

GYPSUM RESEARCH
SIX MONTH REPORT
JULY-DECEMBER 1971

Added Feature:

Ten Years of Gypsum Research

TABLE OF CONTENTS

<u>TEN YEARS OF GYPSUM RESEARCH</u>	1-3
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<u>SIX MONTH SUMMARY</u>	4-5
--------------------------------	-----

Six Month Analysis of Sales & Profits from New Products.....	6
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NEW PRODUCT SECTION

Gypsum Firedoor.....	7
Drywall and Panel Adhesive.....	7-12
Improved Pre-Dec.....	12
Exterior Wallboard.....	12

IMPROVED PRODUCT SECTION

Gypsum Joint Compounds.....	13
Gypsum Textures.....	13
Vinyl Adhesive for Eternawall.....	13-14
Ram Press Process Plaster.....	14
Synthetic Gypsum.....	14
Pre-Dec.....	15
Round Edge Wallboard.....	15

SALES SERVICE SECTION

Shaft Wall System.....	16
Flamespread Rating for Eternawall.....	17
Low Cost Vinyl Board.....	17
Fast Method of Joint Finishing.....	17-18
Corrugated Steel Roof Deck.....	18
Pre-Fab Wood Truss Roof Construction.....	18

PATENT AND LICENSING SECTION

Firestop.....	19
Shaft Wall System.....	19
Gypsum Joint System.....	19
Round Edge Wallboard.....	20

GENERAL AND MISCELLANEOUS PROJECTS

Gypsum Association and ASTM.....	21
Electron Microscope.....	21

TEN YEARS OF GYPSUM RESEARCH

In order for a company to progress, it must take certain risks. The construction of a new plant or acquisition of a new facility is a risk but one that is minimized by the experience and knowledge that the end product can be manufactured and sold at a profit. New products, however, have little or no previous experience or knowledge to draw on, so the risk becomes considerably greater. It would be unwise to invest large sums of money for a product or process where there are so many unknowns. Therefore, new products and processes have to be handled differently - through research. Research permits the larger risks to be taken but with a relatively small capital investment. Some will succeed and others will fail, but large investments will be limited to those which succeed.

For research to be worthwhile, the return from the successes has to surpass the total R & D investment. Let's look at ten years of gypsum research and add up the score. In making a quick assessment of the results, one might only recall the failures. Molded grainboard never got off the ground in spite of an all-out effort to make it work. The radiant heat panel did get started but the market has never materialized. Other minor failures can also be found to build a case for concluding that research cannot be justified.

Before making a premature judgment, we should look at the accomplishments and their value compared to the total financial commitment to gypsum research over a ten-year period.

1. In the early 1960's, Research and Sales convinced management that we should develop and manufacture a ready mix type joint compound. The market for Ready Mix was very small then, and for the first couple years the profitability was nil. In the ensuing years, the market for Ready Mix grew by leaps and bounds and our experience and technology grew along with it. This knowledge, gained from a relatively small investment, justified larger investments for manufacturing facilities at four locations. The end result speaks for itself inasmuch as the 1971 sales and profits from Ready Mix Joint Compound were \$3,564,920 and \$411,780.
2. During the days of the predecessor companies of the G-P Gypsum Division, two important patents were obtained on fire rated gypsum board. Our research efforts have been concentrated in this field to take advantage of these patents. We have spent nearly \$500,000 for Firestop research and

testing during the past ten years, but the investment has paid off handsomely. The savings derived from Firestop weight reductions and raw material cost savings each year return almost as much as the total ten-year investment. In addition, there has been a substantial sales growth of Firestop during these years (23 million sq. ft. in 1961 to 195 million sq. ft. in 1971), and we have licensed other companies to use our technology. The current royalties from our Firestop licensees run close to \$300,000 per year. The last of the original Firestop patents will expire in 1973, but another G-P Firestop patent issued in October 1971. This means we have extended our royalty income for another 17 years. Without this research we could be paying royalties instead of receiving them.

3. New products emerging from research added \$7,718,602 to our gross sales and \$1,394,375 to our gross profits in 1971. Pre-Dec wallboard alone contributed \$1,052,180 to sales and \$315,570 to profits last year.
4. A completely new market for gypsum is the elevator shaft enclosure for high-rise buildings. We have invested about \$75,000 to develop and test a system that has turned out to be one of the best available. Just getting started, \$48,447 worth of shaft wall panels and components were sold during 1971. The sales of regular and Firestop board sold along with the shaft wall surpass sales of the special components. In addition, licensing of the shaft wall system is expected to be a source of future income. We have already engaged one company and have a couple others interested. It is possible that the future royalties from the shaft wall system will approach the present Firestop royalties.
5. Three years ago all of the joint system products at Acme were manufactured using limestone as the basic filler. The cost of limestone is \$21/ton versus a gypsum cost of less than \$2/ton, so the economic advantage is obvious. Today we are successfully using gypsum in place of limestone for Acme's entire production. This was not easily accomplished and required a persistent test program in the face of overwhelming opposition due to early field problems. In December, with all products made with gypsum, Acme joint system sales and profits were \$60,946 and \$11,676. The Acme joint system operation was in jeopardy due to high costs and may have been phased out if no research had been done.

S U M M A R Y

Facts and Figures

This is our first semi-annual report since we moved into our new Tigard Research headquarters. Since this is the year end, we will include some annual figures in addition to the six months figures. The sales and profits generated from new products in 1967 reached all time highs of \$3,307,524 and \$875,769. This growth since 1962 is shown on the charts on pages 3 and 4. The 1967 figures represent 4.1% of the Gypsum Division sales and 4.6% of the Division profits. Firestop sales escalated to 30,604 M sq ft of 1/2" and 81,792 M sq ft of 5/8" which are increases of 26.1% and 19.0% respectively over 1966 figures. We feel that improvements in the products and new fire and sound ratings have been a factor in this growth. In addition, it is estimated that reduced weight limits for Firestop have saved approximately \$62,303 in 1967.

\$200,961 was budgeted for Research in 1967. Our R & D expenses were actually \$174,232 for the year. We have budgeted \$221,000 for Research in 1968. Our expected distribution of budgeted expenditures in 1968 are shown on the graph on page 8.

New Products

The only new product released in the last six months was a vermiculite aggregate texture which will be called Bestex D. The major research activity has been the continuation of projects which were started in 1967 or earlier. The molded grainboard pilot plant is complete and some encouraging trial runs were made. Our option to develop this process has been extended for another six months. The wallboard radiant heating panel is now at the stage where we will be seeking Underwriters approval and at the same time field testing will be started. Another new product is a specially formulated 3/16" thick wallboard which we are proposing to use as a core material in wood paneling. Earlier experiments were conducted at the Savannah plant but the current investigation will be done in cooperation with the Eugene Division.

Improved Products

Hard End wallboard may be one of the most significant improvements in gypsum wallboard in recent years. Very shortly an installation will be made in the Acme wallboard line. From this method we can evaluate the method of manufacturing hard end wallboard and also see what the reaction in the field will be. The Denscal operation is currently underway and replacements of Denscal for Densite are being made to take advantage of the lower cost of Denscal. The estimated savings per ton of Densite replaced by Denscal is \$11.00. Other product improvements being investigated are the replacement of limestone with gypsum in Joint System, the search for a lower cost emulsion for water proof sheathing and the development of a hard edge wallboard.

Sales Service

Some new fire and sound ratings have been developed. The most important were the one hour fire rating and 45 STC sound rating for 1/4" gypsum sound deadening board and 1/2" Firestop over wood studs. The fire test program concluded on a disappointing note when we fell short of our objectives in the last three tests. Laboratory testing is underway, using our pilot furnaces, to seek further improvements in the Firestop formula in order to gain the ratings which have eluded us and also to seek lower raw material costs for Firestop.

Patents

In August of 1967 a patent application was filed for the innovation which has permitted us to manufacture lighter weight Firestop. Our patent counsel was advised by the patent office that the major claims for Dens-Core base patent application will be allowed so we expect a patent to issue in the near future. We have resumed the investigation of National Gypsum's infringement of our Firestop patent. Fresh evidence from new analyses of the National Gypsum products have been submitted to patent counsel. It is now a matter of deciding whether the patent is strong enough to support a suit against National.

The Future

Next year should bring the molded grainboard, the radiant heating panels and the hard end wallboard to a conclusion. If they are successful, we will be furnishing technical assistance to manufacturing and sales to help launch these products. There will probably be many ramifications of these products to be pursued. A very comprehensive investigation into our Firestop formula is also planned. In addition, there will undoubtedly be some completely new developments plugged into our program in 1968.

The rebuilding of our research organization will continue into 1968. The current research group consists of George Green and Ray Hinkel who came with us from Paoli; Don Klus, who transferred to Tigard from our Grand Rapids plant; and the new men, Kelly Stalker and Mike Robinson. The training of the new men will be done simultaneous with the pursuit of our research objectives. Our objectives for 1968 offer more opportunity for us to contribute to the profits of the company than ever before. We will be doing everything possible to make the most of this opportunity.

These are the major achievements of gypsum research during the past decade. A total of about \$2.5 million was invested, including the cost of the unsuccessful projects. The return from that investment totals over \$5.5 million in new product profits and conservatively \$1 million in cost savings for the ten-year period. This does not include benefits from tie-in sales, increased sales from test data developed (such as Firestop), or the aforementioned growth of royalty income. It would be absurd to claim that all this was accomplished solely by research. The cooperation of the manufacturing and sales departments was essential, but it would have been impossible had the research not been done in the first place.

SIX MONTH SUMMARY

So much for past records. Let's see what we did with the 1971 research investment and, more specifically, focus on the major activities during the past six months.

1. The investment in a drywall and a panel adhesive is close to \$50,000 with no return. The market is there and with an acceptable product line the adhesive business may rival the sales and profits of our current joint system operations. We are convinced we belong in this business and have launched an all-out effort to prove it.
2. Gypsum firedoors have been a perennial project and some undoubtedly feel we are kicking a dead horse. The market for firedoors is waiting for us - all we need is the product. One last attempt is being made to gain a one-hour fire rating for the gypsum door.
3. Sales has projected a substantially increased market for Pre-Dec if we can eliminate the necessity for rosette fasteners. We have no ready answer, but we have embarked on an intensive search for one.
4. Eternawall has never reached the sales projections. An investigation was undertaken to reduce the costs so we can sell the product for \$80/M instead of \$150/M. It looks like there will be enough cost reductions to make the price objective and this should spur the sales of Eternawall in 1972.
5. Gypsum has never been considered to be satisfactory for exterior use other than as a sheathing. However, some new coating materials which offer resistance to weathering open up some possibilities that we cannot ignore. Imagine the growth of the market for gypsum if it could be used on the outside of a house!
6. A construction company thinks houses can be cast from a mixture of Denscal and Portland cement. If we cooperate and they are successful, we will have more Denscal business than we can handle.

In addition to these high risk investigations, other projects are being pursued with little or no risk. In these cases we are either building on proven developments or using our experience and technology to increase the sales, improve the quality, or reduce

the manufacturing costs of the gypsum product line. Interspersed between taking prudent risks, we occasionally engage in something to help the gypsum industry or improve our relations in the community. There are no clear profits here, but we think it is like voting - if each one does his part, it will help build a better future for all of us.

SIX MONTH ANALYSIS OF SALES & PROFITS
FROM NEW PRODUCTS

<u>Unit</u>	<u>Product</u>	<u>Volume</u>	<u>Sales Amount</u>	<u>Profit Amount</u>
MSF	Denscote Base (All)	\$ 8,797.4	\$ 348,854	\$ 64,677
MSF	Tile Backer Board (All)	7,340.1	497,625	194,946
MSF	1/4" Sound Deadening Board	3,306.5	118,857	35,228
MSF	Radiant Heat Panels (All)	79.0	32,279	(844)
MSF	Pre-Dec Wallboard	10,336.5	575,473	170,460
MSF	Pre-Dec Ceiling Tile	54.2	4,902	623
MSF	Shaft Liner Panels	62.7	11,338	1,731
Tons	Denscote Plaster	1,687.6	97,700	18,816
Pails	Ready Mix	39,804.3	1,944,781	186,335
Carton	Ready Mix	5,148.0	13,819	(623)
Tons	Triple Duty	1,934.8	254,276	52,395
Tubes	Panel Adhesive	12,936.3	3,094	(109)
Tubes	Drywall Adhesive	15,768.0	10,991	1,501
Tons	Speed Set	165.4	26,827	4,688
Tons	Bestex A	851.7	103,139	2,182
Tons	Bestex B	23.4	3,695	110
Tons	Bestex C	280.2	44,652	2,128
Tons	Bestex D	238.9	35,583	1,835
Tons	Ram Press Process Plaster	41.3	3,592	1,741
MLF	Metal T Spline	32.3	5,299	770
MLF	Metal L Runner & J Channel	24.5	2,779	191
TOTAL:			<u>\$4,139,555</u>	<u>\$738,781</u>

IMPROVED PRODUCT SECTION

Gypsum Joint Compounds

The conversion from limestone to gypsum as the basic filler in all joint system products at Acme is now complete. We are continuing to seek improvements and expand the product line. One example is a Ready Mix topping which is currently being evaluated.

Gypsum Textures

The gypsum aggregated ceiling textures received good acceptance initially, but it was found that these textures would not apply properly through low pressure spray equipment. Reformulations did not solve the problem which now appears to be more than just the air pressure. Most of the difficulty is with the Glover spray equipment which is widely used for texturing. Some trials were made at Glover's location in California. The problem may have something to do with the geometry of the nozzle as well as the pressure. Because of the environmental problem, asbestos had been eliminated from the textures but it may be necessary to replace some of it. In any event, some reformulation will be necessary. An attempt to rent a Glover machine was unsuccessful so a machine was purchased. All of this has resulted in considerable lost time, much to the consternation of Sales. An all-out program is currently underway to revise the formulas so they will apply readily through the Glover and other low pressure spray machines.

In preparation for the new texture plant addition at Acme, we have been formulating textures with expanded polystyrene aggregate. The Glover machine will be used to test the polystyrene textures as well as the present vermiculite aggregate textures. The testing with the polystyrene is tentative because we will not know the exact density and particle size until the expanding and shredding equipment at Acme is installed and working. At least some starting points will be established that should make the formulation easier and faster when the equipment is available.

Vinyl Adhesive for Eternawall

We have previously purchased the adhesive for laminating vinyl film and aluminum foil from independent companies. These adhesives are relatively expensive and not ideally suited to our use. The laminator speed is limited by the tack development of the adhesive. One of the objectives was to incorporate very fast tacking properties in the adhesive. Two candidates were developed and passed all of the creep, bleed through, tack and other characteristics

required for a vinyl adhesive. After conducting plant trials at Fort Dodge and Wilmington, the best adhesive was chosen, and some extensive runs were made at Fort Dodge. Subsequently, Fort Dodge began to use the new adhesive for all their vinyl laminating. The anticipated savings is \$3000 per year from the adhesive alone. Additional savings are expected from the increased machine speed. On a trial run, Fort Dodge was able to run at 89 ft./min. The speed is somewhat dependent on the vinyl film, but it is expected that the average will be well above the old standard of 45-50 ft./min.

A somewhat revised adhesive formula was tried on the aluminum foil and the early runs were satisfactory so the plant will make some longer runs for a more thorough evaluation. The potential savings from the foil laminating are even greater than the savings on the vinyl, because there is a larger volume of foil laminated.

Some inexpensive mixing equipment has been installed at Fort Dodge to blend the adhesive.

Ram Press Process Plaster

The testing and evaluation of the Ram plaster was concluded. The next step is the evaluation by pottery manufacturers who use the Ram process. Thus far the results have been favorable. This investigation has been handled by Blue Rapids in cooperation with the Technical Department. The testing at Ram, Inc., was financed by Tigard Research.

Synthetic Gypsum

The DuPont Company contacted G-P to solicit our interest in the gypsum by-product of their hydrofluoric acid operation across the river from our Wilmington plant. This appeared to be a very good quality synthetic and one which might be very satisfactory for the manufacture of gypsum wallboard. When we got into the economics, we found that the cost of neutralizing the synthetic and getting it across the river would be about \$5 per dry ton. DuPont also plans to phase out this HF plant in 1975. On this basis, additional equipment to dry the synthetic (furnished 50% solids) could not be justified. Also the \$5 per ton cost was not that attractive to Manufacturing, so the investigation was abandoned. In order for synthetic gypsum to be feasible, it has to be of high enough quality to manufacture wallboard without penalty, located such that the cost of delivering it to the gypsum plant is less than the cost of the natural gypsum being used, and the supply has to be consistent. We have not found any sources for by-product or synthetic gypsum that satisfy all of these requirements.

SALES SERVICE SECTION

Flamespread Rating for Eternawall

A flamespread rating of 25 has been achieved for our regular unbacked vinyl covered wallboard by a test at Underwriters'. The rating covers vinyl film from two manufacturers, the regular vinyl adhesive, and the adhesive we are formulating ourselves. In other words, there are no special vinyls, adhesives, or other components which would make it more expensive to achieve the rating. In fact, the use of our own adhesive reduces the cost. It is difficult to ascertain whether competitors have the 25 flamespread for unbacked vinyl and, if they do, whether they could produce it regularly without increasing their costs or limiting their product line. We plan to offer an Underwriters' labeled vinyl board which should put some pressure on the competition.

Low Cost Vinyl Board

There is apparently a potential large market for a commodity product such as the XKE particle board paneling. It was felt that a more productive laminating operation, a lower cost adhesive, and an inexpensive vinyl (1.6 mil) might get our costs to a point where we could compete with XKE. We had even gotten some low estimates on the 1.6 mil woodgrain vinyl from Permaneer. As it turned out, Permaneer decided they were not interested in selling us the thin woodgrain vinyl so we began to look elsewhere. In the meantime we learned that the Distribution Division had a commitment to sell the XKE, so they were not enthusiastic about us marketing a competitive product.

It was finally decided to drop the woodgrain idea and concentrate on inexpensive solid color vinyl on thin (1/4") board that could be sold for wall covering in the mobile home market. The goal is to be able to sell this predecorated board for \$80/M. The 1/4" board has always been considered too weak for use over anything but a solid wall but it is possible that a high glass fiber content plus the vinyl facing will give it sufficient strength to be used over 16" o.c. studs. A plant run was made at Fort Dodge and a test program is underway to compare our board with hardboard and other inexpensive finishes which are conventionally used in mobile homes.

Fast Method of Joint Finishing

The most practical approach found to finish joints faster has been a setting type joint finishing product that can be used with a glass tape and troweled smooth in a single application. In order for this to be successful, the shrinkage of the setting material must

be low, the setting time must be fast yet allow enough time for application, and the product must have exceptionally good working properties. Some formulation work has been done on a finishing compound and we are at the point where our testing will have to be expanded to larger areas or full size panels as a further evaluation of the product and the method.

Corrugated Steel Roof Deck

A small amount of time was spent evaluating a roof deck system proposed by Dalin-Associates, one of our customers. Dalin felt that the Wheeling Corrugated steel decking with Firestop gypsum board attached to the top side would provide a fire rating of at least one hour. A pilot test conducted here showed that the construction would fall far short of the hour fire rating. On that basis the project was dropped.

Pre-Fab Wood Truss Roof Construction

Some assistance is being provided to Frame Joist Corporation towards getting a one-hour fire rated construction. By helping them we can have our Firestop specified for this construction.

PATENT AND LICENSING SECTION

Firestop

Improved Firestop patent #3,616,173 issued in October 1971 to George Green. This improvement has already been extended to our licensees and will enable us to continue licensing under this patent for another 17 years. The 1/2" fire rated board being licensed, a small amount of the 5/8" fire rated board being licensed, and the 1" component of the U.L. fire rated shaft wall system all fall under the new patent. About 25% of our licensing potential should be retained under this patent. One of our old Firestop patents expired last May and the last one will expire 18 months from now. In order to gain maximum advantage from the new patent, we are reviewing our entire Firestop licensing program to try to establish some consistency in the agreements and, if possible, to upgrade some of our royalty rates.

Shaft Wall System

We have reached agreement with Domtar Construction Materials, Inc., of Canada and will grant them a license under the same royalty terms that Celotex is licensed. Flintkote had been a candidate for a shaft wall license, but they have developed a system of their own. If our shaft wall gains widespread acceptance, we may get other licensees. It is generally accepted that practically all elevator shafts in high rise buildings will have gypsum enclosures in the future. This should be a vast new market for gypsum products considering the average wall will have a 2-5/8" thickness of gypsum. Since our sales contact with architects is limited, it behooves us to license as many companies as we can.

Gypsum Joint System

A snag was encountered in attempting to describe the modified polyvinyl alcohol used with the gypsum filler. Monsanto, the manufacturer of the polyvinyl alcohol, misled us into thinking it would be covered in a patent of theirs. When the patent issued, it did not include the alcohol we are using and they refused to supply a description that would satisfy the patent examiner. This invention covers all of the joint compounds being manufactured at Acme, so it is important to seek patent protection. Our analysis of the modified polyvinyl alcohol has narrowed it to the point where we can have an independent laboratory finish the job. The outside analysis is in progress, and a continuation application was filed to allow enough time to get the information to the patent office.