists of six men: Messrs. Lehnert, Schnabel, Sundberg, Hinkel, Green and Smith. Initially, the new men were assigned to work with one of the other members of the group, in order to gain experience. Another reason for this grouping is that certain projects require the efforts of more than one person.

Specific projects have been assigned to each individual or pair of individuals. A monthly research group meeting is held, in which each member gives an oral reporting on his assigned projects. The purpose of these monthly meetings is three-fold:

1. The meetings serve to inform each member of what the others are doing.
2. We receive the benefit of the thinking of the entire group on a given project, even though the project may only be assigned to one man.
3. First-hand guidance in project investigation and planning is provided by Messrs. Hoggatt and Shuttleworth.

A Research and Development budget has been prepared for the year 1963 and an accounting procedure has been set up, which is intended to provide the cost of each R & D project. These costs include salaries, materials, special equipment, plant runs, fees for outside testing, travel expense, etc. Heretofore such detailed cost information has not been available.

This report covers the accomplishments of our research efforts for the past six months. During this period, much time has been devoted to training the new men. We feel that this time has been well spent and will pay off in the future contributions of these men. Also included in this report are the past six months' market performance of products which were developed through research since this group was organized in June 1961.

MARKET PERFORMANCE OF NEW PRODUCTS - JULY 1962 - DECEMBER 1962

A. Firestop 120 Ceiling Tile

1. Amount sold - 74,100 square feet
2. Dollar sales volume - \$13,308
- * 3. Gross Profit - \$4,398

B. Grabit Masonry Adhesive

1. Amount sold - 7 tons
2. Dollar sales volume - \$1,398
- * 3. Gross Profit - \$766

C. One Day Joint System (Limited sale to Philadelphia and Washington sales districts and a few selected customers)

1. Amount sold - 90 tons
2. Dollar sales volume - \$15,616
- * 3. Gross Profit - \$7,619

* Gross Profit estimated by Ardmore Cost Department

SALES	GROSS PROFIT
13,308	4,398
1,398	766
15,616	7,619
<u>30,322</u>	<u>12,783</u>

PROJECTS COMPLETED

A. New Products

1. One Day Joint Compound - R & D 243

Objective: Develop a setting type (gypsum base) joint compound.

Result: For the past six months, we have been market testing this product in the Philadelphia and Washington sales districts, as well as with selected customers in Indianapolis, Indiana; Omaha, Nebraska; and Columbus, Ohio. Our Acme, Texas and Wilmington, Delaware plants have been manufacturing this One Day Joint Compound. About 75 tons of One Day Joint Compound were sold during this period, most of it in the Philadelphia and Washington sales districts. This was a follow-up from our field testing program, which indicated we had a product with great potential. The market tests confirmed our field trials and gave us quite a lot more experience with the product. Only two minor complaints were received during this time, and in neither case has the customer stopped using the product or requested an adjustment. In November, we were informed that National Gypsum Company and United States Gypsum Company were field testing products similar to ours. A sample of National's product was obtained and our examination of their material indicates they are not too far behind us.

Based on the six months of favorable market testing, and the fact that National and probably U.S.G. are field testing similar products, we made a decision on December 4th to release our One Day Joint Compound nationally. About 30 to 60 days will be required for us to receive the necessary bags and raw materials at Acme to begin stocking our plants. Wilmington will continue to manufacture and supply One Day Joint Compound for the area they service. It will be some time after the first of the year before we have all plants stocked and ready for general distribution of One Day Joint Compound.

The advantages we expect to gain from this product are:

- a. Increased sale of joint system materials
- b. Greater profit margin from One Day Joint Compound as compared to other joint system products.

SGP 0014810

- c. Prestige of being the first company to market a product which improves the quality and economy of Drywall joint treatment operations.
- d. A competitive edge over companies, such as Synkoloid, Proko, Reardon, and many others which manufacture joint compounds but are not gypsum manufacturers. These manufacturers would have to purchase gypsum from one of the gypsum companies in order to manufacture a product like our One Day Joint Compound.
- e. An increase in the sale of our gypsum board products is possible, at least until National and U.S.G. have setting type joint compounds of their own. We have seen evidence of the One Day Joint Compound helping board sales in the Philadelphia sales district.
- f. At such time as the demand warrants, One Day Joint Compound can be manufactured at other plants, such as Sigurd and Blue Rapids, with very little capital investment. This would enable us to realize some savings in freight.

2. Gypsum Board Surfaced with Wood Veneer - R & D 215

Objective: To find a satisfactory means to laminate Furnaflex wood veneer to gypsum board.

Result: Although we were able to accomplish our objective, the project was dropped because of the unfavorable economics of this product.

B. Improved Products

1. Super Firestop - R & D 241

Objective: To develop a 5/8" Firestop board which will permit 1-1/2 and 2 hour fire ratings when it is used on the underside of concrete and bar joist floor and ceiling constructions.

Result: Our laboratory testing indicated that a 5/8" Firestop with twice as much glass fiber would provide the additional fire endurance we were seeking for this construction. A fire endurance test at Underwriters' fell 8 minutes short of making two hours, so we received a 1-1/2 hour rating. This makes us competitive with U.S.G., who also have a 1-1/2 hour fire rating for this construction. The additional glass fiber in the special 5/8" Firestop will cost us \$1.12/M sq. ft.

Another test is planned wherein the concrete deck will be 2-1/2" instead of 2" thick. We believe this will permit us to get the two hour rating. The Gypsum Association has obtained a two hour rating on this construction with a furring channel spacing of 12" and screw spacing of 8" O.C. Our test will be made with 24" furring channel spacing and 12" O.C. screw spacing.

If successful, this test will give us a substantial competitive advantage by virtue of requiring fewer supporting members and fewer fasteners for our construction.

C. Sales Aids

1. Screws for Hummer B System - R & D 209

Objective: To develop a less costly screw that can be driven with a power screwdriver to help install Hummer B System faster and therefore more economically.

Result: Field performance tests of these screws were favorable, so 50,000 of these #8 - 1-1/2" screws were ordered under R & D to sell to customers and thereby provide us with a more thorough evaluation. We have sold practically all of the 50,000 screws and haven't had any adverse comments. Further orders for screws have been coming in, so 100,000 screws were ordered and will be stocked at Fort Dodge. We believe that having this improved screw available will help promote the use of our laminated systems. Our #8 screw can be used to attach the second of two layers of 5/8" board to metal studs, so it is also useful in this regard.

2. New Method for Installing Hummer B System - R & D 209

Objective: To find a means for installing Hummer B System, utilizing our #8 screw, which will eliminate the necessity for pre-building sections and for bowing the board.

Result: With Mr. Hummer's cooperation, a means was found for building B System partitions in place. This 3-step method consists of - (1) Attaching first face board to top and bottom runners; (2) Attaching gypsum ribs to first face with screw and nail fasteners and laminating compound, and (3) Attaching second face to ribs and runners with appropriate fasteners. This method of installation is faster and less complicated than the old method and should help spur our sale of the Hummer B System partitions.

3. Rib Standardization for Hummer B System - R & D 209

Objective: Sales requested that we standardize on all 6" wide ribs for Hummer B System partitions instead of the 3-1/2" and 12" wide ribs previously specified.

Result: In addition to the change in the rib width, we revised the joint location as a further simplification of the B System. Impact tests proved satisfactory and a fire endurance test of B System with the 6" wide ribs, #8 screws, in-place installation method, and simplified joint location successfully passed the desired one hour fire endurance at Underwriters'. By previous arrangement, we also received Underwriters' approval for the same revisions on our 2 and 3 hour Hummer B System partitions. No taping or finishing was used in the one hour fire endurance test, which gives us the 1, 2, and 3 hour ratings without joint treatment.

The standardization of the rib widths and joint locations, combined with the previously mentioned improvements in installation, should substantially improve the acceptance of these partitions.

4. One Hour Fire Rated Lath & Plaster Partition - R & D 245

Objective: Sales requested a one hour fire endurance rating for 3/8" regular lath and pinholath over nailable metal studs with 1/2" of sanded plaster as the surfacing material.

Result: This construction successfully passed the one hour fire endurance and is an addition to fire rated lath and plaster constructions.

5. One Hour Fire Rated Metal Stud Partition Faced with 5/8" Firestop - R & D 247

Objective: To participate with Donn Products Corporation to test a partition consisting of 5/8" Firestop attached to 1-5/8" metal studs. A similar test with 3-5/8" metal studs previously passed one hour fire endurance.

Result: The one hour fire endurance was achieved, so this gives us another fire rated metal stud partition.

6. Two Hour Fire Rated Metal Stud Partition - R & D 248

Objective: To participate with Neslo Manufacturing to obtain a two hour partition consisting of 1 layer of 5/8" Firestop Backer and 1 layer of 5/8" Firestop Eternawall on each side of Neslo's metal Z stud. This was requested by Sales for a large job in New York City.

Result: We easily passed the two hour fire rating with this construction. We understand that we did not get the job in New York City due to other factors, but Sales is striving to get two other jobs with this partition. If nothing else, the test has provided us with some information which may help in future tests of similar constructions.

PROJECTS NEARING COMPLETION

1. Owens Corning "Muzzy Mix" Glass Fiber Roving - R & D 210

Objective: To be able to approve this finer diameter glass fiber for use in our board products.

Progress: The Muzzy Mix fiber proved to be more difficult to cut than other fibers. As we looked into our glass cutting operations in general, we found that they were not very efficient and some plants were having difficulty cutting the approved glass fiber types. This meant that it was going to be necessary to improve our glass cutting operation in order to enable us to use Muzzy Mix fiber. Also, it was obvious that some improvement in glass cutting was desired in any event. This was particularly important for manufacturing products such as Firestop 120 and special 5/8" Firestop, where the increased glass fiber usage aggravates the cutting problems.

We have gotten some assistance from Owens-Corning on this and are taking two approaches to the glass cutting problem. One is to speed up our present cutters, and the other is to evaluate a new type of cutter we have purchased on a trial basis. We expect to have conclusions from this in the next 30 days.

Making our cutting operations more efficient should permit us to approve the Muzzy Mix fiber. The advantage to be gained from Muzzy Mix fiber is that its use will allow us to reduce our regular board formula requirements for glass by 25-50%. We will need Underwriters' approval to use Muzzy Mix in any quantity in labeled products such as Firestop. This will be considered as soon as we can approve Muzzy Mix for the regular board items. Owens-Corning has indicated that we can settle on Muzzy Mix as our standard fiber, if we wish.

2. Stud Adhesive - R & D 201

Objective: Develop a satisfactory source for adhesive for attaching wallboard to wood and steel studs which could be marketed under our label.

Progress: We have had three field trials conducted on a Borden adhesive. All of the tests have been quite satisfactory. After a couple more successful trials, we should be able to approve handling this adhesive under our label. This adhesive is priced low enough for us to sell competitively and is quite versatile since it can be used on both wood and metal studs, is not flammable, washes off tools with water, and gives a water resistant bond.

3. Laminating Compound

Objective: Modify our present Laminating Compound formula so that it will bridge areas between boards which are not in perfect contact, and will require less water, permitting it to dry faster.

Progress: A formula has been found which satisfies the objectives and the field trials made thus far have been satisfactory. After a few more trials, we will be ready to substitute this formula for our old Laminating Compound. We have been able to recommend increasing the distance between the spreader notches so the coverage of the product will remain the same. While achieving our objectives, we have reduced our raw material cost for the product by 50¢ per bag. This will serve to increase our profit margin by that amount or enable us to reduce the price of the product in order to make it more competitive.

PROJECTS ON WHICH WORK IS UNDERWAY

1. Extrusion Method for Forming Gypsum Board Products

Objective: To evaluate this process as a means to make gypsum board of more consistently uniform weight and caliper.

Status: It was decided to continue the investigation of this process at New Orleans rather than Grand Rapids. This equipment is not conducive to making lath products and, since New Orleans does not make lath, this seems to be the best location to make future trials of the extrusion equipment. New Orleans advised that the extrusion equipment will fit their machine, so arrangements were made and the equipment has been transferred.

2. High Expansion Densite for Patterns - R & D 132

Objective: To develop a high expansion Densite suitable for use as a casting plaster for Kirksite Dies for automobile bodies.

Status: After investigating a number of additives and combinations of additives, a combination has been found which offers promise. The expansion must be controlled through a range of consistencies and we are in the process of working this out.

3. Special Densite for "Ram Process" Mold - R & D 132

Objective: To develop a special pottery plaster to be suitable for use in the ram pottery making process.

Status: A few field trials were conducted but, in each case, results were reported to be unsatisfactory. Some new information has been gained from an observation of one of the ram process operations and further investigation will be done on the basis of this new information.

4. Densite Tooling Plaster - R & D 132

Objective: To improve on K-71 tooling plaster to meet the requirements of the aircraft industry.

Status: This product must be improved as regards expansion, set, workability, and aging characteristics. An extensive effort is being made to develop a product which will satisfy all these requirements in view of the importance Sales has attached to the project.

5. Water Repellent Treatment for Sheathing Paper

Objective: To find a lower cost material than the Quilon we now use, which will apply easier and offer better repellency.

Status: The wax emulsion treatment, after several modifications and retrials, proved to be unsatisfactory. We are now evaluating a two component material which has looked very encouraging on a small scale. We are planning to make a full scale trial at Pryor, as soon as it can be arranged.

6. Owens-Corning Foam Glass Pellets - R & D 210

Objective: To make a 1" insulation board and/or a 1/2" one hour fire rated board by incorporating Owens-Corning's foam glass pellets into these products. An additional advantage sought is to make a lighter weight board.

Status: We finally settled on a 5.6 lb. apparent density pellet and an extensive investigation was launched. Our conclusions were: a 1" pellet board, having sufficient low thermal conductivity to be sold as an insulation board, would have much too weak a core. We were unable to achieve good enough fire resistant qualities to make a 1/2" fire rated pellet board. We were, however, able to reduce the weight of 5/8" Firestop and regular 1/2" board. Based on a pellet cost of 10¢ to 12¢ per lb., as furnished by Owens-Corning, the savings in freight and stucco displaced do not offset the total pellet cost. We have requested that Owens-Corning develop a lighter weight pellet so that the freight savings and stucco reduction per pound of pellets will be greater, therefore improving the economics.

7. Resin Base Topping Compound - R & D 211

Objective: To develop a synthetic base, dry powder joint finishing material which will have longer pot life and lower shrinkage than present casein base products.

Status: Two field trials have been made with two different formulas but, in each case, we were unable to satisfy all the requirements. In addition to this, a problem of the plasticizer leaching into and discoloring the bag has developed. A revised formula has been found which should overcome all previous problems. We have instructed the plant to make a trial batch of this revised formula and, if it is satisfactory, another field trial will be arranged.

8. Resin Base Joint System Texture - R & D 211

Objective: To formulate a dry texture which can be mixed with perlite and sprayed onto masonry surfaces as a one coat decoration.

Status: The chief problem here was to impart sufficient rust inhibitive properties to prevent steel members from rusting through the texture. We have arrived at a formula which appears to satisfy all the necessary requirements. We have instructed the plant to make a batch of this texture for field testing.

9. Ready Mix Joint System - R & D 211

Objective: To develop a ready-mixed or paste type joint compound to be competitive with U.S.G.'s Ready Mix and other similar products on the market.

Status: We previously developed and successfully field tested a paste joint compound, but cost studies indicated that the product should be made at Acme to avoid freight for dry fillers. Unfortunately the area serviced by Acme is not a large ready mix market. In view of these factors, this project was tabled.

The subject of ready mix was brought up again recently to reconsider furnishing the West Coast, which is one of the largest markets for ready mix, out of Acme. In the meantime, we have been developing a ready mix with a dry resin binder in lieu of the liquid resin used in the previous formula. We have arranged to have some of this material made at Acme and shipped to Paoli. We will mix the product here, put it in pails, and arrange for field testing. If this revised product is satisfactory, it will prevent us from having to store large quantities of liquid emulsion and from requiring equipment to handle the emulsion. While this will not affect the cost studies previously made, it will simplify the facilities we would need and reduce the expenditure for equipment, if it is decided to market a ready mix joint compound.

10. Thincoat Plaster - R & D 219

Objective: To develop a one coat thincoat lath and plaster system which will be suitable for both textured and smooth finished surfaces.

Status: The original product we developed and field tested was not suitable for smooth finished surfaces. A second experimental product has been developed to be used in conjunction with a fast suction lath, and this system appears to be very satisfactory. The new formula has much higher compressive strength, is adaptable to smooth and texture finishes, and costs less to make than our first formula.

Our first field trial of this thincoat formula was quite encouraging. More field trials will be conducted as soon as possible in order to more completely evaluate this new product.

11. Synthetic Gypsum - R & D 221

Objective: To find a means for utilizing synthetic gypsum for plaster and wallboard manufacture.

Status: A plant trial involving calcination, tube milling, and manufacture of board from Mississippi Chemical Company's synthetic by-product was conducted. Problems of fast set and poor bond were encountered. It is now believed that a better choice of accelerators may offset these problems, but it is felt that another plant trial run will be necessary to gain this and other information regarding the possibilities of synthetic gypsum. In the meantime, Synnesvedt and Lechner are preparing a patent application to cover the process we have developed to render synthetic gypsum useable.

12. Prefabricated Panels with Gypsum Ribs - R & D 223

Objective: To develop a prefabricated sandwich panel unit to be used in non-load bearing partition construction.

Status: 100 panels were fabricated at Fort Dodge in order to estimate manufacturing expense and to provide more panels for field testing. Components for 100 panels are available at Fort Dodge for future use. Components for about 80 panels are available at Paoli for field testing purposes.

20 - 4' x 7'-7-1/2" were fabricated at Paoli for a local commercial installation. These panels have now been installed and the completed installation appears to be quite satisfactory. Further field testing of the rib type panel will be done to more completely evaluate its performance and acceptance.

The accompanying photographs show how these rib type panels are fabricated.

13. Pre-fab Panels with Egg Box Core - R & D 223

Objective: To evaluate the egg box core pre-fab panel unit which is being marketed in England by British Plasterboard Holdings.

Status: After obtaining satisfactory egg box sections, we had to find a suitable adhesive. The adhesive used in England required heat and pressure to cause it to set and we have no facilities to utilize such an adhesive. After finding an adhesive, several full size (4' x 8') panels were made. Our impact tests indicate that these panels are stronger and more resistant to damage in handling than the rib panels, but they are also more costly to make than the rib panels. The raw material cost for making the egg crate panels is about \$97/M sq. ft. This compares to about \$35/M sq. ft. raw material cost for the rib panels. The manufacturing cost of

the egg box panels has not been established, but indications are that this cost will be higher than that established for manufacturing rib panels.

14. Radiant Heating Panels - R & D 235

Objective: Investigate gypsum board panels coated with a conductive material as a means to provide radiant heating.

Status: The first two panels of 1/2" - 4' x 4' gypsum board coated with conductive heating material burned out due to too high a resistance for the conductor strips. Electronics Discovery Corporation made another panel, utilizing braided conductor strips and with a more uniform coating of the conductive material. We have kept these panels in operation continuously for about 4 months, in order to see if they will continue to function properly over a period of time.

We are unsure that the radiant heating panel described above will be practical, so we have ordered some conductive wire cable to permit us to explore some other possibilities.

15. Strong-Scott Calciner - R & D 236

Objective: To investigate Strong-Scott Manufacturing Company's Turbolizer for continuous calcining of gypsum.

Status: The legal aspects of this project have been worked out and Strong-Scott has submitted a proposal for an experimental unit. Consideration of this proposition has been postponed, in view of our interest in the continuous kettle calcination method developed by Western Gypsum Products Ltd. in Canada.

16. Dust Collector for Installation on a Kettle and Hot Pit at Blue Rapids - R & D 238

Objective: To enable the kettle to be vented so that moisture can be removed without creating a dust problem.

Status: A Wheelabrator dust collector has been installed on one kettle at Blue Rapids. Latest reports received are to the effect that it is doing the job as intended.

17. Applying Statistical Quality Control to our Manufacturing Operations - R & D 239

Objective: To determine whether our operations can be improved through the use of statistical quality control methods.

Status: We arranged to have Battelle Research Institute make a survey to determine how statistical quality control can be applied in our operations and where they will be most effective.

After receiving the report from Battelle, we have begun to use the statistical methods in our board weight testing and kettle batch setting times. This investigation was started as an R & D project, but now has been taken over largely by the Process and Control group, working with the plant Quality Supervisors. It is providing useful information on dry board weights, kettle batch setting times, etc., from which improvements in performance from month to month, or the opposite conditions, can be spotted.

19. Volumetric Stucco Feeder for Grand Rapids - R & D 240

Objective: To purchase equipment to feed stucco volumetrically to the board machine pin mixer in an effort to make our board weights more uniform.

Status: The equipment has been installed but a number of problems developed in putting it to use. Recent revisions corrected some of the problems and it now appears that the project has a good chance of success.

19. Dry Lightweight Roof Deck Unit - R & D 242

Objective: To develop a lightweight roof deck unit which will have good insulating properties and be competitive with products such as Tectum and Fibertex.

Status: Several units consisting of laminates of gypsum wall-board and 1/2" thick paper faced polyurethane board have been fabricated and tested. This unit would give a U (including built-up roofing) of about .16. Some further investigation will be required to fully explore this idea.

20. Acoustical Tile - R & D 246

Objective: Develop a 1/2" - 2' x 4' acoustical tile.

Status: We are able to manufacture this product at Brunswick; however, we are unwilling to approve the product, due to the excessive sag which has developed in tests conducted at Paoli and Brunswick. Increasing the weight of the board or increasing the glass fiber content did not significantly reduce the sagging tendency of the 1/2" - 2' x 4' acoustical tile. A second approach, as used in England, is to incorporate portland cement in the core of the tile. On a laboratory scale, this has shown promise, so we had a plant run of 3/8" board made with 1% portland cement (based on the calcined stucco). 3/8" board was made for this purpose since the thinner board has more tendency to sag and our lab results can be confirmed more quickly. Thus far our tests show that the specimens containing portland cement are sagging less than the ones without portland cement.

21. Colored Partition Board - R & D 246

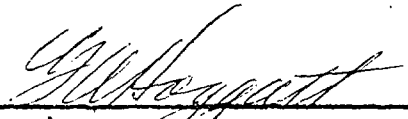
Objective: To make a 2' x 8' pre-decorated partition board for use in the various moveable wall partition systems.

Status: Two special runs of partition boards, decorated with various colored paints, have been made. In each case the decorated partition boards were installed in a commercial building on a trial basis. Both runs were considered to be acceptable and Sales has requested approval to furnish this new product to the Atlanta, Brunswick and Charlotte sales districts.

22. Glitter Surface for Ceiling and Acoustical Tile - R & D 246

Objective: To incorporate a glitter on the surface of our tile products as an inexpensive means of broadening our tile line.

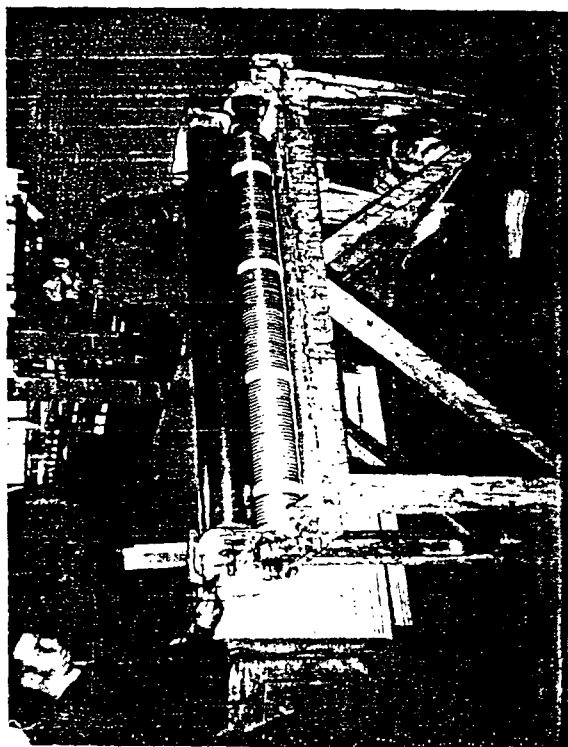
Status: One trial was made at Brunswick in which glitter was sprinkled on the tiles. When we received the tiles, there was little or no glitter on them. We are trying to determine what happened so we can decide whether another trial is advisable.



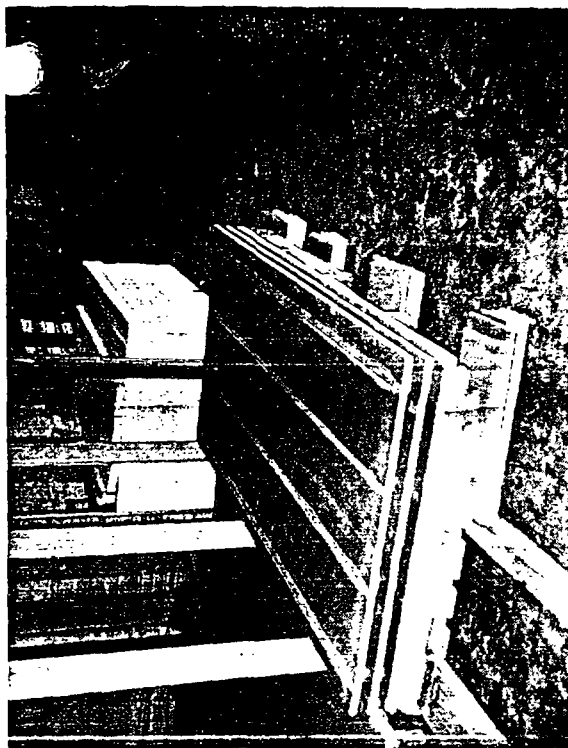
G. A. Hoggatt
Technical Director

February 7, 1963

GAH/as



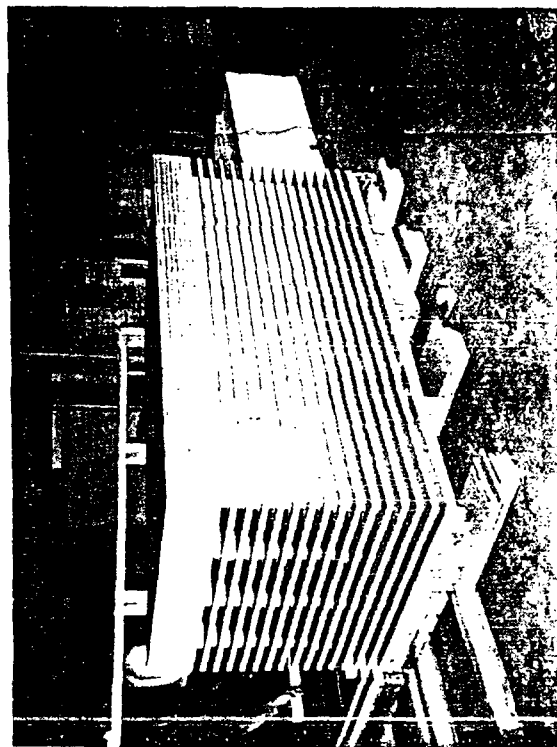
No.1 - Adhesive Application



No.2 - Ribbons of Adhesive on Panel Face



No.3 - Ribs Positioned on Adhesive



No.4 - Stack of Completed Panels