

PLAINTIFF'S EXHIBIT

GP-1296

GYPSUM RESEARCH
SIX MONTH REPORT
JULY-DECEMBER 1971

Added Feature:

Ten Years of Gypsum Research

SGP 0014493

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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.

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>

NEW PRODUCT SECTION

SGP 0014502

Gypsum Firedoor

We just missed in our attempt to get a one-hour rating for a wood flush gypsum door early in 1971. We believe there is a good chance to get the rating on a re-test. Before investing in a repeat test, we surveyed the door manufacturers to be sure there is a market for the gypsum firedoor cores. In order to do this properly, we had to furnish some trial door cores to prospective customers and establish a price. Our estimate for labor and materials to manufacture the doors is \$.33/sq. ft. Adding 22.5% for overhead and 35% for profit brings the f.o.b. price to \$.52/sq. ft. Using \$2 per cwt as the average freight, a carload delivered price of \$.60 per sq. ft. was established. This figure was used in contacting door manufacturers who might be prospective customers. The estimates from those responding totaled 250,000 door cores annually. Using 20 sq. ft. for an average door, five million square feet of firedoor core would be required. Even if only one million feet actually materialized, this would generate sales of \$500,000 and estimated profits of \$100,000.

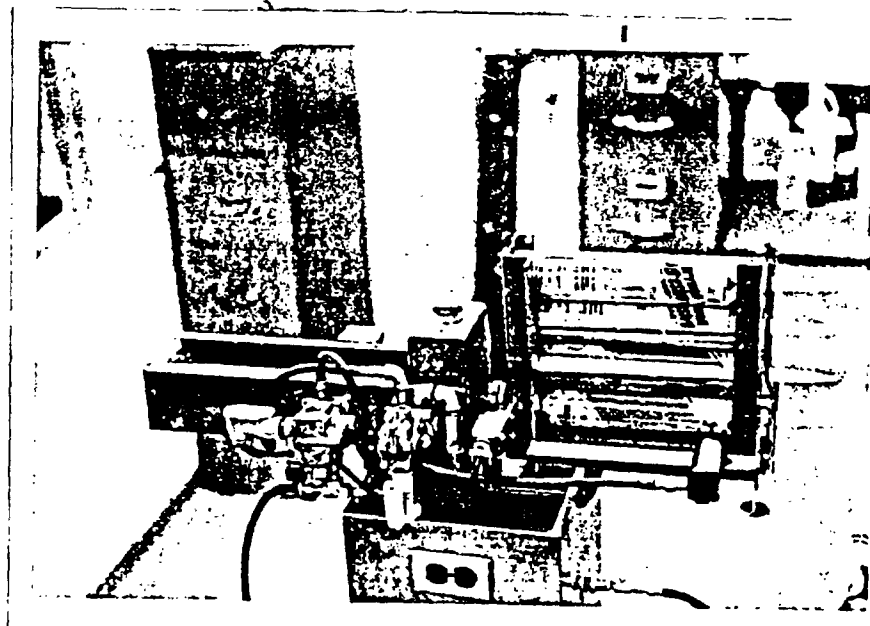
We investigated the possibility of manufacturing the firedoor cores for the U.L. test at the Tigard Lab rather than the plant. This would save several thousand dollars in plant costs. On the basis of the survey and manufacturing the test cores at Tigard, approval was granted to make another attempt to get the one-hour fire rating.

The gypsum door cores were cast on the pilot wallboard machine at Tigard under the auspices of the Underwriters' inspector. These cores have been shipped to Walled Lake Door Company in Richmond, Indiana, to be processed into doors for the fire test. Walled Lake was chosen because of their enthusiastic response and commitment to purchase firedoor material, and also because of their nearness to Underwriters'. The processing of the doors at Walled Lake is scheduled for the first week in January. The fire test at Underwriters' will probably be held in late February.

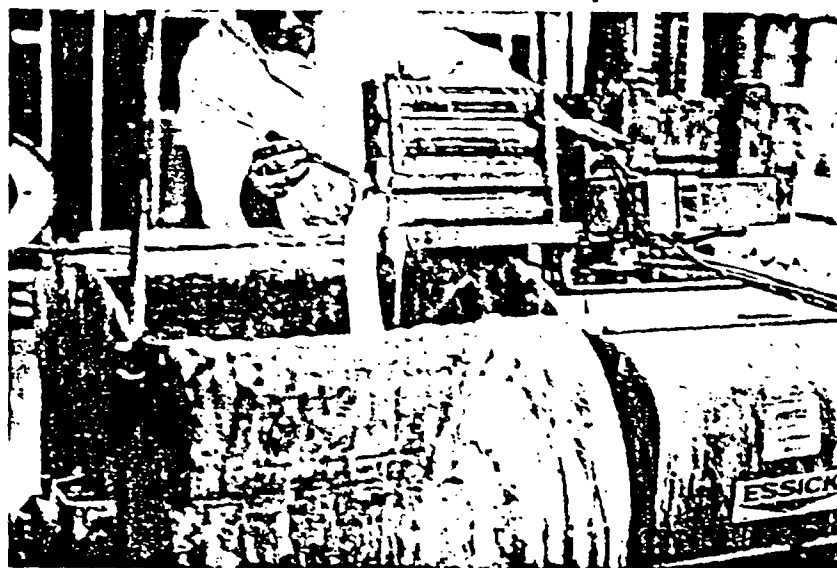
Drywall and Panel Adhesive

Our first effort to develop an acceptable adhesive for application of both gypsum wallboard and plywood paneling was a flop. The adhesive thickened in the tube making the application properties unsatisfactory. Also, the adhesive did not meet the requirements for installing plywood paneling because it did not have quick tack. The adhesive production at Akron was terminated until the problems of acceptance could be solved. We decided to tackle the drywall adhesive and panel adhesive as separate projects, and to concentrate on the drywall adhesive first. This choice was made because the drywall type adhesive did not have the quick tack requirement, and because there is a large market for this drywall adhesive in the Portland area.

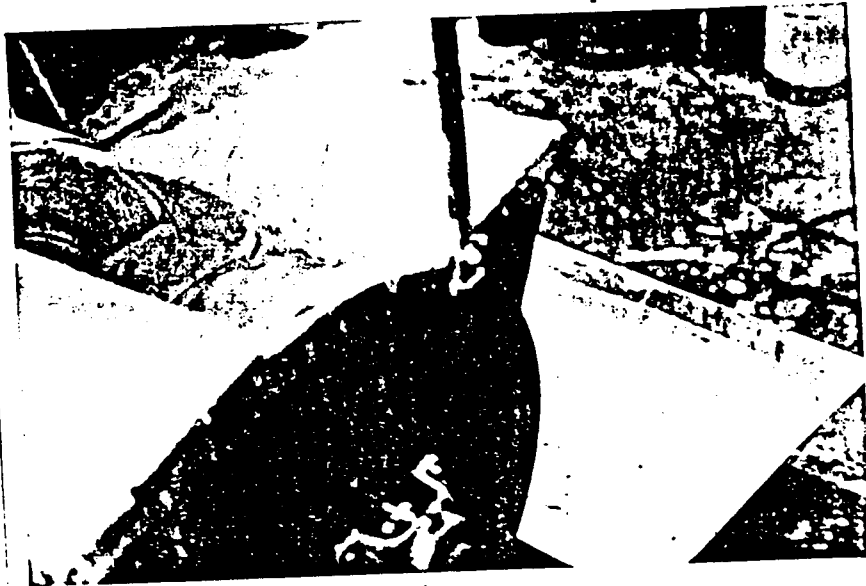
A formula was developed which passed all our tests and was well accepted on the basis of the early field tests. We also were able to re-work the entire carload of old adhesive that had been shipped to the Portland branch but could not be sold because of the poor application properties. About half of the old adhesive has been re-worked and sold. In addition to recovering our investment, we have gained considerable experience with the new drywall adhesive. All of the reports have been favorable so now we are planning to re-work the old adhesive at Akron. Some photographs of the adhesive re-working at Tigard are on the following pages.



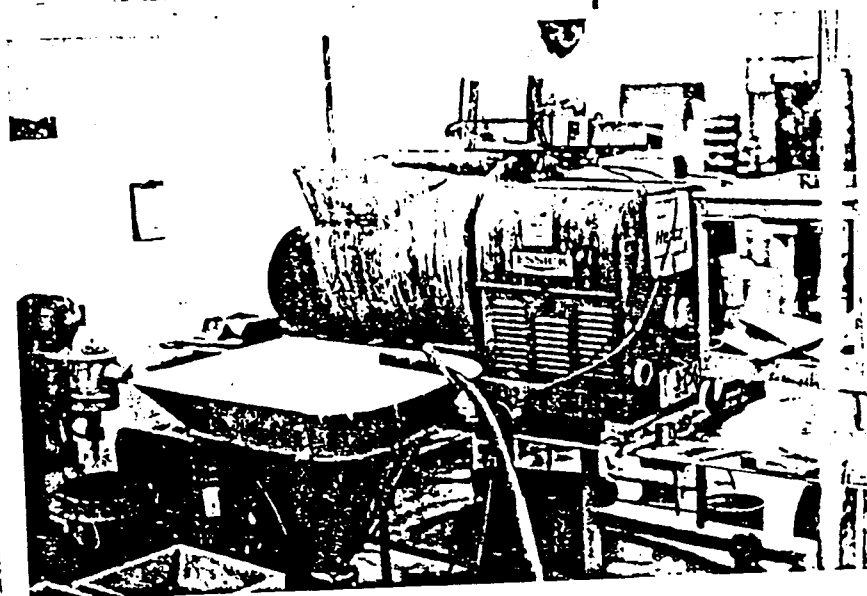
Adhesive Extractor



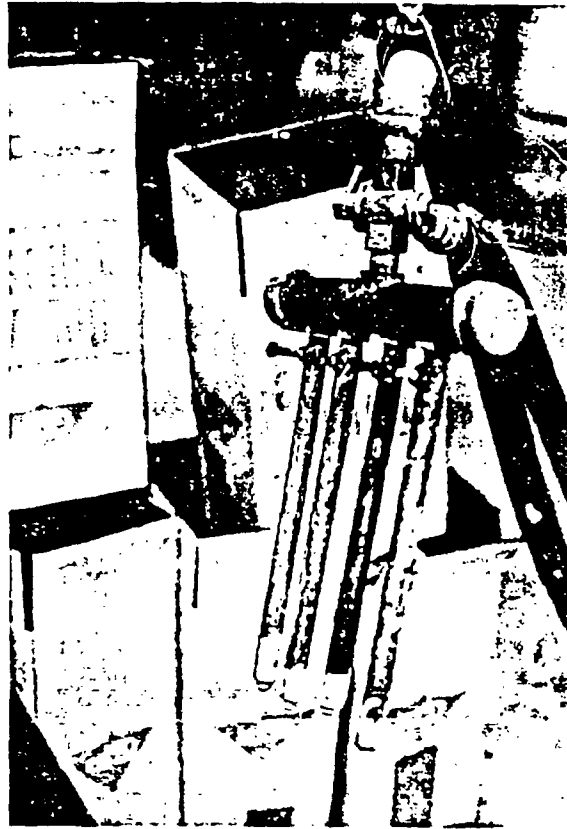
Old Adhesive Extracted into Mixer



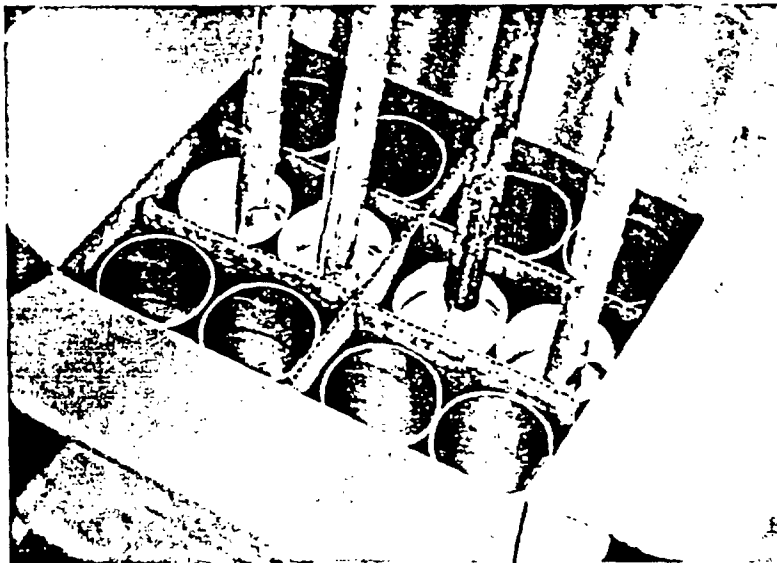
Old Adhesive Blended with
New Ingredients



Reworked Adhesive Transferred
to Hopper



Tube Filler Designed by Don Klus



Four Tubes Filled Simultaneously

Now that the drywall adhesive is well along, efforts can be directed to the panel adhesive.

Improved Pre-Dec

The present Pre-Dec is attached with rosette fasteners which are being tolerated, but the desire is to have a hidden fastener, preferably a staple. The first approach was to manufacture a coarser texture Pre-Dec. The fastener used would be disguised with touch-up paint. Our manufacturing line was not long enough to dry the heavier coating, even at slow speeds, so additional drying capacity was required. Sales felt that the touch-up would not be an acceptable operation by the mobile home builder. Some other ideas have been advanced and are being explored, but they are all in the exploratory stages. In order to be able to determine whether many of the ideas are practical it was necessary to set up a small coater at Tigard. A feasibility study of the various ideas is now underway.

Exterior Wallboard

We have been furnishing a special water resistant 5/8" wallboard for use with Kelly-Moore's Kel-Tex exterior surfacing system. The use of our board with their system has been limited to "The Lake" development in Newark, California, and some warehouses in San Jose. The first 50-100 houses looked very good, some of which were over a year old. On this basis we agreed to furnish a special board for the Kel-Tex system. Periodic inspections were to be made. We began to find shoddy workmanship and unsatisfactory finished appearance as more houses were being completed. This was brought to the attention of the contractor and some improvements were made, but subsequent inspections showed that the application still left much to be desired. The latest inspection revealed that cracks were occurring at the joints on several houses which had been finished for six months or more. This has prompted us to discontinue furnishing the so-called exterior board for the Kelly-Moore system.

If the cracking and vulnerability to poor workmanship could be overcome, this might be a very acceptable method of exterior surfacing. It would open up a potential new market for gypsum board, so we are continuing the project on that basis.

IMPROVED PRODUCT SECTION

SGP 0014509

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.

Pre-Dec

Assistance was provided to plan and start-up the Pre-Dec manufacture at Brunswick. Some time has also been devoted to working with the manufacturer of the rubber sleeves in an effort to get a better and more consistent quality coating roll for the Pre-Dec operation.

Round Edge Wallboard

A projection method was established to accurately measure the degree of curvature of a piece of round edge board. This was done to have a standard way of determining whether our round edge board is within our manufacturing and patent tolerances. The projection device was too awkward to be used at the plant so the Technical Department developed a graduated T-square. This is a simpler method of determining the roundness, and almost as accurate as the projection method.

SALES SERVICE SECTION

SGP 0014513

Shaft Wall System

1. Fire Tests

The Underwriters' tests of the shaft liner panels faced with two layers of 5/8" Firestop did not pass three hours but did gain a two-hour rating and is designated as Design 42-2 Hours. This is not the most competitive wall since we already had a two-hour rating at Ohio State with two regular 1/2" facing layers. The U.L. Design has the usual advantage of greater acceptance plus incorporating horizontal joints in the shaft liner panels. The ability to splice panels is significant because it eliminated the need to handle the long panels that are often required. (shaft wall heights of 16' are not uncommon)

We still need a three-hour rating in addition to a more competitive two-hour U.L. assembly. A test will be conducted at U.L. in January to seek the three-hour rating with three layers of 1/2" Type X as the facing. At the same time, U.L. will place thermocouples between the second and third layers to permit them to extend a two-hour rating with two facing layers of 1/2" instead of 5/8" Firestop. U.L. has been furnished with data from pilot tests made in Tigard which we hope will provide enough information to permit U.L. to extend the two and three-hour ratings from both sides. The test will be made with spliced shaft liner panels so this approval will be included along with everything else. If we get everything, it will be quite a windfall from one test and should enhance our competitive position.

2. Wind Load Tests

Another series of wind load tests was conducted at Wiss, Janney and Elstner Engineering Laboratory. Based on the results we are recommending the 1-1/2 hour shaft wall for up to 11' in height; U.L. Design 42-2 Hour wall for up to 15'; and the chase wall up to 18'. These height limitations were based on a deflection of L/240 (1/2" for a 10' high wall) under a uniform load of 5 lbs. per square foot.

We have not gotten into a test race with USG and National who have much more data, particularly on wind load tests. Our testing has been selective however, and feel that we have the critical data necessary to properly promote the shaft wall system. It will undoubtedly be desirable to do some future testing, as justified by marketing.

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.

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PATENT AND LICENSING SECTION

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SGP 0014517

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.

) Round Edge Wallboard

After the rejection of all claims by the patent examiner the claims were narrowed to only include the curvature limits we are specifying. The examiner has now refused to allow even the narrow claims on the basis that our disclosure is obvious. An appeal has been recommended by Synnestvedt. Inasmuch as our volume of round edge board is substantial, we will probably decide to proceed with the appeal.

GENERAL AND MISCELLANEOUS PROJECTS

Gypsum Association and ASTM

We participated in the round robin test series to investigate performance standards for gypsum wallboard. The current testing is primarily to evaluate test methods. The objective is to improve the ASTM standard for gypsum wallboard and to substitute performance criteria for weight limitations.

We prepared an application specification for fire fighter gypsum board which will be reviewed at the next meeting of ASTM.

Ray Hinkel participated in a shaft wall seminar conducted by the Gypsum Association for the International Association of Wall and Ceiling Contractors.

Other important activities of the industry involve testing and specifications of gypsum wallboard for modular construction and liason with HUD on the lead base paint problem, and construction standards for the housing being developed under operation break-through.

Electron Microscope

At no cost to us, Elektros Corporation in nearby Metzger demonstrated the scanning electron microscope and took some photographs of the interface between the wallboard paper and the gypsum core. A full investigation of the area between the paper and the core might reveal something that could lead to cost savings or fewer bond problems or both. At the very least we would learn more about something which is very basic to us, but which we know very little about.