

PLAINTIFF'S EXHIBIT

GP-1297

RESEARCH AND DEVELOPMENT
SIX MONTH REPORT

January through June 1972

SGP 0014522

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SIX MONTH SUMMARY

This report covers the activities of the Research and Development Department for the six month period ending June 30, 1972. Effective April 1, the responsibilities of Research were expanded to include certain functions of the old Technical Department. The functions retained are those dealing with plant assistance. The quality responsibilities will be handled by the Operations Department, and we will only become involved at their request. It is anticipated that approximately 20% of our effort will be directed to Manufacturing services. The six months reporting will now be divided into six separate sections to cover new products, product improvements, services to Sales, services to Manufacturing, patents and licensing, and other general project assignments not covered by those previously mentioned.

On page 4 is a list of the new products developed through research during the past five years. Previously all past new product developments had been reported, but we feel that the five-year period is sufficient to cover the recent developments. Sales of \$1,136,958 and profits of \$284,149 were generated from these new products. We have also begun to estimate cost savings from R & D activities, since a significant part of our efforts are in that direction. The first half cost savings totaled \$49,194 as a direct result of R & D programs.

New Products:

The major new product developments currently under investigation are (1) non-rosette Pre-Dec, (2) panel adhesive, and (3) polystyrene texture. The non-rosette Pre-Dec was given a top priority by Sales since it was anticipated that, if it were successful, it would substantially increase our Pre-Dec sales. A non-rosette system has been developed and is ready for sales evaluation. The development of a water-base panel adhesive has progressed to the point where it also is ready for field testing. If the field trials are successful, we plan to reactivate the Tigard Adhesive Department in order to market test the panel adhesive. Field tests on polystyrene texture are underway, and the initial reports are encouraging. We will market test in the northwest and field test in other areas.

Product Improvements:

The major projects in this category were those directed at improving our joint system and texture product lines. The rapid

escalation in the price of casein has been a major reason for concentrated activity in the joint systems. Several different binders are being considered as replacements for casein. At Acme we have already made a change from casein to vinyl binders. The results of this change can be seen by comparing the sales and profits at Acme for the first six months of 1971 and 1972. They are shown on page 4. At Akron and Chicago, a polyacrylamide resin manufactured by Dow Chemical Company has shown the most promise as a replacement for casein. Marietta is manufacturing very little dry joint system, so the high cost of casein there is not as critical as it is at the other plants. The transition away from casein should be completed before the end of 1972, preserving the profitability of our joint system line and perhaps giving us an edge on our competition.

Our textures have now been completely revamped. The new formulas not only eliminate casein, but in the ceiling textures we have also eliminated asbestos. This reformulation has made our textures more acceptable and has restored their profitability. Savings of about \$.80 per 40 lb. bag are being realized.

A temporary shortage of asbestos necessitated a crash program to find some alternate sources for this raw material which is used in practically all our joint system products. We were successful in finding alternate sources which prevented loss of sales. We have a continuing program to eliminate asbestos from all joint system and texture formulas since asbestos is classified as a hazardous material by OSHA.

Sales Services:

The main project conducted for Sales was the continued development of the G-P shaft wall system. A variation of our basic shaft wall was tested to provide better resistance to sound transmission. This version of our shaft wall will also be fire tested to achieve a two-hour fire rating from each side. If all the tests are successful, we should have the most complete shaft wall system available. Another Sales request was to cooperate with T.S.G. Industries who are developing a house consisting of sections poured from mixtures of Denscal and Portland cement. This is a new approach to the housing industry and may not be practical, but we cannot afford to dismiss it in view of the large quantities of gypsum which would be used.

Late last year a 25 flamespread rating was obtained for Eternawall. The six month sales of Eternawall were up 45% over the same period last year and we assume achieving the 25 flamespread was a factor in making this increase possible.

Manufacturing Services:

There were three urgent calls from wallboard plants who were experiencing problems in their calcining and board making operations. Our assistance helped provide a quick solution to the problem in every case, stopping losses being experienced due to inefficient operation or substandard quality. We also provided help for the Operations Department on two Ready Mix problems.

Patents and Licensing:

Licensing is receiving a great deal of attention at this time because our basic Firestop patent will expire in May of 1973. We are offering to extend our present license agreements to cover the new G-P Firestop patent which issued last October. We are also preparing an agreement for a new licensee, California Gypsum Products, Inc. Firestop royalties for the first two quarters totaled \$152,257.

We are negotiating licenses on our shaft wall system with two Canadian companies. If the gypsum shaft wall system completely replaces masonry shaft walls, as we believe it will, we want to be in a position to benefit as much as we can. A patent application on the new accelerator system is being prepared with the idea of licensing other companies.

All of the projects handled by R & D during the past six months are detailed in the body of this report.

SIX MONTHS MARKET PERFORMANCE
OF *NEW PRODUCTS

<u>Unit</u>	<u>Product</u>	<u>Volume</u>	<u>Sales Amount</u>	<u>Profit Amount</u>
MSF	Radiant Heat Panels (all)	44	\$ 17,445	\$ (593)
MSF	1/4" Sound Deadening Board	3,481	129,240	35,996
MSF	Pre-Dec Wallboard (all)	17,551	978,574	245,837
Tubes	Drywall Adhesive	6,876	4,014	(97)
MSF	Shaft Liner Panels	17	3,409	1,086
Tons	Ram Press Process Plaster	43	4,276	1,920
MLF	Metal T Splines	-	-	-
MLF	Metal L Runner & J Channels	-	-	-
TOTALS			\$1,136,958	\$ 284,149

*Developed during the past 5 years

SIX MONTHS COST SAVINGS REPORT

<u>Acme Joint System</u>	<u>Sales</u>	<u>Profits</u>
	1972 - \$401,675	1972 - \$76,089
	1971 - <u>386,602</u>	1971 - <u>44,555</u>
	Gain - \$ 15,073	\$31,534

<u>Acme Texture</u>	<u>Sales</u>	<u>Profits</u>
	1972 - \$41,261	1972 - \$10,238
	1971 - <u>25,310</u>	1971 - <u>322</u>
	Gain - \$15,951	\$ 9,916

Total Joint System &
Texture Savings - \$41,450

<u>Fort Dodge Laminating Adhesive</u>	<u>Vinyl</u>	<u>Foil</u>
Raw Material Savings - \$2,579		\$ (14)
Coverage Savings - <u>2,750</u>		<u>\$2,429</u>
Six Months Cost Savings - \$5,329		\$2,415
Total Adhesive Savings - \$7,744		

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NEW PRODUCT SECTION

SGP 0014529

Drywall Adhesive

About 3000 cases of drywall adhesive (twelve 30 oz. tubes/case) were manufactured at Tigard and are being sold to various branches in the northwest. About 2000 cases were manufactured from the old adhesive which had been reworked. The sales of the reworked adhesive were credited to the Akron plant since they had been saddled with the loss from the adhesive which was shipped to the northwest. Akron also had a supply of the old adhesive. Most of this was reworked into 1200 cases of drywall adhesive. Field trials of the drywall adhesive were very successful and marketing was commenced. The sale of the adhesive has developed slowly in spite of the good acceptance. Of the adhesive manufactured in January and February, there are about 700 cases left in Tigard and 600 cases in Akron.

Panel Adhesive

The Distribution Division currently sells over one million tubes of panel adhesive per year. This adhesive must develop tack quickly so that few, if any, fasteners are required. There was some question whether fast tacking properties could be incorporated in a water base adhesive. The control was the adhesive manufactured by Continental Chemical and sold through the Distribution Division. This product is one of the fastest tacking solvent adhesives on the market so it represented quite a challenge. A formula has been developed which comes very close to Continental in quick tacking properties. It has been screened through the distribution product manager. Several cases (24 pint tubes/case) were prepared and we are currently waiting for field trials to be arranged. If field trials are favorable, Tigard Adhesive may be reactivated to manufacture and market test the water base panel adhesive in the northwest. The next step would be to install an adhesive manufacturing operation that could distribute nationally through our branch organization.

Gypsum Firedoor

The gypsum firedoor was tested at Underwriters' in February in a second attempt to pass the one-hour fire and hose stream test. The fire test was successful but the hose stream test failed again, this time by a significant margin. The burnout of the treated wood on the jamb side along with the erosion of the core caused the failure. After this test it was decided to abandon the project.

SGP 0014530

Some exploratory work has been done on a gypsum/Portland cement core which may have sufficient water resistance to pass the hose stream test. We have not investigated this fully, however. Our previous plan to use Blue Rapids as a manufacturing site for the cores is not now feasible and there is no excess Denscal production, so there is a different set of conditions now.

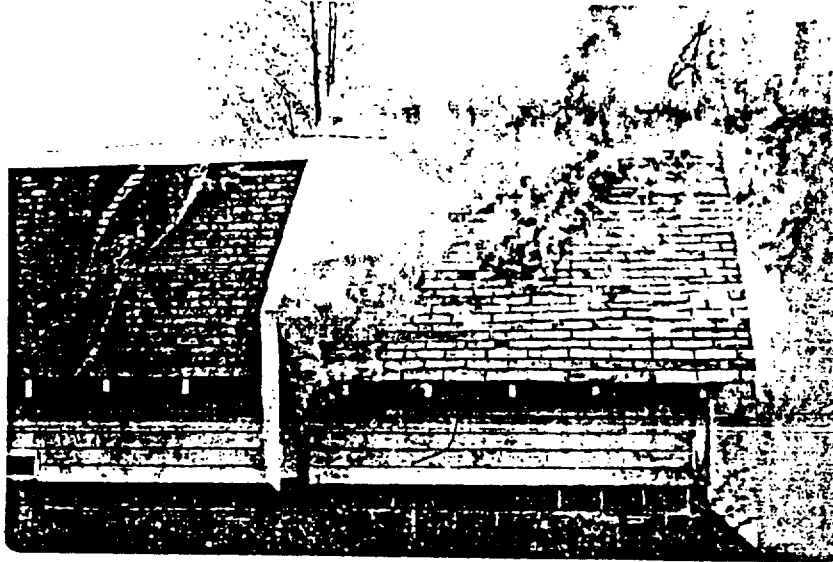
Pre-Primed Soffit Board

During a discussion with the Distribution Division, it was learned that all of the wood for soffits was pre-primed. This started us thinking about a pre-primed gypsum soffit board.

Our Pre-Dec equipment is a natural place to manufacture primed soffit board. The paint primer was formulated and 100 pieces of 1/2" x 12' long pre-primed gypsum soffit board were made on Acme's Pre-Dec line. The additional cost is estimated at \$6-8 per M. Sales is to evaluate the potential market using the 100 pieces as samples.

Gypsum/Plywood Fireblock

The Gypsum Association program to promote gypsum wallboard for use in roof construction has not met with much success. One of the drawbacks was the separate installation of the gypsum wallboard and the roof sheathing. We thought a laminate of gypsum and plywood would overcome this objection. Laminates of 1/4" gypsum wallboard (U.L. GPFS-5) with 5/16" or 3/8" plywood should provide the combined strength and fire protection properties. Flexural strength tests showed that the laminate was at least equal in strength to 3/8" sheathing grade plywood. A small-scale burn out test proved the value as a fire protective membrane (see photo on following page). It was decided, however, that the size of the laminate (4' x 8') and the weight would detract from the marketability. The project was, therefore, discontinued.



Exterior Wallboard

Our sale of water resistant board for the Kelly-Moore Kel-Tex system was discontinued when the houses in "The Lake" subdivision in Newark, California, began to show beading and cracking. Kelly-Moore changed to a resilient joint compound and we believe this may have been responsible for the problems which developed. Poor wallboard application aggravated the conditions. Shortly after we stopped furnishing the wallboard, the homeowners and the builder

(Transamerica Corp.) became alarmed at the worsening condition of the houses. An investigation is currently being made to ascertain the cause and pinpoint the responsibility.

In spite of this failure, the gypsum board may still have a future for exterior application if a better means can be found to reinforce the joints. Some panels were built and tested using Speed Set and glass fiber tape for the joint reinforcing prior to the application of the acrylic surfacing. The panels were racked to failure and no beading or cracking occurred so this method may have merit. The system will be applied to two exterior walls of our test module for exposure testing.

Polystyrene Texture

A newly developed texture contains a polystyrene aggregate and is used for ceilings. The equipment to expand and shred polystyrene was installed in the Acme modernization. The preliminary field trials have been favorable. The polystyrene texture is more acceptable in certain markets because of its ease of application and whiter appearance than the vermiculite textures.

IMPROVED PRODUCT SECTION

SGP 0014534

Textures

The reformulation of the coarse (vermiculite aggregate), medium (vermiculite aggregate), and fine (perlite aggregate) ceiling textures is now complete. The question of low versus high pressure has been resolved so the textures can be applied through both high and low pressure spray rigs. The raw material cost savings averaged \$.80 per 40 lb. bag. These savings in addition to the operational savings made possible by the plant improvements at Acme significantly increased the profitability of our ceiling textures. In addition, the asbestos has been eliminated from these formulas, making them ecologically more acceptable.

The wall texture (no aggregate) has also been reformulated to eliminate the casein and make it more economical. Raw material costs have been reduced \$.32 per 25 lb. bag. We have not been able to entirely eliminate asbestos but have reduced it. Field tests of this formula have been requested to confirm the lab testing.

Joint System Products

a. Casein Replacement

The shortage of casein and the subsequent rise in the price from about \$.30 per pound to a high of \$.72 per pound prompted us to seek a substitute binder. Casein has been the standard in joint system products starting in the 1940's and it became apparent that finding a satisfactory substitute would not be easy.

Vinyl Binders: We have already gone through a change from casein/limestone to vinyl/gypsum at Acme. In this case, the price of the limestone as well as the casein forced the change. The vinyl binder is not entirely satisfactory because it is not compatible with casein products which are still being marketed and there is a difference in the application properties.

Starch Binders: Certain modified starches were tried as binder substitutes for casein. Although there was some acceptance, it was not universal. Also, some quality problems developed as a result of variations in starch. We are still marketing some starch products, but on a very limited basis.

Polyacrylamide: During the past eight months, a product manufactured by Dow Chemical Company has been undergoing evaluation.

This program was stepped up as the shortage of casein became more acute and because early trials were encouraging. This binder, called Dow 164 Resin, was compatible with casein and imparted much the same working characteristics as the casein. A plan to gradually phase casein out at Chicago, Akron, and Marietta is in effect. This plan is to coincide with the depletion of the inventory of casein for which we are committed. The tentative date to phase out casein is October 1972.

b. Asbestos

Phillip Carey, our chief supplier of asbestos, was unable to ship our orders on time, so another source has to be found quickly. We had been using a small amount of Union Carbide SG-210 in some products so it was a candidate. Also evaluated were two types of asbestos from J-M. The SG-210 was found to be very satisfactory and we are still testing one type from J-M. We have begun using SG-210 in certain products and feel that there is a slight advantage in quality as well as a very small raw material cost saving. The main thing is that we are now more flexible and less dependent on a single asbestos supplier.

Laminating Adhesive for Eternawall

Fort Dodge has been using adhesive formulated at Tigard for their vinyl laminating. In six months there has been \$5329 savings. The same adhesive was diluted and used for foil lamination and produced another \$2415 savings.

SALES SERVICE SECTION

SGP 0014537

Shaft Wall System

a. Fire Tests:

Even though we did not achieve a three hour rating with 1-5/8" thick shaft liner panels and two layers of 5/8" Firestop, we did get some concessions from Underwriters'. These were:

- 1) A two hour rating for the 1-5/8" panels and two layers of 1/2" from the shaft side (U511).
- 2) A two hour rating from both sides with two layers of 5/8" (U503).
- 3) Horizontal splicing of the panels for both constructions

The three-hour objective was dropped in favor of a version of our shaft wall with better sound barrier properties. The fact that some competitors have cavity walls tested for sound and the growing importance of sound in all building codes make a cavity wall necessary for us to have a complete system. Another emerging code requirement is to have the walls rated from both the shaft side and the finish side. The initial approach was to test from the shaft side only. With these considerations in mind, a testing program was launched to develop a cavity shaft wall that would permit sound ratings up to 50 STC and two hour fire ratings from each side. The new wall would also have to be able to be installed economically so it is competitive with other systems. Both metal studs and metal furring channels were considered to provide the cavity space necessary to obtain the sound properties. The 1" board formula was evaluated in order to have the optimum fire resistance.

In order to be sure the installation would be economical, we consulted with St. John's Drywall of Portland who have made commercial installations of our regular shaft wall. They emphatically recommended furring channels over metal studs because the channels would be easier to attach. The reason is the channels have flanges whereas metal studs do not.

Pilot fire testing resulted in a 1" board formula with increased glass fiber content and no clay or raw vermiculite. This is also a less expensive formula. The final decision was to determine what facing sheets to use. The most conservative would be two layers of 5/8" and the most speculative would be one layer of 5/8". One layer of 5/8" would have a good chance

from the shaft side but is a risky proposition from the face side. Our experience has been that we would require a good margin in our pilot test to be sure of a successful U.L. test. It was concluded that we should attach the metal furring channels vertically 24" o.c. to the center of each shaft liner panel and attach two face layers of 1/2" Firestop to the furring channels.

b. Sound Tests:

Several versions of our shaft wall were tested for sound transmission at Geiger and Hamme Acoustical Laboratories. The basic two-hour system with two layers of 1/2" Firestop (U511) gave an STC of 39. The furred construction with 1" glass fiber in the cavity gave the following values:

Two 1/2" face layers	-- 47 STC
Two 5/8" face layers	-- 48 STC
Three 5/8" face layers	-- 50 STC

This gives us a complete range of sound ratings to promote along with the fire ratings.

T.S.G. Industries

At the request of Sales, we cast sections of Denscal and High Early strength Portland cement and tested them for shrinkage and fire resistance. T.S.G. is investigating the manufacture of houses by pouring complete shells and floor slabs on the site and assembling them. The sections vary in thickness between one and four inches. Our fire tests showed that they would get about 35 minutes with single section, and well over an hour for two sections with an air space between them. There is considerable shrinkage, particularly in the thin areas. The 50-50 Denscal/cement mixture has much more tendency to shrink than the 75-25 mixture.

We had an opportunity to see a house they had poured. It wasn't completely representative because the walls were all a full 4" thick. Our impression was that the construction probably wasn't economical, but they did prove that it is feasible to cast a house with gypsum and Portland cement.

Low-Cost Eternawall

After furnishing 200 pieces of a special 1/4" vinyl covered wall-board to the Elkhart branch, Sales advised us that there was no market for the product.

Monolithic Eternawall

Some investigations were made using various weights and patterns of Eternawall in the monolithic system. It was concluded that solid colors should not be recommended for monolithic application.

Other Sale's requests were handled but they are too numerous and too minor to list.

MANUFACTURING SERVICES SECTION

Wallboard, Lath, and Plaster

- a. One trip was made to Akron, three to Grand Rapids and one to Buchanan to provide plant assistance. These concerned high T.C. stucco, poor wallboard core quality, analysis of rock deposits, and instruction in the use of the flame photometer.
- b. We are continuing to analyze rock or stucco samples for the plants that require periodic analyses. We have discontinued making weekly purity analyses for every plant.
- c. A radiant heat panel complaint in Baltimore was investigated.
- d. We are continuing to keep the formula books up-to-date for all wallboard, plaster, and industrial formulas.

Joint System

- a. We responded to a shortage in our asbestos supply by evaluating some other sources. We were able to expand our use of Union Carbide's SG-210 which makes us less dependent on Phillip Carey as a supplier.
- b. A trip was made to Marietta to participate in the discussions concerning a large amount of defective Reichold emulsion that caused quality problems.
- c. Heavy duty vinyl bags are being evaluated as Ready Mix containers. The vinyl bags are less costly than the pails and boxes and are easier to fill than the boxes.

SGP 0014542

PATENTS AND LICENSING SECTION

SGP 0014543

Firestop

Our United States patent covering glass fiber and raw vermiculite will expire in May 1973 so we are offering our U.S. Firestop licensees an opportunity to use our new #3,616,173 "clay addition" patent beyond May of next year. Our Canadian patent on glass fiber and raw vermiculite has about 2-1/2 more years to run. The royalties for the clay addition patent would be the same as before except for 1/2" Firestop which will be increased from \$.10/M to \$.45/M for some licensees. Thus far, no one has accepted our offer. This is understandable since these companies have been paying royalties for 17 years and were looking forward to some relief. As things now stand, most of their 5/8" fire rated board (Type X) would be royalty free but they would pay us royalties on 5/8" XXX and all 1/2" which is the "clay addition" formula. One new licensee, California Gypsum Inc., has taken a license to manufacture wallboard under the "clay addition" patent.

Shaft Wall

Licenses were prepared by our legal department and negotiated with Westroc and Domtar. The final documents have been sent to them for execution.

An action from the patent office has been received rejecting all the claims of the shaft wall application. We are currently studying the examiner's position so a rebuttal can be prepared. The examiner's arguments do not appear to be impregnable.

Round Edge Board

We also received a rejection of all claims in the round edge application. The examiner presented some rather strong arguments here but Synnestvedt and Lechner feel we have at least a 50% chance of having the claims allowed. Two affidavits were prepared attesting to the differences in our edge and the Disney (U.S.G.) edge and the advantages of our development.

Accelerator System

It was decided to apply for U.S. and Canadian patents on the method of acceleration developed by the manufacturing department. As a first step, Synnestvedt and Lechner have been instructed to conduct search of the art.

Gypsum Joint Compound

It has been decided that we can use a conventional polyvinyl alcohol with the gypsum formula rather than the specially modified alcohol we originally thought was necessary. This removes the novelty so the application for patent was abandoned.

SGP 0014545

GENERAL PROJECTS SECTION

SGP 0014546

Gypsum Association

- a. Comprehensive testing of various thickness boards from several plants was done to thoroughly evaluate test methods and to establish values to propose to the technical committee. If the Association can agree on these values, a revised standard will be submitted to ASTM for adoption. The importance to G-P is the deletion of the weights and the reduction in the weak direction flexural strength. Advances in technology have resulted in lighter weights and lower flexural strengths without sacrificing quality, but we are marginal in so far as meeting current ASTM standards. Additional characteristics in the revised standard are core hardness and resistance to deflection under humid conditions which will give a truer evaluation of wallboard quality.
- b. For years the industry has been seeking a satisfactory method of distinguishing between regular and Type X wallboards. The two-burner test is erratic and undependable. Joe Watt has developed a very simple method which is also reproducible. This method was demonstrated at the last C-11 meeting and will also be presented at the next Gypsum Association technical committee meeting for consideration.
- c. A special task force of the Gypsum Association technical committee met to consider the fact that NFPA specifications for air handling systems do not include gypsum wallboard. If not corrected, it could mean that codes may restrict gypsum board from ceilings where there are plenums and elevator shafts which are part of the air handling system in some buildings. A revision of NFPA 90A has been proposed which will permit gypsum wallboard to be used with certain limitations on temperature and humidity.
- d. The Materials Handling Committee is pursuing the following projects:

Carloading Program with American Association of Railroads: Procedures have been established for cushion under carriage flatcars and a test program is currently in progress to establish similar loading procedures for conventional railroad cars. The object is to reach agreement with the AAR on loading procedures that will be adequate but not restrictive and costly to the gypsum industry.

Plastic Wedge Block: This device was developed by Joe Watt to replace the old wooden wedge block. It makes for better and

easier separation of boards in a lift and has been adopted by the association and the G-P Distribution Division for their handling of gypsum board and other sheet materials.

Also in progress are programs to establish specifications for poly tarp covers; loading procedures for paper rolls in trucks; loading procedures for cans of Ready Mix; investigation of shrink film packaging; and possible elimination of wallboard end tapes.

The Gypsum Association Materials Handling Manual is continually being up-dated with these new procedures and recommendations as they are developed.

ASTM

The important ASTM C-11 subjects have already been reported as they also fall under the Gypsum Association subject matter.

In E-5, a number of revisions to the E-119 fire test procedures are being considered and we are keeping abreast of them.