

**PLAINTIFF'S
EXHIBIT**

GP-290

**SIX MONTHS REPORT
PRODUCT DEVELOPMENT &
TECHNICAL SERVICE DEPARTMENT**

June thru December 1975

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SIX MONTHS SUMMARY

New products developed during the last five years contributed \$1,759,866 in net sales and \$254,448 in gross profits to the Division in the last half of 1975. The primary new product developments carried over from the last reporting period are asbestos free ready mix, firedoor cores and Sentinel wallboard. Market testing of asbestos free ready mix is underway to prepare for the probable eventual necessity to eliminate asbestos from all products. A fire retardant hemlock was successfully tested with our firedoor core eliminating the profiling of the edges and hopefully will increase acceptance of the core. A 4 mil instead of 1.6 mil Sentinel paper will be used in order to facilitate the lamination. The U.L. flamespread test for the 4 mil Sentinel wood grain paper resulted in retaining the rating of 20, so all obstacles to the successful marketing of Sentinel appear to have been removed.

Major plant projects include the asbestos shortage, the airborne asbestos monitoring program and the assistance in the evaluation of the lignosite/landplaster accelerator system. Strange as it may seem, asbestos, a raw material we are trying to eliminate, has been in short supply. However, by juggling formulas and shipments, our requirements were satisfied. Recent plant surveys of airborne asbestos fiber show lower concentrations, probably due to improved handling procedures, better housekeeping and reduced usages of asbestos. Even so, we will still be marginal insofar as meeting the OSHA limits which go into effect July, 1976 and will definitely not meet the new lower limit which has been proposed. In the process of evaluating National Gypsum's patented accelerator system consisting of starch and landplaster, Western Operations found that a mixture of lignosite and landplaster worked even better. This accelerator system looks like it will permit substantial savings and improve the board products at the same time.

The major sales project was the fire and structural testing of the I-Stud shaft wall. We narrowly missed the two-hour fire rating from one side, which clouds the picture, but it may still be possible to obtain code approvals on the basis of the overall performance of the wall in the tests.

Our participation in the Gypsum Association has increased somewhat because of taking a turn in assuming some of the responsibilities. We plan to propose that the Gypsum Association gather sales statistics on joint compounds just as they do on wallboard products. This would give us a better handle on our market penetration as well as providing information for any future expansion that might be contemplated.

There are activities on three patents. A patent on an improved method of core waterproofing will issue shortly. An application on the firedoor composition has just been filed and an application covering the lignosite/landplaster accelerator system is being prepared.

As usual, our activities have been guided by the requirements of Manufacturing and Sales. The details of these activities follow.

SIX MONTHS SALES & PROFITS FROM NEW
PRODUCTS DEVELOPED WITHIN THE PAST FIVE YEARS

<u>Product</u>	<u>List Sales</u>	<u>Gross Profit</u>
Pre-Dec Wallboard (all)	\$1,137,970	\$ 118,238
Sentinel Wallboard (all)	27,679	2,045
Firedoor Cores (Tigard)	45,331	13,363
Asbestos Free Topping, (Acme & Chicago)	73,563	11,679
Asbestos Free Bedding (Acme & Chicago)	6,003	1,372
Asbestos Free All Purpose (Acme & Chicago)	2,200	282
Asbestos Free Triple Duty (Acme & Chicago)	124,443	23,830
Modified Casein Topping (Akron)	196,005	52,166
Modified Casein Bedding (Akron)	62,381	14,189
Asbestos Free Ready Mix (Akron)	9,437	957
Polystyrene Texture	23,938	5,888
Asbestos Free Speed Set (Blue Rapids)	50,916	10,439
Totals	\$1,759,866	\$ 254,448

NEW PRODUCT DEVELOPMENT SECTION

There are two more fire tests that could help the sales of our firedoor cores. One is for a 1½-hour rating. Currently, all the door manufacturers must specify U.S. Plywood or Weyerhaeuser 1½-hour doors. This is somewhat of a deterrent in selling one-hour doors with our core. The other test which might be helpful is an Underwriters' test. We have submitted an application for a U.L. test, but are delaying until we get the wood edge banding situation under control and have determined whether BOCA and Southern Building Code will approve Warnock-Hersey tests and label service.

2. Sentinel Wallboard

The Sentinel program had taken some different directions to investigate printing wood grain on wallboard paper and trying a 4 mil paper instead of the 1.6 mil. We found that printing the wallboard paper introduced new problems and costs, but the 4 mil. Sentinel paper was easier to laminate and worth the small additional cost. Another flamespread test was required which changed the rating from 20-10-0 to 20-15-0. There should be no further obstacles to proceeding with an all out effort to market the Sentinel board. In addition to Fort Dodge; Wilmington, Sigurd and Brunswick are potential manufacturing sites for Sentinel.

3. Boric Acid Stable Ready Mix

Ready Mix acceptability, especially in the market served by Chicago, has been less than satisfactory. The complaints were primarily short working or lumping. After many months of frustration, George Fowler and Bill Gettel in the course of a competitive survey found that our ready mix was reacting with wallboards containing boric acid. Even though boric acid is used in the core of the board, it migrates through to the surface of the face paper and subsequently reacts with joint compounds containing such raw materials as polyvinyl alcohol. Boric acid has been used in the core of wallboard for some time, but we think the use of thinner wallboard paper, increased usage of boric acid due to lighter weight wallboard, increased usage of polyvinyl alcohol and use of higher molecular weight polyvinyl alcohol have all contributed to bring the problem to its present level of severity. We also believe it may have been responsible for the inconsistent acceptance of ready mix manufactured at Chicago and probably has caused us to lose sales in other markets as well. Once the problem was recognized, an all out effort was made resulting in a formula which is stable to boric acid, has improved working properties, does not have as good low temperature bonding and costs approximately the same as the previous product, although this varies from plant to plant. We are working closely with all concerned to effect an orderly transition. We will also be looking for improvements and cost savings opportunities with these formulas.

4. Asbestos Free Ready Mix

Several different substitutes for asbestos have been tried, but none have imparted the same properties provided by asbestos. A combination of an

acrylic thickener and attagel clay seems to do the job. In the first field trials the boric acid problem came up and it was necessary to re-formulate the asbestos free product so it was not susceptible to this contamination. Subsequent trials were successful and now a boric acid stable asbestos free ready mix is being market tested in the area served by the Akron plant.

Progress is being made toward an asbestos free gypsum ready mix for Acme as well. This is being formulated along the same lines as the Akron asbestos free and we hope to be ready to conduct field tests in January or February.

MANUFACTURING SERVICES SECTION

MANUFACTURING SERVICES

1. Wallboard Survey

A second wallboard survey was made to evaluate the effect of the recommendations made in the first survey and to make another check on how we stand quality-wise in the markets we serve. There were some improvements, but overall the results were somewhat disappointing in that our previous recommendations on caliper were not totally followed. In addition to generally recommending caliper control and more attention to end grinding, specific suggestions were made to each plant.

High complaint costs seem to indicate that periodic surveys should continue to be made. Another survey is planned for this spring to allow enough time for the expected quality improvement from the lignosite/landplaster accelerator system.

2. Ready Mix Competitive Survey

About 20 different ready mix products were compared. Our products showed up quite well, in general, although there is some room for improvement in working characteristics as compared with U.S.G. ready mix. None of the competitive asbestos free products tested were very satisfactory so we seem to have the edge there.

The greatest value of the survey was the recognition of the boric acid problem. The so-called short working complaints were found to instead be due to an incompatibility of our ready mix with wallboards containing boric acid.

3. Chemical Division Asphalt/Wax Emulsion

A trial quantity of asphalt/wax emulsion prepared by the Decatur lab was tried at Brunswick during a run of tile backer board. The regular Flintkote emulsion performed better, but the Chemical Division's material contained less wax. When enough emulsion was used to compensate for the lower wax content, it performed comparable to the Flintkote emulsion. We understand the Chemical Division will install equipment to produce a larger quantity of emulsion for us to try.

4. Airborne Asbestos Survey Program

In January all joint system plants will have been monitored for the second time. Fiber counts at Akron, Chicago and Marietta are lower than the first time. This may reflect the lower usage of asbestos and better housekeeping in general. In spite of these efforts we received an OSHA citation at Marietta because one of the counts was obscured by too much dust and was not re-taken. The penalty was reduced after an informal hearing. This is

an example of over-zealous enforcement of OSHA regulations as the penalty never should have been assessed in the first place. However, it does show how vulnerable we would be if we hadn't started a monitoring program. The number of samples required and the tedious counting procedure is very time consuming. Hopefully some sampling can be eliminated for stations where the counts have been low.

The new regulation permitting only two fibers per cubic centimeter goes into effect next July. Our most vulnerable area is the mixing station. It is conceivable that further modifications can be made to reduce the counts below the two fibers/cc limit. The alternative is to eliminate asbestos from all products. We have only six months left to make that decision. Another even more restrictive OSHA proposal will limit individual fiber counts to 0.5 fibers/cc. If this is adopted, we can forget about any further equipment modifications and proceed with the elimination of asbestos.

5. Wallboard Accelerator

National Gypsum Co. contacted us to interest us in a license on a patent which they have for an improved accelerator accomplished by grinding starch with gypsum. They claim several advantages, but in particular, a reduction in the amount of landplaster accelerator and starch adhesive normally required. An investigation of National's patented process resulted in Western Operations discovering that a lignosite/landplaster combination ground together in our water cooled ball mills performed even better than National Gypsum's starch method.

A comprehensive investigation will be undertaken to try to determine the function of the lignosite and starch in making a more potent accelerator and to evaluate other additives that may improve accelerator efficiency. A small ball mill will be acquired in order to prepare lab samples and we will have also requested plant samples.

6. Asbestos Shortage

A strike of all the asbestos producers in Canada except J. M. caused a severe shortage of asbestos. Unfortunately we had not been previously purchasing from J. M. but fortunately we were using another grade of asbestos from Union Carbide (in the U.S.) for some of our requirements. We were able to re-formulate using a combination of the two, and a reduction in the overall requirement. This got us through the pinch period with very few interruptions in production.

7. Limestone Particle Analysis

At the request of Eastern Operations we made coulter counter determinations of several Pfizer limestone candidates for Akron. One grade from Pfizer's New Canaan deposit proved to be both satisfactory and economical. Savings in excess of \$30,000 per year are anticipated.

SALES SERVICES SECTION

Uniform load tests were conducted by Studco to evaluate wider and heavier guage I-Studs. Studco sponsored the testing, but we will be able to use the information in our promotional efforts.

2. Ready Mix Topping and Cover Coat for Chicago

A ready mix topping was field tested in Chicago but is still not completely satisfactory according to the comments. The preferred competitive topping is being submitted so we can make another try.

The development of a ready mix to compete with U.S.G.'s Cover Coat is progressing and we hope to be ready for a plant trial and field testing shortly after the first of the year.

3. Texture

An investigation of a complaint on coverage was found to be the result of too little expanded polystyrene in the product. Corrective measures have been discussed with the plant. In the course of this work it was found that our texture was darker in color than the original material, this was found to be due to darker quarry rock. The rock for joint system filler is being carefully selected to overcome the problem.

4. General

Numerous sales requests were handled such as furnishing data, sending test reports and preparing displays, or merely responding to questions.

SIX MONTHS REPORT
PRODUCT DEVELOPMENT &
TECHNICAL SERVICE DEPARTMENT

January thru June 1975

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SIX MONTHS SUMMARY

The list sales and gross profits from products developed at the Tigard Gypsum Lab during the past five years were \$1,632,636 and \$267,347 for the first six months of 1975. A breakdown of the products is on page 3.

The commercialization of the firedoor core was the dominant project during this period. Following the optimization of the formula a one-hour rating was obtained for a 4' x 8' door. In cooperation with Engineering and Manufacturing, a plant for producing the cores was established in Tigard, Oregon and in May the plant was turned over to Western Operations. This plant is currently furnishing cores to Vancouver Door Co. and will be capable of furnishing other door manufacturers as arranged by Sales. The firedoor project is being continued to obtain more test data and ratings to expand the marketability of the core and also to look for improvements and cost savings.

The adoption of a new adhesive system for ready mix is progressing and will save 10¢ to 12¢ per pail at every plant except Akron and also help our raw material procurement situation. All but one Canadian asbestos manufacturer is on strike, so a crash program is underway to reduce our usage of asbestos. Other joint system projects are the formulation of a non-asbestos ready mix and a ready mix with superior working properties.

A competitive wallboard survey was conducted with all gypsum board plants participating. The comparative test results indicated that some improvement in core hardness, taper depth and flexural strength were advisable. Changes were recommended which should make our products acceptable without any increase in cost. Another survey is planned in the next six month period which should reveal how effective the changes were.

We were negotiating with Certain-Teed Products Corporation with the idea of obtaining some development rights under a patent they have for producing gypsum fibers. A validity study turned up information which makes their patent very shaky. We have, therefore, abandoned negotiations with Certain-Teed. The importance of the fibers will be dependent upon proven uses for the fiber. Our interest declined when we found that there is some doubt that they would serve as a replacement for asbestos in ready mix.

There has been an increased interest in 5/16" gypsum board for mobile homes because of the possibility of HUD restricting interior surfacing materials used in mobile homes to products having low flamespread ratings. At the request of Sales, we conducted a series of tests to provide mobile

home manufacturers with some information concerning adhesives, fasteners and bracing. Pre-Dec and Sentinel Board are products that we envision selling to the mobile home industry.

All the projects under consideration are detailed in the body of this report.

SIX MONTHS SALES & PROFITS FROM NEW
PRODUCTS DEVELOPED WITHIN THE PAST FIVE YEARS

<u>Product</u>	<u>List Sales</u>	<u>Gross Profit</u>
Pre-Dec Wallboard (all)	\$ 841,666	\$ 71,236
Sentinel Wallboard	835	10
Firedoor Cores	7,488	2,004
*Vinyl Topping (non-asbestos)	53,553	11,037
*Vinyl Bedding (non-asbestos)	7,315	1,457
*Vinyl All Purpose (non-asbestos)	193,371	50,259
*Triple Duty (non-asbestos)	119,508	27,448
Modified Casein Topping	224,294	60,313
Modified Casein Bedding	68,254	15,512
Modified Casein All Purpose	96,505	24,353
Polystyrene Texture	19,847	3,718
Totals	\$1,632,636	\$ 267,347

*Non-asbestos vinyls sold by Acme and Chicago. Some asbestos products at Acme couldn't be broken out. Does not include interplant shipments of non-asbestos products.

PRODUCT DEVELOPMENT SECTION

2. Sentinel Wallboard

The striped woodgrain paper manufactured by Orchard and laminated to 5/16" wallboard has been revived in view of HUD's proposed new flamespread requirements. Western Operations has arranged to have some wallboard paper printed and run on the wallboard machine at Fort Dodge. Some further trials will be made since this would probably be more economical than laminating a separate paper to the board. One drawback of the printed wallboard paper is that a durable and washable clear coating would probably have to be applied.

3. New Ready Mix

An adhesive system consisting of 1.0% Gelvatol 6000 or Air Products 523S and 2% Elvace emulsion has been undergoing market testing. Chicago and Acme have adopted the formula and Marietta and Milford have market tests in progress. In addition to the 10¢ per pail cost savings, our usage of emulsion will be diminished, putting us in a better position in the event of future shortages. Also, two interchangeable PVA sources will make us more flexible. Ancillary advantages are that the emulsion can be added faster, therefore helping increase production and fewer cars of emulsion will be required, so there should be less labor in unloading cars. The market testing so far shows that the product is improved with respect to crack resistance, bond and workability.

4. Ready Mix Topping

The new formula topping developed for Acme, and with their help has received good acceptance. Sales of ready mix topping increased 700% over the same period a year ago.

5. Non-Asbestos Joint Compounds

The non-asbestos vinyl joint compounds being furnished from Chicago were not receiving very widespread acceptance, so another formula was conceived using starch in combination with the vinyl alcohol. This increased the water carrying capacity, made the non-asbestos vinyl more like a casein product and now it is receiving better acceptability. All of Chicago's production has been converted to the starch-vinyl formula.

The effort to come up with a non-asbestos ready mix has been more difficult, but this has been given a high priority in view of the increasing demand for asbestos-free products.

6. Gypsum Fibers

Most of our effort has been to find applications for the fiber and to assist in the validity study with Schuyler, Birch, Swindler, McKie & Beckett. Trials of the fibers in metal casting have been reported to be very successful. A field trial of the fibers in wall texture has also

been favorably reported on. Not much has been done with the fibers in joint compounds because of the priority of other projects and the lack of incentive due to the fibers not being commercially available. There is considerable doubt that the fibers are stable enough to use in ready mix and this is another minus factor.

There are many possible uses, such as in spray fireproofing and flocking for Christmas trees, so there still could be some good potential volume for the fibers. The next step should be a pilot plant to produce a sufficient quantity of the fibers to evaluate other uses and to determine costs of producing the fibers.

MANUFACTURING SERVICES SECTION

e) Field Service - Joe Watt has been doing considerable field work for Western Operations. Some has been in conjunction with the sales of 5/16" board to Champion Homes in Weisser, Idaho and the rest to assist with various customer complaints and problems.

2. Joint System

a) Airborne asbestos fiber measurements - A procedure was established for measuring airborne asbestos fiber. This method involves sampling through pumps worn by plant personnel. The air is pumped through a filter at a given rate so that the volume of air filtered is known. The number of fibers on the filter are counted by the phase microscope method and a computation made of the fiber content per cubic centimeter of air. The current OSHA regulation calls for a minimum of 5 fibers per cubic centimeter. This will change to 2 fibers per cubic centimeter in 1976.

Thus far, Akron, Chicago, Milford and Marietta have been monitored. Acme will be measured shortly. All measurements taken were less than the 5 fiber/cubic centimeter OSHA limitation. However, some measurements taken of the man who adds the raw materials have exceeded the eventual limit of 2 fibers per cubic centimeter. Where the measurements exceed the OSHA limits, dust masks are essential. Test reports from each plant will be on file in the Operations Office, at the respective plant, Mr. Hurd's office and the Tigard Lab. OSHA requires that these measurements be made at each plant every six months. Having this done on the outside would have cost about \$2,000 per year per plant, or a total \$10,000 annually.

b) Grit problem - A recurrence of the grit problem necessitated removal of Calgon T from our ready mix formula. The Calgon precipitates magnesium ions which congregate to form grit particles. There was some concern that this would adversely affect product acceptance, but the removal of the Calgon took place without any reaction.

c) Cracking problem - A revision in the formula at Milford was found necessary to improve the crack resistance. This formula contains more mica, less asbestos and less emulsion. A recent survey of the Baltimore-Washington market indicates that the new formula has overcome the cracking problem.

d) Asbestos shortage - All the Canadian asbestos suppliers except Johns-Manville are on strike, including our major supplier, Phillip Carey. We purchase asbestos from Union Carbide in the U.S., but they are currently oversold as well. A different type of asbestos (7RF02) is being purchased from J-M. A reduced quantity of 7RF02 asbestos is being used without affecting the acceptance of our products. The problem is that not enough total asbestos from Johns-Manville and Union Carbide is available for our needs. All the plant asbestos inventories are low and we are facing interruptions in our production schedules. A reduced asbestos formula is under development to stretch our inventories and prevent any loss of production.

e) Preservatives - After finding and testing a non-mercurial preservative, we find that the manufacturer (Olin Chemical) doesn't have it listed with the EPA. Apparently our potential use would not be sufficient justification for them to do so. Another non-mercurial called Cosan is under investigation.

3. Analyses

About 15 to 20 gypsum analyses are conducted each month. The samples submitted have included plant rock specimens, competitive samples and potassium sulphate (for salt content).

SIX MONTHS REPORT
PRODUCT DEVELOPMENT &
TECHNICAL SERVICE DEPARTMENT

July thru December 1974

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SIX MONTHS SUMMARY

The net sales and gross profits from new products developed during the past five years were \$1,083,491 and \$205,859 for the last six months of 1974. The figures for individual products are shown on page 3.

Recent developments have caused us to emphasize certain projects in the last half of 1974. One of these events was the successful one-hour firedoor test at Warnock Hersey, Ltd. Processing equipment was assembled to be certain that full-scale firedoor cores could be produced and to decide whether these cores would be suitable for making firedoors. Also, a survey was made to estimate the market potential for firedoor cores. It looks like we can manufacture an acceptable firedoor core and the market picture and profit potential are good, so plans were made for a small manufacturing plant.

Another development which affected priorities was the increase in the cost of casein joint compounds. At Chicago we replaced casein products with a line of vinyl joint compounds and at Akron we adopted a combination casein/starch formula. These changes substantially improve the profitability of the products involved at both locations.

Still another influence on project emphasis grew out of the OSHA restrictions on the use of asbestos fiber. These regulations make it desirable to eliminate asbestos from as many products as possible. The vinyl joint compounds currently being manufactured at Chicago are asbestos free. This leaves only the casein products manufactured at Akron and all Ready Mix still containing asbestos fiber. However, our textures and some industrial plaster products contain talc which may fall under the same restrictions as asbestos fiber. Concurrent with this effort, we are purchasing equipment to make measurements of airborne asbestos and talc. In order to comply with OSHA regulations, it would have cost more than \$10,000 annually to monitor airborne asbestos fiber at each plant as required by OSHA. It will cost a fraction of that to make our own measurements.

Evaluation of patent #3,822,340 covering gypsum fiber crystals by Western Operations has stirred some interest in potential uses for gypsum fibers. We will be looking into this further and possibly make some cooperative arrangement with Franklin Key (owned by Certain-Teed Products) who is the holder of the patent.

Gypsum paneling, or Sentinel board as it is called, was manufactured on a limited basis at Fort Dodge. This 5/16" thick gypsum board with 1.5 mil striped woodgrain paper overlay is to be sold to the mobile home market. A flamespread rating of 20 and a structural rating have been obtained. Additional equipment is needed to handle and guide the thin paper overlay, but this expenditure has been postponed pending the determination of a sufficient market for the product.

Two personnel changes were made since last summer. Joe Watt has assumed the field service responsibility for Western Operations in addition to continuing his Divisional technical service activities for our department. Kermit McCarthy completed his training in Tigard and has transferred to Fort Dodge as Quality Supervisor. The recruiting and training program has been discontinued, at least for the time being.

SIX MONTHS SALES & PROFITS FROM NEW
PRODUCTS DEVELOPED WITHIN THE PAST FIVE YEARS

<u>Product</u>	<u>List Sales</u>	<u>Gross Profit</u>
Pre-Dec Wallboard (all)	\$ 840,019	\$149,532
Sentinel Wallboard	9,519	(5)
Polystyrene Texture	16,416	4,030
Vinyl Topping (non-asbestos)	27,668	5,505
Vinyl Bedding (non-asbestos)	5,619	1,368
+Vinyl Triple Duty (non-asbestos)	14,785	(64)
Vinyl All Purpose (non-asbestos)	1,865	73
*New Casein Topping	93,500	28,500
*New Casein Bedding	35,800	7,270
*New Casein All Purpose	<u>38,300</u>	<u>9,650</u>
	\$1,083,491	\$205,859

+Includes non-profitable old formula containing asbestos which could not be broken out.

*Estimates based on Akron production figures. Profits are conservative because of combining results with old casein formula which was less profitable.

PRODUCT DEVELOPMENT SECTION

2. Non-asbestos Joint Compounds

a) Bag products - After several months of furnishing non-asbestos vinyls manufactured at Marietta to the Chicago market, it was decided to phase out casein at Chicago and manufacture the asbestos-free vinyls there. It is too early to assess the impact of this transition, but there was no future economically in continuing to market casein joint compounds.

b) Ready Mix - Field testing of a non-asbestos Ready Mix is underway in the Rochester, New York, market and the initial report was favorable. A disadvantage of the non-asbestos formula is that it has a higher raw material cost of about \$.12 per pail.

3. Modified Casein Joint Compounds

Combination casein/starch formulas were developed in order to counteract the substantial increase in the cost of casein. The field testing and eventual transition at the Akron plant proceeded almost without comment. Raw material savings are \$.34 per 25-pound bag. We chose this approach at Akron to use our commitment for casein and also as an alternative to the non-asbestos vinyls we are producing at Chicago. It is conceivable that some customers will wish to continue using casein and others will change to vinyl, so we are prepared to satisfy both with interplant shipments. It is not practical to manufacture both products at the same plant because of contamination.

4. Woodgrain Paper Laminate (Sentinel Board)

Fort Dodge laminated enough of the striped grainboard paper from Orchard to establish that some additional equipment is necessary to improve the percent perfects. At the present time the market is being studied to be sure the investment in equipment can be justified.

A U.L. flamespread rating of 20-10-0 and a structural or racking resistance of 115 lbs./lin. ft. were obtained through testing of the Sentinel board. Arrangements have been made to certify these results by printing the U.L. flamespread and General Testing structural ratings on the product.

5. Ready Mix Topping

A Ready Mix that has good working properties and easy sanding is under development. We have been furnishing a product from Acme and

have made some limited shipments from Milford, but further refinements are in progress.

6. Carbon Fibers

We requested samples of the continuous carbon fibers being produced by Union Carbide. Presently these applications are restricted to exotic applications, such as golf club shafts, but economies in the manufacture of the carbon filaments are expected to make other uses practical. Since carbon fiber has a 3000°F melting point, they have an obvious possibility as a fire resistant reinforcing for gypsum board. The carbon fibers cut and dispersed well, although they were softer than the glass fibers we use. However, the fibers are very slippery and tend to pull out of the calcined gypsum during the fire exposure, thereby limiting their value as a reinforcing. Another possibility we will look at is a mixture of glass and carbon fibers, but at this time the carbon fibers seem to have questionable value.

MANUFACTURING SERVICES SECTION

MANUFACTURING SERVICES

1. Wallboard

a) 1/2" Type X Firestop - After completing the laboratory investigation, we contacted Underwriters to determine what kind of test program would be necessary. U.L. requires so many tests that the program is much more expensive than we had anticipated (over \$20,000). On the basis of the high cost of the test program outlined by U.L. and also the difficulty in passing some of the tests, we will not pursue the project at this time.

b) Wallboard core strength - Compressive strength tests were conducted on cubes cast from the board slurry and sent to Tigard from each plant. The only conclusion drawn was that all the values were lower than they were several years ago and that any further decrease in core strength might be detrimental. Fort Dodge has found that a finer Raymond mill grind improved their strength and bonding properties, but the loss of production to achieve the finer grind cannot be justified. Other means for grinding finer are under consideration.

c) Pre-Dec at Sigurd - The possibility of manufacturing Pre-Dec at Sigurd using an extra roller coater from Acme to apply the paint and the board kiln for the drying are under investigation. The object is to use the board machine equipment to manufacture Pre-Dec on the weekends when it is idle.

d) By-product gypsum - Samples of by-product gypsum from DuPont at Richmond, Virginia, and American Cyanamid at Savannah, Georgia, were examined. Both materials appear to be suitable for use in the manufacture of wallboard. Our interest in by-product gypsum at these locations is nil, so we will not engage in any further investigation.

2. Joint Compounds

a) Emulsion for Ready Mix - Purchasing was able to obtain enough Elvace emulsion from DuPont for Akron and Marietta in addition to Milford and Chicago, who converted to Elvace earlier in the year. Replacing Reichold's polyvinyl acetate emulsion with Elvace saves \$.11 per pail, so far more savings are being realized than was originally projected.

b) Cracking problem - The most serious joint compound problem has been excessive cracking in Ready Mix. A reduction in the mixer speed (to reduce air entrapment) and a slight formula revision was

effective at Chicago, but not at Milford and Marietta. Akron, for some reason, has not had the cracking problem. A major formula revision may be necessary at Milford because of the severity of the problem there.

c) Spoilage and preservatives - During the end of the summer, a rash of Ready Mix spoilage problems occurred. The combination of warm weather, inadequate cleanup procedures at the plants and marginal preservative levels were responsible. We have recommended a more thorough inspection and cleanup of the mixers and emulsion tanks, and have increased the level of preservative protection at Acme where the problem was most acute.

Evaluations of sodium omadine preservative were favorable and additional testing is underway. The objective is to eliminate the mercurial preservatives without sacrificing protection against bacterial contamination.

d) Packaging of Ready Mix - The plastic bag proved unsuccessful, so attention was devoted to means for reducing the cost of Ready Mix in four-gallon cartons. Much of the hand labor of forming boxes and stapling can be eliminated by a machine manufactured by 3-M. It has been recommended that this equipment, which forms and tapes the carton, be purchased for Acme.

e) Measurement of airborne asbestos fibers - George Green took a course offered by the National Institute of Health to learn the procedures and equipment which are necessary to take air samples and measure the fiber concentration. OSHA standards permit five fibers per cubic centimeter and require plants using asbestos to make measurements every six months. Having this done by an outside laboratory would cost \$1,000 for each measurement. We are setting up to make the determinations ourselves in order to comply with OSHA but minimize the expenses in doing so. A phase microscope was purchased for making the fiber counts and the air sampling equipment has been ordered from Mine Safety Appliances. We expect to have all the equipment and begin making measurements at the plants shortly after the first of the year. However, M.S.A. has failed to meet three promise dates thus far.

3. Gypsum Analyses

Elaine Zulauf has been making an average of about twenty analyses per month. Most of the samples come from Akron where the purity is marginal and Grand Rapids where there has been a high concentration of salt.

3. Sweets Catalog Literature

A thorough review of the Sweets literature was made to bring it up to date and make it technically accurate.

4. U.L. Approval

We have received Underwriters' approval to use a laminated panel (two layers of 1/2" Firestop) instead of 1" core board in our T-stud shaft wall system.

5. Field Service - Joint Compounds

George Fowler has spent considerable time in the Chicago and Baltimore/Washington D.C. markets. In the case of Chicago, we were distributing the non-asbestos vinyl compounds and gathering comments as a preliminary to the change from casein to vinyls. The opportunity was also taken to acquire competitive products and to sample Ready Mix and Speed Set among prospective customers. In Baltimore and Washington D.C. the objective was to overcome adverse comments on our Ready Mix by field testing various improved formulas. We have also been field testing a Ready Mix topping there.

PRODUCT DEVELOPMENT & TECHNICAL SERVICE
SIX MONTHS REPORT

January thru June 1974

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SIX MONTH REPORT SUMMARY

New products developed in the past five years generated \$1,418,382 sales and \$293,833 profits for the first half of 1974. Cost savings achieved during the first six months are estimated at \$233,000 annually based on the sales for the first half. The individual new products and savings are listed on page 3.

There has been progress on a number of products under development. The latest firedoors are ready for testing at Underwriters in Canada. A non-asbestos dry joint compound is being market tested in Chicago and a recently formulated non-asbestos ready mix looks promising on the basis of preliminary laboratory testing. Elimination of asbestos continues to be a high priority project due to severe manufacturing restrictions involved in using this raw material. Trial runs of a laminated woodgrain paper with printed grooves have been made. This product has been requested by the Distribution Division to fill the need for a low cost non-combustible panel for mobile homes. In an effort to retain casein as an economical joint system binder, a combination casein/starch formula is being market tested. If successful, the formula could be marketed economically at the highest projected price for casein.

The major plant service was the elimination of vermiculite from our 5/8" Type X Firestop. In addition to the cost savings, vermiculite is in short supply so it prevents procurement problems. Now we are attempting to reduce our raw material costs of 1/2" Firestop. Other services performed were assistance with the new flatcar loading procedures, purity analyses of gypsum deposits and core drillings, investigation of Dens-Cote radiant heat ceiling and joint system, relocation of the Speed Set manufacture, and an investigation of a new ready mix container.

Services to Sales included the development of a more economical shaft wall system, a competitive texture survey, field service on joint system products, a structural label for predecorated wall panels, and the comparison of the wear life of U.S.G.'s and our pottery plaster.

During the six months, trainee Howard Schutte was transferred from Tigard to Acme as joint system quality supervisor and Kermit McCarthy was hired as a trainee for the plant organization. We also recruited and hired Dan Harmon for Eastern Operations and he was sent to Brunswick for training.

SIX MONTHS SALES & PROFITS FROM NEW PRODUCTS
DEVELOPED WITHIN THE PAST FIVE YEARS

<u>Unit</u>	<u>Product</u>	<u>Sales Volume</u>	<u>List Sales Amount</u>	<u>Gross Profit Amount</u>
MSF	Pre-Dec Wallboard (All)	22,984	\$1,329,751	\$ 279,839
MSF	Shaft-Liner Panels	253	5,632	1,020
MLF	Metal T Splines	75	17,734	1,508
MLF	L-Runners & J-Channels	10	1,208	(148)
BGS	Polystyrene Texture	18,438	59,712	10,109
BGS	Vinyl Topping	2,348	<u>4,345</u>	<u>1,505</u>
	Total		\$1,418,382	\$ 293,833

*ESTIMATED ANNUAL COST SAVINGS
GENERATED IN THE PAST SIX MONTHS

1.	5/8" Firestop vermiculite elimination	\$113,000
2.	Reduction in polyvinyl acetate at Akron, Chicago, Marietta and Milford	31,000
3.	Reduction in polyvinyl alcohol content at Akron, Chicago, Marietta and Milford	66,000
4.	Use of Elvace at Chicago and Milford	<u>23,000</u>
	Total	\$233,000

*Based on first six months sales in 1974

PRODUCT DEVELOPMENT SECTION

PRODUCT DEVELOPMENT

1. Firedoors

The test doors fabricated at Walled Lake Door Company have been at Underwriter's for several months. U.L. has problems with their wall furnace at Northbrook which they led us to believe would be solved within a short time. Months passed during which we contacted them at least once each week. Finally it was decided to ship the doors to Canada. Following that decision, it took another month to get U.L. to ship the doors and now we are waiting for confirmation that they have arrived at U.L. in Canada.

2. Non-asbestos Joint Compounds

a) Bag products - Based on Acme's experience with non-asbestos vinyl bedding, topping and All Purpose, similar products were developed using limestone as the basic filler. In order to prevent contamination with casein products, the non-asbestos vinyls are being manufactured in Marietta and shipped to Chicago. The trials were favorable, so a truckload of the non-asbestos vinyls was shipped followed by two carloads. This should provide enough experience to determine whether these products will be acceptable.

b) Ready Mix - The development of an asbestos-free ready mix has progressed more slowly. A stable viscosity without asbestos is difficult to achieve, but a recent formula developed by Bill Gettel looks encouraging. We are continuing to pursue it on a high priority basis.

3. Replacement for Casein

Casein at the current price of 80¢ per pound would make bedding, topping and All Purpose formulas uneconomical. In other words, they would have to be priced too high to be competitive. One possibility is to phase out casein products entirely and replace them with vinyls. However, the vinyls are not completely proven and, even if they were, there isn't enough vinyl adhesive available. If a replacement or extender for casein could be found, it would give us another alternative.

A formula in which 75% of the casein was replaced by a modified starch seemed to be satisfactory. The starch is one that we have used as an adhesive in the past for joint systems and texture products. About 600 bags were manufactured at Akron and shipped to the Rochester and Wilmington branches. If this product is acceptable, we can continue to profitably furnish a casein formula even if the price of casein reaches \$1 per pound.

absorbs 6% to 7%; so this somewhat negates the advantage gained by the use of the PVA. There are two factors which seem to affect the absorbency of the paper. One is the absorbent bond liner of our paper and the other is the wetting type foams we use.

In order for all plants to use the PVA/asphalt-wax system, it would be necessary to have equipment to solubilize the PVA and meter it into the mixer. Sigurd has a steam generator and some tanks to do this, so we have suggested they use the PVA/AWE system in all their water resistant boards. In addition, some silicone treated paper and rosin size (non-wetting type) foam has been sent to Sigurd to try to overcome the paper absorbency.

DuPont has advised us that there is no polyvinyl alcohol of the type we have been experimenting with available at this time. However, we are inclined to continue the project so the work will be finished whenever the alcohol supply loosens up.

7. Talc Formula Ready Mix

A ready mix formula containing a substantial amount of talc was developed to meet the requirements of the Houston, Texas, market. Even though the formula was well received, only limited quantities have been sold in Houston. Shipments of the formula into other markets have fared better and repeat shipments are being made in several instances. The limestone version of the talc formula has been tried in Atlanta; Georgia; Raleigh, North Carolina; and Grand Rapids, Michigan; apparently with success but without much feedback. For some reason the talc formula has less crack resistance than the regular, so this would have to be rectified. Because of involvement in Elvace emulsion, reduced polyvinyl alcohol, asbestos elimination, and other projects, the talc formula has been allowed to languish. As soon as some other things are taken care of, the talc formula will be reassessed. It is a problem for a plant to have two ready mix fillers to contend with, so we want to select the best one.

MANUFACTURING SERVICES SECTION

e) U.L. follow-up service - The investigation of a new procedure involving more scrutiny on our part and less from U.L. is being handled by Eastern Operations. Thus far, there has not been agreement on the details of the new procedure.

2. Pre-Dec

Brunswick has been using two coaters to obtain a uniform texture pattern. Don Klus made a plant investigation and noticed the doctor roll was out of round. A new doctor roll was prepared and installed. Brunswick is now back to making a uniform pattern with one coater roll.

3. Joint System

a) Quality problems - Almost as soon as the grit problem in ready mix was solved, we were faced with complaints of high shrinkage and inferior working properties. It had been determined that the combination of Dowicil preservative and Calgon dispersant reacted to form grit particles. In view of the shrinkage complaints, Calgon was put back into the formula. This has resolved the shrinkage complaints without causing a recurrence of the grit.

Excessive cracking in ready mix at Akron, Chicago, and Milford suddenly became a quality problem. This was finally traced to our switch to Reichold polyvinyl acetate resin when DuPont discontinued the manufacture of polyvinyl acetate. The problem was traced to the fact that Reichold emulsion contained only 4% Dibutyl Phthalate whereas the DuPont emulsion had 8%. We requested that Reichold increase the Dibutyl Phthalate plasticizer to 8% and this seems to have corrected the problem. As a quick measure to improve the cracking, we had increased the mica and reduced the asbestos; but these ingredients are now back to their normal levels.

b) Raw material shortages - We are on an allotment basis in our purchases of polyvinyl acetate and polyvinyl alcohol. DuPont's exit from the homopolymer vinyl acetate market put us in a position of buying from Reichold exclusively. We had been evaluating a copolymer emulsion called Elvace and, after field and market testing, converted Milford and Chicago. Initially this saved 15¢ per pail, but recent increases in the price of Elvace make the current savings 11¢ per pail.

Even more critical is the short supply of polyvinyl alcohol which we use in ready mix and dry vinyl products. Some investigation was done on a summer formula ready mix having 50% less polyvinyl alcohol. Market testing of this formula was started immediately. There was no unfavorable reaction (in fact, the working properties were probably improved), so we now have all plants using the reduced polyvinyl alcohol formula. This will keep our ready mix operation going and also free up some alcohol for use in the dry vinyl products.

c) Speed Set - The location of Speed Set manufacturing was moved from Acme to Blue Rapids. We simultaneously introduced a new Speed Set formula which was developed by Howard Schutte when he was in training at Tigard. The new formula is substantially improved in mixing and working properties. The relocation to Blue Rapids will result in lower costs and should improve our service to the other plants. Also, Blue Rapids' larger size blending equipment and the readily available Denscal should permit better response to orders.

d) Plastic bags for ready mix - The cost of filling four-gallon cartons and the skyrocketing cost of metal pails has caused more emphasis to be put on the plastic bags. One thousand 6-mil printed plastic bags were purchased. An adhesive has been found that will tie the bags together during shipment so the problem of the bags sliding around has been solved. Now what we need is to determine the market acceptance of the bag material. The projected cost per bag is 30¢, and the filling cost with the proper equipment should be no more expensive than filling pails and significantly less than the cost of filling four-gallon boxes.

e) Continuous viscosity equipment - The continuous viscosity recorders have been installed at three plants. Thus far only Milford is using the equipment to good advantage.

f) Field service - George Fowler has been establishing contacts with customers in the markets serviced by Chicago, Milford, and Marietta. He has concentrated on Chicago recently because of the testing of a non-asbestos vinyl and because Chicago needs more business. He has also responded to field problems in Baltimore, Maryland; Raleigh, North Carolina; and Lexington, Kentucky. George also coordinated the relocation of Speed Set manufacturing and has arranged numerous plant trials at Marietta and field trials in the Atlanta market.

g) Non-mercurial preservative - The restrictions on the use of mercurial preservatives make the elimination of mercurials a worthwhile undertaking. At Chicago we cannot use mercurials at all because our wash-up water goes directly into the municipal sewage system. The Dowicil preservative is not as effective as we would like, so a search was made for a more effective non-mercurial preservative. Out of about 25 candidates, two were found to be worthy of plant trials which will be made at Akron and Milford.

4. Analyses

It has been necessary to conduct analyses two days some weeks in order to handle the number of samples submitted. We have had extra samples from Grand Rapids where they have encountered high concentrations of salt recently. In addition to the regular analyses Fort Dodge core drillings, competitive products and by-product gypsum samples were submitted.

MARKETING SERVICES SECTION

MARKETING SERVICES

1. Shaft Wall System

A new shaft wall system has been devised by Ray Hinkel at the request of Sales to compete with other systems which are less expensive to install than our shaft wall. Since our T-stud wall was developed, U.S.G., Flintkote and Kaiser have come out with cavity walls with a single stud and utilizing 1" wallboard as opposed to the 1-5/8" gypsum panels in the G-P shaft walls. The new method involves an I-stud with tabs punched out of the web to engage 1" panels. The finish side would be faced with two layers of 5/8" Firestop. This system should be fully competitive and may even have some advantages over the other systems. Indications are that we can pass the two-hour fire test at the University of California. This is where U.S.G. and Kaiser have tested their new shaft walls.

Because of the investment required for testing and dies for the new system, it has been decided to proceed with structural tests only at this time. We have purchased hand formed I-studs for this purpose. Enough studs were purchased for the fire tests as well in the event that we decide to proceed.

2. Texture Survey

A comparison was made of our texture products with that of several other manufacturers. Our textures (both wall and ceiling) ranked high in spraying properties, whiteness and bond but some competitive textures have better hiding properties than ours. This is something we will investigate. Our textures were the only ones that were asbestos free. We have probably not taken advantage of this.

3. Structural Labeling for Predecorated Wallboard

We had previously conducted shear tests on ceiling (truss roof) sections using Pre-Dec and established a U.L. label to be used in combination with the U.L. flamespread label. Certain states require structural ratings for walls, so Sales requested a similar label for 1/4" and 5/16" wallboard that is decorated with a Pre-Dec coating, a printed pattern, or a laminated film for use on partitions. After contacting U.L., it was evident that it would require many months in order to conduct the tests and attain the ratings. It was decided to have General Testing Inc., who are local, witness the racking tests and provide a labeling service. The tests were completed and now three plants are equipped to label 5/16" wallboards certifying a racking resistance of 115 pounds

PRODUCT DEVELOPMENT &
TECHNICAL SERVICES DEPARTMENT

Six Month Report
July through December 1973

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SIX MONTH SUMMARY

The last half of 1973 was marked by raw material shortages which usually resulted in crash programs to find alternatives. In some cases, the alternatives proved advantageous costwise. All the projects resulting in cost savings were as follow:

	<u>Projected Annual Savings</u>
1. Replacing titanium dioxide in Pre-Dec	\$120,000
2. Using off-grade starch products (1973 only)	3,000
3. Eliminating rock washing at Grand Rapids	55,000
4. Revising Dens-Cote formula	26,500
5. Converting Buchanan to continuous calcination	33,700
6. Increasing calcining capacity at Wilmington	73,000
7. Lowering raw material costs for Acme's non-asbestos joint system products	<u>58,500</u>
	\$369,700

There are other savings such as the wallboard quality improvements at Fort Dodge, and the improved loading procedures at Blue Rapids that are difficult to put a figure on. We had hoped to complete the project to eliminate the vermiculite in 1973, but U.L. is insisting on another fire test. The potential savings is about \$125,000 per year.

New products developed within the past five years contributed \$1,010,148 to net sales and \$419,876 to gross profits of the Division for the six months. The texture formula revisions, completed in 1973, show continued improvement in sales and profits. The analysis of sales and profits of new products and figures for the textures are shown on page 3. The following product developments are under investigation at the present time:

1. Firedoor filler - The U.L. test of the new Firedoor material will be held early next year. The future of Firedoor will ride on this test.

2. More efficient core waterproofing - The plant trials have been so encouraging we plan to have some plants begin to use the new method. Better product quality and lower costs are the potential benefits.

3. Dry joint compounds - Elimination of casein is a must and replacement of asbestos is highly desirable; both are primary objectives.

4. Ready mix joint compounds - Solutions to some current quality problems and development of a product with superior working properties are top priority projects. Success will be necessary to help marketing continue to expand ready mix sales.

Some process developments are underway, too:

1. By-product gypsum - Our evaluations of by-product gypsum from N.L. Industries indicate that this gypsum is comparable to high purity natural gypsum. Negotiations are in progress with their Canadian subsidiary which could result in a G-P wallboard plant in Canada.

2. Silicone treated paper - A thorough investigation of National Gypsum's silicone paper will be held in an effort to reduce starch levels and minimize bond problems. Recent price increases in starch have made this a more attractive proposition if it offers the benefits claimed by National Gypsum.

3. Ready mix container - The cost of our ready mix packaging (pails and boxes) are such a high percentage of the total cost that we have been searching for an alternate. A double-wall plastic bag seems to have some possibilities and field trials are being planned.

Some personnel changes were made during the past six months. George Fowler has assumed the job of co-ordinating joint system developments in the East and is headquartered at Marietta. Howard Schutte was hired in August and is a trainee who will be transferred to a plant in the future. All new technical applicants for the Gypsum Lab are hired on the basis of eventually being transferred to a plant. This policy provides people to assist with projects in Tigard while they are undergoing training for plant assignments.

The various cost savings and product or process development projects are detailed in the body of this report.

ANALYSIS OF SALES & PROFITS FROM NEW PRODUCTS

<u>Unit</u>	<u>Product</u>	<u>Sales Volume</u>	<u>List Sales Amount</u>	<u>Gross Profit Amount</u>
MSF	1/4" Sound Deadening Board	4,452	\$ 173,330	\$ 58,064
MSF	Pre-Dec Wallboard (all)	24,750	785,831	355,985
MSF	Shaft Liner Panel	--	--	--
MLF	Metal T Splines	78	15,191	1,500
MLF	L Runners & J Channels	22	2,088	(1,055)
BGS	Polystyrene Texture	11,132	33,708	5,382
			\$1,010,148	\$ 419,876

TEXTURE SALES & PROFITS 1972 & 1973

		<u>Wall Texture</u>		<u>Vermiculite Ceiling Texture</u>		<u>Polystyrene</u>	
		<u>Sales</u>	<u>Profits</u>	<u>Sales</u>	<u>Profits</u>	<u>Sales</u>	<u>Profits</u>
1972	1st half	\$ 87,951	\$(5,875)	\$ 12,090	\$ 2,321	\$36,065	\$7,887
	2nd half	107,633	(5,299)	111,566	29,242	4,602	455
1973	1st half	99,625	(2,593)	151,603	49,174	19,340	3,254
	2nd half	102,958	8,288	143,526	44,489	33,708	5,382

MANUFACTURING SERVICES SECTION

3. Joint System

a) Grit problem - Almost without warning, large crystals began forming in ready mix causing streaking and resulting in numerous complaints. In addition to the expense, our volume of business began to suffer. The crystal contains phosphate, so the Calgon dispersing agent was suspect since it is the only phosphate in the formula. Also somewhat suspect is the Dowicil preservative since the gritty crystals began to occur about the same time we eliminated the mercury preservative in favor of Dowicil. Under the scrutiny of the investigation, the Dowicil was found to be inadequate. In an all-out effort to eliminate the crystal formation, the Calgon was removed from the formula and the mercury preservative was put back in place of the Dowicil. Our retained samples and the absence of complaints indicates the source of the crystals has been found. However, complaints of shrinkage and hard working properties have taken the place of the grit complaints. These are now under investigation to determine whether formula changes to counteract the grit is responsible for the new problems. The testing prior to making the changes did not lead us to believe there would be any loss in quality.

b) SRA joint compound with Dow resin - Some further lab development was done at Dow's request, but we were unable to obtain better bonding to metal corner bead. The final phasing out of the unsuccessful SRA involved reclaiming a substantial inventory of raw materials and finished product. Dow Chemical took the resin adhesive back and agreed to reimburse us in methocel which will be used in Akron. We tried to rerun the SRA into one-gallon ready mix, but casein components from our blending system reacted with the ready mix. The SRA now is being rerun into our casein bedding and topping as a means to salvage what we can.

c) Polyvinyl acetate emulsion - Among the raw materials which are in short supply is polyvinyl acetate. DuPont has furnished us for years, but will discontinue their Elvacet emulsions in early 1974. This leaves us with one emulsion supplier, Reichold. Other suppliers either declined to bid or were too high in price to consider.

As soon as we learned of this situation we arranged to investigate DuPont's 1875 Elvace which is a co-polymer. The Elvace is priced higher but we have found that less adhesive is required. Small quantities (several drums) of Elvace have been sent to Akron, Marietta, and Milford and plant batches of ready mix were made. To date, some pails have been taken out to the job but no conclusive results

have been determined. We have requested that the plants, particularly Akron, make some limited shipments, but thus far this has not been done. The interest in the Elvace is to develop an alternate emulsion source in the event that we have problems with Reichold.

d) Limestone sources - We urged that Milford use James River limestone because other sources might not be able to keep us supplied and the price of the James River was less. We also felt that if we got well established with Thompson Weiman, which is whiter, it might be very difficult to make the change at a later date. Milford made very gradual transition to be sure there were no adverse comments, and are now using 100% James River limestone.

e) Preservatives - Since mercurial preservatives have come under scrutiny by environmental people, we have been looking for other suitable candidates. We had switched to Dowicil but were not completely satisfied with its effectiveness. Bill Gettel made a comparison of 19 different preservative possibilities. Out of these, three products emerged as having equal or near equal fungicidal and bacterial protective properties as the phenyl mercuric acetate we had used for many years. A plant batch with each of the three preservatives will be mixed and further testing will be done. It is imperative that a suitable preservative system be found since the mercurials will have to be phased out eventually and the Dowicil has not been satisfactory.

4. Analyses

We have continued to conduct chemical analyses of rock samples as requested from the various plants. Analyses have been particularly important for Akron and Grand Rapids where the purity is marginal or elsewhere when an investigation was being made into a calcining operation. Also analyzed were by-product gypsum specimens and complaint samples.

MARKETING SERVICES SECTION

MARKETING SERVICES

1. Pre-Dec Shear Tests

After much frustration trying to get U.L. to move, the dies for the combination structural/fire hazard labels were received and are being used by the plants. We are not aware of any other company that is using this combination label, so perhaps it will give us a sales advantage. Also, it is no more costly to apply the combination label than it was for the fire hazard label we had been using.

2. Complaint Investigations

We have assisted on some complaints concerning Dens-Cote plaster, texture, ready mix, and vinyl covered fiberboard. In most cases, only a field investigation was involved.

3. Joint System Market Survey

A comparison was made of our basic products with those of competition which were sent in from the various markets at our request. As a result, we have a better knowledge of what our competition is doing and where we need improvements. At least four important facts were learned from the survey:

a) We need to improve the working characteristics of our ready mix at Acme. This confirms what Sales has been telling us.

b) The competition is ahead of us in the development of non-casein products. Some competitors have abandoned casein completely.

c) Most of the companies are still using mercurial preservatives in ready mix. We had the impression that everyone had gotten away from mercurials, but this is not the case.

d) Competitors are apparently not making much progress in the elimination of asbestos from the products. We are probably ahead of our competition in this respect.

We will urge our Sales and Production people keep sending in competitive samples so that surveys can be made on a regular basis. We are now requesting competitive textures to compare how our textures stack up against the competition.

PRODUCT DEVELOPMENT SECTION

PRODUCT DEVELOPMENT

1. Firedoor Filler

The latest firedoor cores basically consisting of 65% perlite, 15% gypsum, 15% portland cement, 3½% polyvinyl alcohol, and formed under pressure were processed into some test doors at Walled Lake Door Company in Indiana. These doors were tested in our pilot furnace and, based on the results, a full-scale test at Underwriters was recommended. This material performs well in the hose stream test since it does not erode away like previous gypsum firedoor compositions.

With Underwriters witnessing, twenty-eight 20" x 37" x 1-9/16" slabs were processed using a rented press in Portland. This firedoor material has a 300 psi compressive strength at 24 lbs./cu. ft. and is regarded as the best we have made on the basis of strength and handling properties. The slabs were shipped to Walled Lake who have agreed to fabricate the doors for the U.L. test. We anticipate that the doors will be made in January and the test will take place in February or March.

2. Water Resistant Wallboards

Laboratory tests and plant runs have now conclusively proved that the combination of polyvinyl alcohol and asphalt/wax emulsion provides much better water resistance than the emulsion alone. The optimum quantities of each ingredient or the exact type of polyvinyl alcohol have yet to be determined. More plant experience is needed to finalize the tests and to pinpoint the quality and economic advantages. Our paper is so absorbent it is difficult to measure the improvement precisely. It has been decided to attain the best possible results for the core and attack the paper problem separately. It may be necessary to have equipment to dissolve the PVA prior to its use. We plan to convert two plants to the PVA-asphalt/wax waterproofing. Tentatively they will be Sigurd and Brunswick. This will provide a better assessment of the new waterproofing before a total transition is made.

3. Non-asbestos Joint System

All of the dry products now being produced at Acme are asbestos free. As previously noted, the attendant savings were \$.15 per bag. Based on 1973 sales of 390,000 bags, the total anticipated savings is

\$58,000 annually. A casein version was formulated and some plant batches were blended at Akron. The field trial results in Rochester, Cleveland, Detroit, and Wilmington were favorable. Market testing in Detroit seemed to be favorable. Meanwhile, the Akron plant was under pressure from OSHA to discontinue the manufacture of dry compounds with asbestos or else reduce the airborne fiber content in the mill. Manufacturing and Sales recommended making the change to the non-asbestos formula and we concurred. Almost as soon as the product hit the market, the complaints started. The non-asbestos products did not have sufficient body or anti-sag which is the property furnished by the asbestos. An attagel clay, which is being used as an asbestos replacement in the vinyl formulas at Acme, is apparently not as effective or as reliable in the casein formula. Also, the price of casein has begun to accelerate again so we appear to be whipping a dead horse. Our time will be better spent concentrating on a non-casein product without asbestos for the Chicago and Akron plants.

Recently casein products were phased out of Marietta and vinyl formulas substituted, but it is too early to determine the effect. Since casein bedding and topping are relatively low volume items at Marietta, the risk in making the change there was minimal.

4. Improve Dens-Cote Plaster

The project to reformulate Dens-Cote was undertaken to a) eliminate Denscal which can be sold industrial accounts, and b) to build in better working properties. U.S.G. has made changes in recent years which have increased the acceptance of their veneer plaster. They have eliminated Hydrocal from their Imperial veneer plaster without substantially reducing the compressive strength. We believe U.S.G. may be using a sophisticated calcining method, but we prefer to avoid this. Sigurd was having particular difficulty getting Denscal from Blue Rapids, so an interim formula was released after a few successful field trials. We are continuing to work on the formula since the compressive strength is lower than we would like. Blue Rapids also made some Dens-Cote without Denscal and has shipped it to Wilmington for evaluation in that market.

We have estimated that the raw material and freight savings in the case of plants other than Blue Rapids will approximate \$26,500 annually if we are successful. Also, over 400 tons per year of Denscal, formerly used in Dens-Cote, will be available for sale to industrial customers.

5. Houston Formula Ready Mix

We have not been able to achieve complete acceptance of our Acme ready mix in the Southwest, and Houston in particular. A recent market survey showed that several competitive products from the market have better working properties than our ready mix. Our new quality supervisor trainee, Howard Schutte, has developed a formula which appears to have comparable working properties to the best competitive product. We are getting the necessary raw materials to Acme to prepare a plant batch of this ready mix for evaluation in Houston.

INDUSTRY REPRESENTATION SECTION

INDUSTRY REPRESENTATION

ASTM

The primary matters being considered by ASTM C11 which affect us most are as follow:

1. Specification for gypsum wallboard (C36) and test methods (C473) - The proposed revision in the standard will eliminate wallboard weight as a criterion and will relax the cross-direction strength requirement. In the future we may wish to manufacture board lighter than 1700 lbs./M for 1/2" and 2250 lbs./M for 5/8", and the lower cross-direction strength is more realistic. This standard will be voted on in January, and if there are no delays it will be in effect by March or April 1974.

2. New definition for Type X wallboard - The gypsum industry has been seeking a bench test which will supplant the full-scale fire test as the means to distinguish between regular and Type X wallboard. A so-called two burner test was tried but found to be unreliable. A flexure test, developed by Joe Watt, is superior to the two burner test but another test was developed at the National Bureau of Standards and is better yet. The next step in the evaluation of the NBS method is a series of round robin tests.

3. Application of veneer base and plaster - These former ANSI standards are in the process of revision into ASTM format. When finally approved, both product and application standards will be under ASTM.

Gypsum Association

1. Technical Committee - The major items on the technical committee agenda are the industry fire and sound testing program, the field testing of joint system products which contain asbestos, metrication, the National Bureau of Standards fire research program and co-ordination of activities with the building code committee and ASTM. The fire test program is somewhat stymied because of failure to be able to reproduce test results of 15-20 years ago. This has caused some confusion which should be resolved so we can get on with business of providing the fire test data required by the industry. Failure to do so might stimulate another round of testing by all the major gypsum companies which could be to our disadvantage. The testing for airborne asbestos in the field use of joint compounds will be helpful in determining the urgency of

eliminating asbestos as a component. Since metric units are imminent, it is important to begin to explore how this will affect the weights and dimensions of our products.

2. Materials Handling - The value of pursuing this as an Association matter is to keep abreast of the developments in the loading of railroad cars and trucks. We have had some problems because of shipments not arriving in good condition, so we want to do everything we can to assist our plants in using loading procedures that are economical yet will prevent damage to the products enroute to our branches and customers.

PRODUCT DEVELOPMENT &
TECHNICAL SERVICES

SIX MONTH REPORT

January through June 1973

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SIX MONTH SUMMARY

In the first six months of 1973 there has been a re-direction of our activities to put more emphasis on plant related projects. In recent years, the economics of wallboard manufacture has been significantly improved through faster machine speeds, lower wallboard weights, and lighter weight paper. While these changes have been beneficial, they have narrowed the margin for error which has resulted in more requests for technical assistance to maintain a satisfactory level of quality. Our product development projects are being confined to commodity items or cost savings, most of which are brought about by business conditions or competitive situations.

Six months sales and profits for new products which were developed during the past five years totaled \$1,976,604 and \$478,749. Texture sales and profits were up 95% and 840% over the same period during 1972. We believe the increase in texture sales and profits is a direct result of our reformulation of the textures. In addition to these advantages, asbestos, classified as a hazardous material, was eliminated from our textures. We successfully concluded the field and market testing of an alternate thickener for Ready Mix. The savings will amount to 9¢ per pail and after all plants make the switch, the total savings will be \$160,000 annually.

At Acme we are marketing an All Purpose without asbestos and which will also save \$50,000 a year in raw material costs. Our objective is to find substitutes for asbestos in all joint system products. The stringent requirements being imposed by the Occupational Safety and Health Administration (OSHA) may result in asbestos elimination being the only practical solution.

Another important project is a continuing effort to evaluate factors which influence the bond between the paper and the core of gypsum wallboard. The increased speeds and reduced weights have caused the bond to be a vulnerable area. A task group consisting of representatives from our paper manufacturing, gypsum manufacturing, and laboratory has been formed to jointly investigate all aspects of the gypsum/paper bond.

Georgia-Pacific, through the various representatives to the Gypsum Association, has proposed the establishment of an industry wide fire and sound testing program. Our proposal was accepted by the Gypsum Association and the program is just getting underway. If an effective program can be maintained, our fire and sound test costs will be reduced by approximately \$20,000 per year. Another important

matter being considered by the Gypsum Association is the question of rail car loading. The American Association of Railroads (AAR) has had such bad experience with damaged shipments of gypsum board they plan to require loading methods which would prove costly to the industry. Through the Materials Handling Committee, we are attempting to seek a compromise which will satisfy the railroads, without a significant increase in loading costs.

During our preparation to license other gypsum companies under our Firestop patent 3,616,173, one of the companies revealed information that undermines the validity of our patent. This development necessitated a change in our future plans and strategy. Instead of licensing, we will emphasize cost reductions and other improvements in Firestop which will put us in a better competitive marketing position. Firestop products continue to gain in importance as evidenced by sales increasing 44% for 1/2" and 31% for 5/8" comparing the first six months of 1972 with the first six months 1973. The first objective under the new program will be to reduce the raw material cost of 5/8 Type X Firestop. The goal is an annual savings of about \$100,000.

The Tigard Lab is hiring and training some quality supervisors for the operating divisions. It seems to work out well for new technical personnel to be drawn from the large reservoir of applicants furnished by our Personnel Department in Portland, and to receive laboratory training prior to assuming the plant responsibility. In February, Chuck Hilton completed his training program and was transferred to our new Milford plant as the quality superintendent. We have plans to hire another quality trainee for the plant organization.

A decision has been made to relocate Gene O'Neill from Tigard to the Marietta, Georgia, joint system plant. This is being done to establish closer contact between the laboratory and the joint system manufacturing and sales. With all the plants producing joint compounds in the East and Midwest, and the lab on the West Coast, we have not been able to maintain the desired continuity between the lab and plant activities.

A more detailed description of all the activities of the Product Development and Technical Service Department is included in the body of this report.

ANALYSIS OF SALES & PROFITS

<u>UNIT</u>	<u>PRODUCT</u>	<u>SALES VOLUME</u>	<u>LIST SALES AMOUNT</u>	<u>GROSS PROFIT AMOUNT</u>
MSF	1/4" Sound Deadening Board	4,447	\$ 171,135	\$ 48,396
MSF	Pre-Dec Wallboard (All)	30,885	1,772,347	424,606
Tubes	Drywall Adhesive	4,656	2,504	(32)
Tubes	Panel Adhesive	--	--	--
MSF	Shaft Liner Panel	--	--	--
MLF	Metal T Splines	32	6,140	577
MLF	L Runners & J Channels	11	1,231	8
Tons	Ram Process Plaster	41	3,906	1,940
Bags	Polystyrene Texture	6,601	19,341	3,254
			\$1,976,604	\$ 478,749

TEXTURES COMPARISON - TOTAL SALES & PROFIT - YTD THRU JUNE

<u>PRODUCT</u>	<u>1972</u>		<u>1973</u>	
	<u>SALES</u>	<u>GROSS PROFIT</u>	<u>SALES</u>	<u>GROSS PROFIT</u>
Wall Textures	\$ 87,951	\$ (5,875	\$ 99,625	\$ (2,593
Ceiling Textures:				
1) Perlite	3,959	1,029	2,662	411
2) Vermiculite	12,090	2,321	151,603	49,174
3) Polystyrene	36,065	7,887	19,340	3,254
	\$140,065	\$ 5,362	\$273,230	\$ 50,246

COMPARISON OF FIRESTOP BOARD SALES - YTD THRU JUNE

<u>PRODUCT</u>	<u>1972 SALES</u>	<u>1973 SALES</u>
1/2" Firestop	29,136 MSF	42,114 MSF
5/8" Firestop	74,757 MSF	97,549 MSF

PRODUCT DEVELOPMENT SECTION

PRODUCT DEVELOPMENT1. Drywall and Panel Adhesive

The manufacture of drywall and panel adhesive from the Tigard pilot plant was discontinued in February after more than 5,000 cases of adhesive had been sold. Four thousand four hundred cases of drywall adhesive were manufactured at Akron and sold, including 1,300 cases recently manufactured to use up the remaining raw material inventory. It was decided to abandon the adhesive project because construction of a plant in a central location could not be justified by the volume of adhesive which could be sold. It is possible that the manufacture of adhesives can be considered at some future time in conjunction with another product, such as Ready Mix. A technical report was prepared and submitted covering our pilot plant operation and field experience with adhesives.

2. Firedoor Filler

Dale Greve from the Western Region Operations developed a method of manufacturing Firedoor material similar to that used in manufacturing particle board. Instead of the usual pouring process, the ingredients are formed under pressure. There are also some differences in the formula from the previous Firedoor material. This product is stronger and has sufficient water resistance to withstand the hose stream, which is the crucial part of the test for fire rated doors. The first slabs prepared were shipped to Walled Lake Door Company in Indiana, who are a large potential customer. The slabs were off-size and had to be sanded several times. In the process of the sanding they cracked and no doors could be made. Through further formulation work, we have been able to make the Firedoor slabs less brittle while still retaining good compressive strength and have improved our techniques so they can be pressed closer to the final 1½" thickness. In July another set of Firedoor slabs will be prepared for a second trial at Walled Lake. If this trial is successful and the pilot fire tests are also favorable, another Underwriters' fire test will be recommended.

3. Wall Texture

During the past year and a half, revisions have been made to all of our texture products to improve the acceptance of these products and to reduce the raw material costs. An attendant objective was to

develop products which did not have asbestos in the formula. The increasing concern of hazards of asbestos fiber and the fact that the textures are spray applied, persuaded us to try to accomplish both goals simultaneously. The project was successfully concluded for the fine, medium, and coarse ceiling textures, and this left the wall texture to be reformulated. The casein wall texture has good market acceptance and a comparable formula proved difficult to develop. However, the formula is so expensive that we are losing money on every bag sold. We first tackled the gypsum textures at Acme and finally were able to develop an acceptable product. At Chicago the texture business is small, hardly justifying inventorying raw materials. It was decided to furnish Acme's gypsum wall texture to Chicago. Quite a number of field tests were conducted in the markets serviced by Marietta before an acceptable formula was found. The formula contains a talc which turned out to be in short supply, so that has delayed our progress. The same formula is now being field tested in the markets served by the Akron plant. When our shipments of talc arrive and the trials at Akron are concluded, we will have a profitable product that is not subject to the OSHA limitations on asbestos.

4. Ready Mix

Several Ready Mix projects have been undertaken. These are:

a) Less expensive thickener--We had been using a guar gum water retention agent as a substitute for the hydroxyethyl cellulose. The guar gum imparts some better working properties in addition to being quite a bit less expensive than the hydroxyethyl cellulose. There were some manufacturing problems which were all resolved. Also, the market testing has shown that the product is completely acceptable. The guar gum has been listed as an acceptable alternate thickener and, as mentioned earlier, will save \$160,000 annually based on the first six months Ready Mix sales.

b) Easier sanding Ready Mix for Acme--For some reason the Ready Mix with gypsum filler being produced at Acme is harder to sand than its limestone counterpart produced at the other locations. This characteristic is inhibiting the expansion of our Ready Mix sales in the market served by Acme. We tried to tie in the elimination of asbestos fiber with the sanding problem but this proved to be too big a step. Currently a formula with asbestos, but with a reduced amount, is being tested in Houston and other markets.

c) Higher molecular weight polyvinyl alcohol--The Sales Department advised us that we had incurred an unusual number of Ready Mix bond complaints during the winter of 1972-73. The complaints covered both

Chicago's and Akron's Ready Mix. These complaints are undoubtedly caused by the product being used when the temperatures are lower than 45°. Under these conditions, polyvinyl acetate, which is the primary binder, loses its effect as a binder. Our first thought was to install water heaters to be sure that the Ready Mix leaving the plant was the proper temperature. This will also help control variations in the viscosity of the product. However, this still does not solve the problem when the material is used at low temperatures. One possible solution is to use a higher molecular weight polyvinyl alcohol as the secondary binder. This will impart better binding efficiency, especially at low temperatures since polyvinyl alcohol is not adversely affected by the temperature. The initial results show that better bond properties can be achieved with higher molecular weight alcohol. Field trials are in progress to be sure there is no change in the working characteristics. We are moving this project slowly, but it is important that it be concluded before winter.

5. SRA Joint Compounds

In an effort to find a solution to the skyrocketing price of casein, we accelerated our evaluation program of joint compounds formulated with a synthetic resin furnished by Dow Chemical Company. The early trials were very successful and the contractors particularly liked the working properties of the SRA joint compounds. We received a batch of Dow resin which got us into some bonding difficulties, but this was attributed to the resin being too low in molecular weight. Subsequent shipments seemed to correct the problem and, in view of the continuing shortage of casein and sharp increase in price, we were inclined to proceed with the marketing of the SRA products. All of a sudden we began to have complaints that SRA joint material was failing to adhere to the metal corner beads. Since this condition developed after the joint compounds were applied, and in many cases after the paint was applied, we had large volumes of SRA joint compounds scattered throughout the area serviced by the Chicago plant before we realized the severity of the problem. Our only recourse was to settle the complaints which had been lodged and return all possible SRA material to the plant. We returned to the old formulas and fortunately the price of casein had fallen to about 44¢ per pound from a high of about 72¢ per pound. There were several factors that caused the SRA compounds to not bond properly to corner beads. The most significant was the tendency the material had for requiring large quantities of water when it was mixed very vigorously. This caused a dilution of the adhesive content and, therefore, a weakening of the bond properties.

Even though casein has come down in price, we are still in need of a substitute binder. Casein will probably increase in price in the future and may again reach a level where it will be prohibitive to use it.

6. Speed Set

An improved Speed Set formula has been developed to take advantage of a larger market for this product. The accelerator system has been changed to cause the set to proceed rapidly once it starts. This is especially important for factory home builders who need the shortest possible set but still need enough time to apply the material. There are some market tests in progress to thoroughly evaluate the new Speed Set before we make a change.

7. Low Consistency Molding Plaster

As a result of the demand for Densite and Denscal, we would like to be able to substitute molding plaster for Densite or Denscal wherever possible. One possibility is to use a powerful dispersing agent which will lower the water requirement of the molding so it can be used at least as a part replacement for Densite or Denscal. The first effort is to formulate Dens-Cote plaster without Denscal. This would free up about 1000 tons of Denscal per year. Another possibility is to use low consistency molding plaster in oil well cement.

MARKETING SERVICES SECTION

3. One-hour Metal Stud Wall

After considering all the possibilities of testing a metal stud wall with 1/2" Firestop for one hour, it was decided that our best bet would be to purchase it from our licensee, Westroc Industries. Westroc narrowly passed the test on about the third try, so it was decided that it would be better to pay them \$500 than to risk \$2000 or more in a test of our own.

4. New Pre-Dec Colors

A series of new Pre-Dec colors specifically for the wall Pre-Dec were developed and submitted for evaluation. It was decided that we would retain our present colors until such time as the volume of wall Pre-Dec would warrant switching to some new shades.

5. Comparison of Luan Paneling and Pre-Dec

Due to a shortage of Luan paneling, we began to offer wall Pre-Dec as an alternative for mobile home construction. For a time it appeared that if the shortage of Luan were to persist, the market for wall Pre-Dec might expand. In order to offer the Pre-Dec as an alternative, it was necessary to furnish some comparative test data on both products. We conducted a series of tests primarily comparing the strength. The Pre-Dec came out a poor second, but the information was passed along and presumably was used in some fashion by our marketing people.

6. Fast Method of Joint Finishing

A method of applying wallboard and finishing joints without tape was developed which appears to have merit. We talked to some companies in the factory-made home business, but so far we have not been able to interest anyone enough to try the method. We are reluctant to begin promoting anything that has not been field tested, so the project is stalled until we can get a trial.

7. Miscellaneous

We have responded to several requests to investigate wallboard complaints, joint system complaints, and car loading problems.

MANUFACTURING SERVICES SECTION

Another aspect of the wall Pre-Dec which has been evaluated is the surface washability. It is more desirable to have a washable finish on a product that is used for walls than ceilings because the wall surface is more vulnerable to smudges, fingerprints, etc.

d) Rubber applicator rolls--The plants have had problems with inconsistencies in the rubber coating rolls received from Rubatex Corporation. Several efforts have been made in the past to see if Rubatex could furnish us with an improved roll. We can afford to pay more for the rolls if they are more consistent in quality and last longer. Rubatex is furnishing us with more rolls of supposedly higher quality and Armstrong Cork Company is also sending some rolls to the plants for evaluation. Also under investigation is a foamed polyethylene material.

3. Joint System

a) Milford start-up--We participated in the start-up at Milford which proceeded smoothly after a few initial problems. This is the only Ready Mix operation not using pre-blended filler.

b) Continuous viscosity measurement--The present Brabender method of measuring viscosity takes up valuable production time because of the delay while the test is being accomplished. Another method where the electrical load on the mixer is measured and recorded provides a continuous measurement of the viscosity and it eliminates any delays for testing. The continuous viscosity measurement will be a more accurate viscosity and provide a product of more consistent quality.

c) Faster mixing--It has been found that the mixer speeds can be increased to as much as 100 revolutions per minute without adversely affecting the product. This will permit shorter mixing times and, therefore, increase production.

d) De-aeration--Some experiments were conducted using a vacuum pump on our Ready Mix mixers to eliminate all the entrained air from the product. This appears to make a superior working product, but there is some question whether the improvement is sufficient to justify the expense of the de-aeration process.

f) Communications--As mentioned in the Summary, we are arranging to have Mr. Eugene O'Neill transfer to Marietta in order to maintain closer contact between the laboratory developments and the joint system operations. A small laboratory has been built over the existing quality control lab in the Marietta plant for Mr. O'Neill. Another communication aid is a monthly bulletin which will go out to all of the joint system plants to keep everyone informed of the various activities at other locations.

4. Analyses.

We are continuing to conduct analyses for those plants that request it or where some special work may be in progress that makes it advisable to know the purity. The Akron plant is experiencing a decline in their rock purity, so we are analyzing samples weekly. The increased production at many plants has put pressure on the calcining capacities, and in many instances we have analyzed kettle samples. Included in the analyses were complaint samples, specimens of by-product gypsum, and chloride determinations from Grand Rapids' samples.

PRODUCT DEVELOPMENT &
TECHNICAL SERVICES

SIX MONTH REPORT

July through December 1972

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SIX MONTH SUMMARY

This report covers the activities of the Product Development and Technical Service Department during the past six months. Our identification has been changed to be more appropriate since we absorbed some of the functions of the old Technical Service Department. The report is divided into five sections describing each activity; i.e., product development, manufacturing services, marketing services, industry representation, and patents & licensing.

Our investment in product development and technical service in 1972 was \$303,762. The distribution of expenses is shown on page 3. New products developed during the past five years added nearly \$3 million to sales and nearly \$0.75 million to the division profits in 1972. The figures for the last six months are shown on page 2. A recent project which is beginning to pay off is the revamping of our texture line. Comparing 1972 with 1971, texture sales were up 16% and profits up 660%. A less expensive binder for joint system at Acme was thoroughly tested, proven and adopted late last year. Projected savings are \$33,000 annually.

There are more cost savings investigations in the works for next year. A Ready Mix formula currently being field tested has a potential annual savings of \$130,000. A water repellent size for wallboard paper was initiated in Tigard and is in the preliminary stages of plant evaluation. The potential advantages for this paper bond liner treatment are reduced starch usage, increased machine speed, improved quality. The savings should be enormous. Two continuing projects in joint system are (1) the search for a casein replacement, and (2) the elimination of asbestos fiber. We had a bad experience with our first effort to find a substitute for casein, so we are looking at some other possibilities. We are making progress toward the elimination of asbestos from all the joint system and texture formulas, but it is a tedious process.

A few investigations, such as development of drywall and panel adhesive, will be phased out. The Firedoor project was revived when one of our Manufacturing people came up with a new idea. We are searching for a way to use molding plaster in products where Denscal or Densite are now required. Our Firestop licensing program will be reassessed since our basic patent expires in May of 1973. Fire and sound testing expenses will be diminished if we can persuade the Gypsum Association to do more testing.

SIX MONTH ANALYSIS OF
SALES AND PROFITS FROM NEW PRODUCTS

<u>UNIT</u>	<u>PRODUCT</u>	<u>Sales Volume</u>	<u>List Sales Amount</u>	<u>Gross Profit Amount</u>
MSF	Radiant Heat Panels (All)	38	\$ 14,617	\$ (9)
MSF	1/4" Sound Deadening Board	4,171	150,986	42,548
MSF	Pre-Dec Wallboard (All)	23,411	1,409,342	335,654
Tubes	Drywall Adhesive (Akron)	41,616	22,531	(494)
MSF	Shaft Liner Panels	34	7,105	2,464
MLF	Metal T Splines	38	6,502	1,537
MLF	Metal L Runners & J Channels	19	1,767	904
Tons	Ram Process Plaster	55	5,453	2,999
Bags	Polystyrene Texture	1,612	4,602	455
Bags	SRA Bedding Compound	17,048	30,205	7,652
Bags	SRA Topping Compound	84,133	138,555	42,634
			<u>\$1,791,665</u>	<u>\$ 436,344</u>

1972 ANALYSIS OF
SALES AND PROFITS FROM NEW PRODUCTS

<u>UNIT</u>	<u>PRODUCT</u>	<u>Sales Volume</u>	<u>List Sales Amount</u>	<u>Gross Profit Amount</u>
MSF	Radiant Heat Panels	82	\$ 32,062	\$ (602)
MSF	1/4" Sound Deadening Board	7,652	280,226	78,544
MSF	Pre-Dec Wallboard (All)	40,962	2,387,916	581,491
Tubes	Drywall Adhesive	48,492	26,545	(591)
MSF	Shaft Liner Panels	51	10,514	3,550
MLF	Metal T Splines	38	6,502	1,537
MLF	Metal L Runners & J Channels	19	1,767	904
Tons	Ram Process Plaster	98	9,529	4,919
Bags	SRA Bedding	17,048	30,205	7,652
Bags	SRA Topping	84,133	138,555	42,634
			<u>\$2,923,821</u>	<u>\$ 720,038</u>

PRODUCT DEVELOPMENT1. Drywall and Panel Adhesive

During the past six months, the Akron plant sold 40,000 tubes of drywall adhesive. An additional 45,000 tubes of drywall adhesive and 13,000 tubes of panel adhesive were sold by Tigard. Repeat orders of both products indicate that we had satisfactory market acceptance. It has been decided, however, that we will not manufacture adhesives and the project will be abandoned. We will sell the remaining adhesive in Tigard and Akron will manufacture a little more adhesive in order to deplete their supply of raw materials.

2. Non-Rosette Pre-Dec

Two possibilities for installing Pre-Dec without rosettes were developed and presented for consideration. One method involved a reverse foil back Pre-Dec with the foil serving as the vapor barrier. The other method consisted of using gypsum strips over the conventional polyethylene vapor barrier and laminating the Pre-Dec to the strips. These systems were judged to be too expensive by marketing and it was decided to discontinue this project.

3. Textures

Over a year ago, we set out to develop a new family of textures which would be more acceptable and more economical. The increase in the price of casein resulted in sharply diminished profits for our entire line of textures. Another objective was added when asbestos, an ingredient in our textures, was classified as a hazardous material.

We responded by developing new formulas without asbestos for all of the ceiling textures. A new product with polystyrene aggregate still contains a small amount of asbestos. The non-aggregated wall texture has presented a major problem because it must be so versatile. Several unsuccessful field trials of wall texture have been held. Very shortly another formula will be field tested which we expect to be successful. If so, it will bring this project very close to completion and we would expect to see dramatic increases in our texture sales and profits for 1973.

4. Joint System Formulations

For a number of years, our efforts centered around using fine gypsum instead of limestone as the filler at Acme. In the past six months, we have been more concerned with the high cost of casein at the other

plants and with the new safety standards relating to the use of asbestos fiber. With this in mind, our emphasis on joint system formulations has been as follows:

a) Casein Replacement--We developed formulas containing a polyacrylamide adhesive supplied by Dow Chemical Company. The products were called SRA (synthetic resin adhesive) and initial field tests and market results were favorable. However, these products encourage the use of more water than is desirable, which results in high shrinkage and inadequate bonding. This was complicated by other factors causing serious field problems. It is questionable whether a satisfactory formula can be made using the Dow adhesive. In any event, most of our present efforts are being generated to handle the problems created by the SRA joint compounds.

b) Asbestos Replacement--A new All Purpose formula without asbestos is being field tested in the market serviced by Acme. An additional advantage is that the elimination of the asbestos has lowered the adhesive requirement resulting in a substantial lowering of the raw material costs. The reports from our field tests have all been favorable, so the scope of the field evaluation is gradually being increased.

At the same time, we are investigating the possibilities for eliminating asbestos in Ready Mix. This work has not progressed as far as the elimination of asbestos in the dry joint system and texture products.

c) Ready Mix Formulas--Two major Ready Mix investigations are underway. The first is the evaluation of a new thickener which would save at least \$130,000 annually if it proves to be satisfactory. The second is a request from sales to impart easier sanding characteristics to Acme's Ready Mix. Trials of the new thickener are scheduled in the areas serviced by Chicago and Marietta. The sanding problem at Acme will necessitate some major changes, but it is receiving prompt attention because it is inhibiting the sale of Acme's Ready Mix.

d) Speed Set--An investigation is underway to improve the setting time characteristics of our Speed Set. The objective is to shorten the time between the initial stiffening and the final set. This will provide more working time to the user, and therefore, make the product more acceptable. The market for setting type joint compounds is increasing rapidly, and we are probable not getting our share of this business. In addition to the formula improvements, Manufacturing is considering whether to make Speed Set available at Blue Rapids in order to improve the cost and distribution.

MANUFACTURING SERVICES SECTION

Additional trials of longer duration will be conducted at Akron and Grand Rapids so a better assessment of the advantages should be possible after those runs. The anticipated advantages, in addition to reduced starch usage, are increases in machine speed and improvement in operation efficiency.

2. By-Product Gypsum

DuPont Company has sent us some small samples of by-product gypsum they will have in their Richmond, Virginia, plant which will go on-stream in 1976. This is a long time off, but DuPont wants to try to find some use for the gypsum to overcome the problem they will have in disposing of it. From the samples tested, we have determined that the by-product gypsum will be high in purity, very white, and free of contaminants. We are continuing to keep abreast of waste gypsum in the event that one comes along which is economical to use.

3. Pre-Dec

Manufacturing requested our assistance in planning an early start-up for the Fort Dodge Pre-Dec operation. We also prepared and distributed a complete quality control procedure for Pre-Dec which will help prevent future problems if it is followed.

4. Joint System

We have provided assistance in planning and ordering of equipment for the Milford Ready Mix plant. Mr. C. B. Hilton was recruited and trained here and will become the quality control supervisor at Milford.

5. Gypsum Analyses

We have reduced the analysis procedure to those deposits where the purity is marginal or where the plant specifically requests that an analysis be made. Some plants have had to increase their calcining capacity to keep up with the wallboard requirements. We suggested that kettle samples be submitted in these cases to be sure the stucco was not over or under calcined. We formerly hired a part time analytical chemist to conduct the analyses two or three days each week. We now analyze only one day each week. Instead of hiring a part time analyst, Mrs. Elaine Zulauf was trained to handle this in addition to her secretarial responsibilities.

RESEARCH AND DEVELOPMENT
SIX MONTH REPORT

January through June 1972

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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.

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	

NEW PRODUCT SECTION

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.

(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

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.

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.

PATENTS 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.

GYPSUM RESEARCH
SIX MONTH REPORT
JULY-DECEMBER 1971

Added Feature:

Ten Years of Gypsum Research

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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>

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.

GEORGIA PACIFIC
GYPSUM RESEARCH

JUNE TO JANUARY

1971

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S U M M A R Y

This report covers activities in gypsum research for the past six months ending December 31, 1970. The breakdown of the money invested in research during 1970 is shown on page 4. As a measure of the value of research we list sales and profits from new products. The figures for the past six months are shown on page 5. The full year's results show a contribution of \$5,284,634 to list sales and \$820,724 to gross profits from products developed through research during the past 10 years. Other benefits from research are cost savings and sales assists, but these are often difficult to assess. A good portion of our budget each year goes for fire and sound testing. Our 1970 sales of 5/8" and 1/2" Firestop were up 49% and 28% respectively over 1969, so this is strong evidence of the value of that work.

Our primary concern, however, is with current projects which are directed to the sales and profits of the future. The complete list of investigations are contained in the body of this report, but some of the more important developments in the last half of 1970 were:

1. Manufacture of Mastic Adhesives

The branches are currently selling an adhesive for installing plywood paneling. Similar adhesive is used to apply gypsum wallboard, and both types are growing because of the increase in factory built units. We already have much of the equipment to manufacture these adhesives in our joint system plants. The combination of having available manufacturing facilities and distribution outlets prompted us to formulate an adhesive. The experimental work was completed and it was decided to purchase a mixer and tube filling equipment. The first production of the adhesive is scheduled for January at the Akron, New York, plant. We expect this to be a profitable business and one which will fit in well with our present manufacturing and marketing programs.

2. Progress Towards a Gypsum Firedoor

It has been over 15 years since the gypsum firedoor development first began. The project has been marked with a series of failures and frustrations. The potentially favorable economics have kept the project on a high priority in spite of the setbacks. In the past year the investigation has progressed to the point where we have been able to recommend a fire test at Underwriters' Laboratories. Wood framed cores filled with a special foamed gypsum were produced on the wallboard machine at Blue Rapids. These gypsum cores were subsequently processed into flush wood firedoors at the Curtis plant in New London, Wisconsin. The important Underwriters fire test will take place in February. A successful test will not guarantee to put us in the firedoor business, but it will provide justification for a full scale investigation at our gypsum and door manufacturing plants.

3. Development of an Elevator Shaft Wall

United States Gypsum Company found a market for gypsum wallboard shaft enclosures in high rise buildings. These walls were formerly constructed with masonry block, but the gypsum walls are much lighter in weight. In response to a request from our sales, a similar wall was devised that is lighter in weight and easier to install than USG's system. The two hour fire rating and wind load tests were successfully completed. We will sell a 1 5/8" thick x 2' wide shaft liner panel and metal components in addition to the layers of regular gypsum board for the finish side. Our first job will be the First National Bank Building in Portland.

4. Conversion to Gypsum Filler for Joint System at Acme

This transition has been slower than anticipated because of the lack of acceptance of some of the products made with the gypsum filler. We have been making a gypsum Ready Mix for well over a year, but we have encountered resistance in attempting to substitute gypsum/vinyl formulas for the old limestone/casein products. The rising prices of casein and limestone plus increases in freight rates have simply made it uneconomical to ship these old formulas. All reasonable efforts are being made to make the gypsum products acceptable.

5. Using Gypsum as a Filler for Plywood Putty

Through our marketing people, we learned that the Eugene Division uses over 100 tons of limestone each month to produce a putty for filling imperfections in plywood. The preliminary tests indicate that gypsum is an acceptable substitute for the limestone. Some large scale trials are planned. We expect to be able to furnish the gypsum at a competitive price with the limestone the Eugene Division is buying outside the company.

6. Fast Joint Finishing Methods for Factory Home Builders

Normal taping and finishing of gypsum wallboard is too slow for factory built homes. We developed a tapeless joint compound which had merit but was not practical, so it was abandoned. The current investigation is directed to the overall problem of using gypsum wallboard in mass produced homes. We may not find a dramatic solution, but we do expect to learn enough about the problems to make specific recommendations concerning the use of our products.

7. A New Line of Joint System Textures

The wall and ceiling textures we have been marketing are not profitable. We are trying to change this situation by 1) improving the quality of the products 2) economizing on the formula and 3) increasing the manufacturing efficiency. Less expensive formulas have been developed and field testing is in progress. The first trials have been encouraging. In the meantime, the Engineering Department is working on a better plant design and additional facilities to use expanded polystyrene as an aggregate. The polystyrene aggregate is essential if we are to have a complete texture line.

8. A Flamespread Rating was Obtained for Pre-Dec

In an Underwriters fire hazard test a flamespread rating of 20 was achieved for the Pre-Dec board we are selling for mobile homes. This means Pre-Dec can be used anywhere non-combustible construction is specified. Pre-Dec was introduced in February of 1970, and during the past six months 5 million square feet were sold. The purpose of the flamespread rating is to help increase the sales.

9. Sound Tests of Floor Constructions

Two floor-ceiling assemblies with Densrock gypsum floor topping over a plywood subfloor were tested for airborne and impact sound. Excellent ratings were achieved that will let us compete favorably with similar constructions with lightweight Portland cement floor topping.

10. Patents to Issue Soon

Our investment in patent applications has been unusually high the past two years. The reason is that several of our innovations offer potential licensing opportunities. We have been advised that the claims for our patents on the improved Firestop formula and the radiant heat panel have been allowed. The patents will issue early in 1971. No action has been received on our round edge and gypsum joint system patent applications.

* * * * *

There was one organization change the last half of 1970. Mr. A. Kelly Stalker transferred to the Curtis Door Division. We are glad that our people can receive opportunities in other parts of the company. Mr. Sanford M. Rome has been hired to replace Mr. Stalker.

We had hoped to add to our research equipment and facilities during 1970, but these investments were postponed because of the squeeze on cash outlays. The items requested are not crucial to our immediate needs, but they are important if we are to expand our ability to contribute to the future of the Division and the Corporation.

* * * * *

ANALYSIS OF SALES & PROFITS FROM NEW PRODUCTS

June 28-Dec. 24, 1970

<u>Unit</u>	<u>Product</u>	<u>Sales Volume</u>	<u>List Sales Amount</u>	<u>Gross Profit Amount</u>
MSF	Denscote Base (all)	8,639.4	\$294,670.03	\$ 21,130.33
MSF	Tile Backer Board	5,932.0	372,000.34	126,086.17
MSF	1/4" Sound Deadening Board	3,410.0	102,454.82	19,006.30
MSF	Radiant Heat Panels	141.8	53,833.70	(1,779.52)
MSF	Pre-Dec Wallboard	5,001.4	287,998.28	59,956.85
MSF	Pre-Dec Ceiling Tile	8.6	742.10	265.56
Pails	Ready Mix	344,983.0	979,335.58	127,968.67
Cartons	Ready Mix	2,297.0	5,670.85	(594.89)
Tons	Triple Duty	2,224.1	279,231.90	30,902.31
Tons	Denscote Plaster (all)	1,696.7	93,386.66	18,709.49
Each	Thermostats	318.0	1,905.28	512.36
Lbs.	Insulated Nails	224.0	1,724.80	319.37
Tons	Bestex A	667.6	87,084.21	5,086.87
Tons	Bestex B	36.4	5,741.68	555.45
Tons	Bestex C	178.4	28,918.28	230.93
Tons	Bestex D	168.0	26,250.14	(432.67)
Tons	Speedset	162.9	<u>24,291.50</u>	<u>4,502.34</u>
TOTAL			<u>\$2,645,240.15</u>	<u>\$412,425.92</u>



During the last run at Blue Rapids we had an Underwriters inspector witness the manufacture of 15 gypsum cores with fire retardant wood frames. These were shipped to the Curtis Door plant in New London, Wisconsin, to be made into doors.

3. Making of Doors for U. L. Fire Test

The gypsum cores arrived at New London in good condition. There were still some defects such as bowing of the frames and layering of the gypsum in a few of the cores, but we feel that these can be overcome. The sanding produced even surfaces. The skins were laminated to six cores using phenol-resorcinol glue in a cold press, and the bond was quite satisfactory. Four of these doors will be fitted in U. L. labeled door frames and shipped to Chicago for the fire test.

* * * * *

Fast Method of Joint Finishing

The need for a faster method of reinforcing and concealing joints has come about through the growth of the factory built housing industry. One of our competitors, National Gypsum Co., has developed a system consisting of an iron-on tape in conjunction with a setting type joint compound. In our judgment, their system doesn't have much merit, but the mere fact that they have something to offer puts us at a sales disadvantage.

Our first approach was a tapeless polyester base joint compound. A product was developed which provided greater joint strength than regular tape and set hard within a few hours. It was a two component system and required acetone for clean up. The set was influenced by the temperature and was difficult to control. The clean up was time consuming and distasteful because of the acetone fumes. These disadvantages outweigh the advantages, and in any event it would be difficult, if not impossible, to re-educate the trade. On this basis, the tapeless joint compound was abandoned.

The current investigation covers all phases of factory-built structures including studs, stud spacing, facing materials, methods of attachment, joint reinforcements, joint compound, and anything else that seems pertinent. We are considering testing a complete unit in Tigard to simulate the conditions in a mobile or modular house plant. The object is to come up with a set of recommendations for factory home builders so they will give preference to Georgia-Pacific products.

* * * * *

Gypsum Filler for Plywood Putty

Through a conversation between Gene Burch and someone from the Eugene Division, it was learned that the Eugene Division was using over 100 tons of limestone per month for putty used to fill knotholes and imperfections in plywood. Gene passed the information along to us with the suggestion that our fine gypsum filler might be used in lieu of the limestone. This gypsum filler would have to come from Sigurd to be economical, but a trial quantity was obtained from Acme where it is being used in joint system. Seven hundred pounds was used in a plant trial at Eugene, and they said it performed as well or better than the regular limestone filled putty. The limestone costs them \$30 per ton. The freight on a carload of gypsum from Sigurd is \$15 per ton so the \$15 difference makes it look interesting. A new product Eugene plans to produce will take another 100 tons of filler so this makes it even more attractive. If we could realize \$5 per ton profit, it would amount to \$1000-\$2000 per month.

In order to provide fine gypsum from Sigurd, it will be necessary to install the air separation equipment we already have. Before installing any equipment, we are shipping 6000 lbs. of gypsum to Eugene for a full day's run. If this run is successful, we'll recommend that Sigurd install the air separator.

* * * * *

Pre-Mixed Laminating Adhesive

According to our industrial sales people, there is a substantial market for laminating adhesives in the area serviced by Acme. It is their opinion that we can service this market if we have a competitive product. A preliminary formula was developed, and some trials were made. We did not receive any

I M P R O V E D P R O D U C T S S E C T I O N

Lower Cost Ready Mix

We have been shipping Ready Mix made with gypsum for over a year now from Acme. Sales contended that our costs were still too high in relation to the prices, so another reformulation was made. The basic change was the substitution of a small amount of the RS6219 polyvinyl alcohol for a large part of the polyvinyl acetate emulsion. This served to cut the raw material costs by 15¢ per five gallon pail. The field trials were all satisfactory, in fact, the new formula seemed to have even better acceptance than the old. We have been shipping the new material about five months now.

* * * * *

Gypsum Filler in Dry Joint System

Unlike the Ready Mix, the change to gypsum met with considerable opposition. In addition to the substitution of gypsum for limestone, we were also substituting vinyl for casein. After several revisions we were able to gain acceptance in several markets. However, there are still problems of workability with some of the products. We are attempting to overcome these objections. We were able to change the Triple Duty and Ready Mix to gypsum probably because they have always been vinyl base products. The All Purpose, Bedding, and Topping which were casein/limestone formulas are where we have encountered problems of acceptance. Acme is continuing to furnish the casein/limestone formulas where we have not gained acceptance for the gypsum/vinyl formulas. Ironically, the All Purpose is the lowest price product and also the one where we have encountered the most opposition. The latest cost figures show that we lose money on every bag of casein All Purpose sold. The profit on the other casein products is also marginal.

* * * * *

New Texture Line

We have been losing money on our aggregated textures for some time. The chief reason is the labor that goes into the product because of the inefficient operation at Acme. The basic filler is prepared at the joint system plant and transferred to the white mill where the bags are emptied. The aggregate is added, the material is rebagged and sent back to the joint system plant for shipment. With the proper equipment in the right location, this operation could be streamlined so that each operation would be in sequence without any movement from one location to another. In addition to manufacturing inefficiencies, the products have suffered from relatively high raw material costs and average to poor acceptance depending on the market. On the West Coast, which is the largest texture market, we have been unable to compete because we do not have a polystyrene aggregate texture. This texture sprays much easier than texture with the perlite or vermiculite aggregate that we are using.

The current investigation has several objectives.

1. To reduce the raw materials costs of our texture products by using gypsum as the basic filler.
2. To improve the hiding, coverage, and spraying properties of our textures.
3. To eliminate asbestos from the textures since asbestos constitutes a health hazard when spray mists are breathed by the applicator.
4. To formulate a polystyrene aggregate texture and convince manufacturing to purchase the equipment necessary to expand and shred this polystyrene.
5. To have Engineering and Manufacturing redesign the texture operation.

Some field trials of the new aggregated textures have been conducted, and the results are promising. Advantages reported are better coverage, better hiding and less bounce back. The amount and size of raw vermiculite is varied to produce a light, medium, or heavy texture. The raw material cost of the new texture is 28¢ per 40 lb. bag less than the old formula. Asbestos is eliminated which should be a sales aid. Instead of asbestos, we are using Cellu-Floc which is a G-P product.

We will follow up the field tests in Memphis with a market test. One contractor has ordered 1000 bags. In the meantime, we have been field testing a non-aggregated texture. This texture had good application properties, but tends to be lumpy when mixed and sensitive to addition of other materials such as paint. Reformulation is underway. We hope to have an entire new family of textures (gypsum base at Acme and limestone at the other plants). The limestone formulas will be similar to the gypsum, i.e. no asbestos, color matched, and be able to be intermixed without creating problems. Sales plans to have new bags (yellow) and identify the products differently to get rid of the stigma of the Bestex name.

* * * * *

Hard End Wallboard

The idea of end spraying gypsum board with a resin emulsion was tried again at Sigurd. Some modifications were made to the spray apparatus to restrict the spray pattern and a set of pinch rolls were installed to hold the boards together as they were being sprayed. These changes overcame the objections to the boards sticking together and the spray pattern being too wide. Sigurd was not clear on the operation of the equipment so this was explained. The purpose of the end spraying is to reduce end split and make a board with a harder end. It is now up to the Sigurd plant to use the equipment and see if the advantages of the end spraying are significant.

* * * * *

P A T E N T S S E C T I O N

Firestop Improvement

Earlier in the year we had an action from the patent examiner rejecting all of our claims. Synnestvedt & Lechner's response convinced the examiner to allow the claims relating to clay, but not the ones relating to colloidal silica and alumina. We decided not to acquiesce but to conduct more tests and make another effort to gain acceptance of all the claims. This patent is potentially important, and we want it to be as strong as possible. After presentation of test data and two affidavits to the patent office, allowance of all claims was granted.

The patent should issue in March of 1971. Our patent counsel has suggested that we contact our licensees upon issuance of the new patent, advising them of its existence, and our intention to continue licensing under it.

* * * * *

Radiant Heat Panel

All the claims were rejected, but our rebuttal to the examiners arguments and Synnestvedt & Lechners interview prompted him to reverse his position and allow all claims. This patent will issue early in 1971. We have no immediate licensing plans.

* * * * *

Round Edge Wallboard

There has been no action from the patent office, and no one has taken a license from us although some interest has been expressed. If we can get the patent, we should have some licensing possibilities.

* * * * *

Gypsum Filler for Joint System

The patent application has been filed. Since we are using gypsum filler in joint system, it already has some commercial significance.

* * * * *

Shaft Wall

We have decided to file for a patent since we have an opportunity to license some other companies.

GEORGIA PACIFIC
GYPSUM RESEARCH

JANUARY TO JULY

1971

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SUMMARY

New products developed through Gypsum Research contributed \$655,594 gross profit to the Division in the first half year.

The G-P elevator shaft liner system and Pre-Dec wallboard for mobile homes are two new developments which proved to be good profit makers. We have leap-frogged our competition in providing one of the most economical methods for enclosing elevator shafts in high rise buildings. Jobs using our system are in progress in Portland and Chicago, and Sales tells us that others will follow. In addition to the substantial volume of gypsum in the shaft wall, it provides an inside track to sell other products for the interior partitions in these buildings. Pre-Dec has been responsible for \$145,110 profit in the first half of 1971. This is an excellent example of our ability to sell a low cost commodity for which there is an existing market. The manufacture of Pre-Dec is being considered at other plant locations in addition to Acme.

Our entry into the panel and stud adhesive business has met with some problems of acceptance by users of solvent type products. This can be a profitable business for us, so an all-out effort is being made to improve the market acceptance.

Some brand-new developments are just beginning which should keep the momentum going. At the suggestion of Alex McCaskill and using the commodity approach, we are investigating the possibility of manufacturing a low cost vinyl covered wallboard. The objective is to increase the sales and profits from our capital investment in laminating equipment. Another recent development and a potential new outlet for gypsum board is a so called "exterior gypsum wallboard." This product serves as a base for the application of an acrylic coating on the outside of a building. We are working with Kelly-Moore, who supplies the acrylic coating, to evaluate this new exterior finish. Pictures of the gypsum board/acrylic texture finish are shown on pages 8, 9, and 10.

Under product improvements, a new line of wall and ceiling textures is being introduced. The new textures have been well received in the market and the raw material cost is substantially lower. The slow transition from casein/limestone to vinyl/gypsum joint compounds at Acme is about 80% complete. Now instead of facing a decision of whether to continue manufacturing joint system at Acme, a larger and more efficient operation is being planned.

The royalty return from Firestop licensing has grown to about \$250,000 annually. The increase in royalties has been due to our continued

development of Firestop products, management's enforcement of the patent, and stricter building code requirements for fire protection. The basic Firestop patent expires in 1973, but we have another patent which will issue shortly and sustain a significant portion of our Firestop royalty potential for another seventeen years. We have licensed The Celotex Corporation under our shaft wall patent application and this will add to our future royalty income. The sales of G-P Firestop products has continued to grow, and at a faster rate than our competition, so the royalties make additional profit on the sales of our competitors.

As we have seen, research is important to develop new and more profitable outlets for gypsum products. Equally important is the timing of the development and the provision of facilities to manufacture the product. In most instances, our timing has been good, but in some cases it could have been better. The shaft wall, Pre-Dec, and gypsum joint compound projects all appear to have been well timed. The improved texture line is several years late and it will take a big sales effort to take full advantage of the work that has been done. In most cases we should be researching the product years before the market develops - so that when the demand occurs, the product has been fully tested and is ready. It would help if we had more market information than is currently available. Such knowledge would make our efforts more effective and improve our timing to maximize the profits from new developments.

ANALYSIS OF SALES & PROFITS FROM NEW PRODUCTS

January Through June 1971

<u>Unit</u>	<u>Product</u>	<u>Sales Volume</u>	<u>List Sales Amount</u>	<u>Gross Profit Amount</u>
MSF	Denscote Base (All)	8,208.4	\$ 297,424	\$ 26,892
Tons	Denscote Plaster (All)	1,447.7	82,949	15,417
MSF	Tile Backer Board (All)	6,203.1	411,880	153,925
MSF	1/4" Sound Deadening Board	3,150.8	101,658	21,696
MSF	Radiant Heat Panels (All)	124.4	49,083	(7,759)
MSF	Pre Dec Wallboard	8,381.8	476,707	145,110
MSF	Pre Dec Ceiling Tile	2.1	184	53
MSF	Shaft Liner Panels	108.6	19,597	1,521
M Lin. Ft.	"T"-Spline	43.7	6,898	1,367
M Lin. Ft.	"L"-Runner	10.0	930	132
M Lin. Ft.	"J"-Channel	9.0	1,606	80
Pails	Ready Mix	515,413.4	1,599,292	226,006
Cartons	Ready Mix	2,572.1	7,028	62
Tons	Triple Duty	2,198.2	289,976	54,979
Tubes	Panel Adhesive	89,724.0	32,135	11,703
Tubes	Drywall Adhesive	6,924.0	5,055	1,242
Tons	Bestex A (All Plants)	675.5	89,384	642
Tons	Bestex B (All Plants)	48.2	7,969	374
Tons	Bestex C (All Plants)	278.0	43,977	351
Tons	Bestex D (All Plants)	167.1	25,677	(885)
Tons	Speedset	172.5	26,749	2,035
Each	Thermostats	218.0	1,318	362
Pounds	Insulated Nails	204.1	<u>1,571</u>	<u>289</u>
TOTAL:			<u>\$3,579,047</u>	<u>\$655,594</u>

IMPROVED PRODUCTS SECTION

Gypsum Textures

Our objective in developing a new line of textures is a) to improve the market acceptance to increase volume, and b) to reduce the raw material cost to improve the profitability. Our only hope to accomplish the cost reduction was to be able to use gypsum instead of limestone as the filler and vinyl or starch instead of casein as the binder. This fit into the over-all program at Acme to eliminate the expensive casein/limestone formulas. We also manufacture texture at Akron where the gypsum is too dark in color so it was necessary to work with limestone here.

The first approach taken was to find a pigment system which would provide the optimum hiding and coverage. Once this was done, we searched for the right combination of the binders, fillers, water retention agents, and aggregates. The initial formula consisted of a vinyl binder. This texture was tested in Memphis and performed well enough that more than a thousand bags were sold. During the field testing, it was found that there was room for even more improvement. The texture required high pressure to break up easily during application and dried out fast making cleanup rather difficult. The textures were re-formulated and a combination of a starch and a gum were used in place of the vinyl binder. This time the texture received even better acceptance in the difficult Memphis market. Trials in the Florida and Denver markets were also favorable and in late June we ceased manufacturing the old casein/limestone textures at Acme, replacing them with the gypsum/starch formulas. In addition to the better acceptance, the raw material cost of the aggregated texture was reduced from \$1.85 to \$1.05 per 40 lb. bag. The cost of the non-aggregated texture was reduced from \$1.07 to \$.71 per 25 lb. bag. This takes us from a loss position to a profitable one providing even more incentive to increase texture sales.

Concurrent with the gypsum base textures at Acme, limestone textures for Akron were developed with the same pigment and adhesive systems. These textures are slated to be field tested late this summer. The raw material cost reductions will not be as substantial as those realized at Acme, but they will still be significant. All the textures are color matched so that any cross shipments from Acme or Akron should not cause any problem.

The finishing touch for a complete texture system is to have an expanded polystyrene aggregate. Engineering is working on the layout of equipment to expand and shred this aggregate.

Gypsum Joint Compounds

Our efforts to develop a satisfactory All Purpose with a gypsum/vinyl formula at Acme met with considerable resistance in the field. While there was some acceptance, certain markets, notably Memphis and Oklahoma City, would not use the new product. In the meantime, we were losing money on every bag of limestone/casein All Purpose that was sold. The Ready Mix has been successfully converted to a gypsum formula and we have been furnishing it for over a year. Also, the Central Mix had gotten acceptance, but the All Purpose proved to be a different matter. After much re-formulating and re-testing, all of which exasperated everyone involved, a formula was found which has satisfied users in Memphis and Oklahoma City. The same formula has been tested as a Triple Duty (in lieu of the limestone Triple Duty) and again favorable reports have been received. Through persistence, a difficult problem of acceptance was solved. The only remaining casein product to be eliminated is Topping and we are diligently working to develop a suitable gypsum/vinyl substitute. When accomplished, this will complete the transition at Acme restoring the profitability to an operation that had become a losing proposition.

Ram Press Process Plaster

George Fowler, our industrial engineer from Blue Rapids, proposed that we go all out to make our Ram process plaster competitive to U.S.G. It was suggested that we do this by working with the people who manufacture the Ram pottery presses. It was decided to proceed with at least one visit to Ram to see if we were making progress. Before doing this, quite a lot of work was done at Blue Rapids to develop a formula which would be as close to U.S.G's Ceramical as possible. A formula consisting of equal amounts of Densite and Denscal, white Portland cement, gum arabic, and the optimum combination of set control agents was sent to Ram Inc. to be evaluated in comparison with Ceramical. The photographs illustrate the Ram pottery making process.

SALES SERVICE SECTION

All of these factors will be taken into consideration in the upcoming series of flamespread tests at Underwriters' Laboratories in Santa Clara. We will test Stauffer and Columbus white stipple 6 mil vinyl. We purchase most of our vinyl from Columbus but the Stauffer vinyl performs better. We will use the National Casein PCVE adhesive which we are using and a formulated adhesive which performs well on the machine, better in the flamespread test, and is more economical. If possible, two different amounts of each adhesive will be tried. We will use 65 lb. paper inasmuch as it was determined that the lighter the paper the better. The U.L. series of flamespread tests should be completed in August.

Monolithic Eternawall

At the request of Sales, a method of making a monolithic or smooth joint for vinyl covered wallboard was developed. This was accomplished by forming a round edge board with a 1" wide .015" deep taper and keeping the vinyl loose (unlaminated) 4" back from the edges of the board. The recommended method of finishing the joints is: a) Apply two coats of 30 minute Speed Set to the joint filling the round edge and taper, b) adhere the flaps in wallpaper fashion with a suitable vinyl wallpaper paste.

These tests were conducted on 25 oz. fabric back vinyl with a color pattern. Sales subsequently found it desirable to purchase and market a 12 oz. white vinyl in order to meet competition. This will give a less satisfactory result than the vinyl originally tested, but it may be acceptable.

Fast Method of Joint Finishing

Sales advised that competition had a method of completely finishing joints in 30 minutes. We were never able to substantiate this when we contacted some of the people who were supposedly using this method. National Gypsum has a system called "Thermoweld" which has limited acceptance. U.S.G. has no system but their Durabond setting type products are the most acceptable in the market. We have two problems: One is to improve the working properties of Speed Set, and the second is to develop a faster method of finishing joints, but not necessarily 30 minutes. In fact it would be better if the total time were closer to one hour.

George Green has developed a setting type product that has a relatively long working life (45 minutes) but hydrates quickly (15 minutes). The working life can be extended without significantly changing the time of setting. Normally to achieve a 45 minute working life would require a set of 1½ to 2 hours because of the stiffening that precedes the set. The stiffening is caused by the early formation of needle-like crystals. This stiffening has been substantially eliminated by a crystal habit modifier which makes rectangular rather than needle shape crystals. This discovery

paves the way for a product which will give maximum working time for a quick set material. The next step is to incorporate good application characteristics. We will evaluate a method of finishing much like we use for the Dens-Cote system. In other words, embed glass fiber tape, trowel over the tape, and double back to trowel the joint smooth. If this were successful, it would be a way of finishing the joints in an hour - and essentially in one application.

Low-Cost Vinyl Covered Wallboard

We are investigating low-cost predecorated wallboard laminated with thin vinyl or other inexpensive facing. The objective is to generate more sales for laminated products to fully utilize our laminating equipment. The net result should be lower costs and, therefore, greater sales and profits.

Our approach has been a) to use lower cost vinyl or other decorative films (We have ordered samples of Elm Coated Fabric's 2 mil vinyl, Stauffer's 2 mil vinyl, Permaneer's woodgrain vinyl, and DuPont's Tynec non-woven to evaluate); b) to reduce the adhesive cost (An adhesive was formulated that is over 10¢/lb. less than the adhesive we are currently buying and trials at Fort Dodge and Wilmington have been favorable); c) to increase the operating speed (The new adhesive with its higher tack is permitting speeds of 60-80 ft./min. as compared to standard of about 40-50 ft./min. It may require some additional handling equipment but a 50% increase in speed will help reduce our manufacturing costs.)

Pilot Fire Testing

During the past 5 months, pilot fire tests have been conducted on a corrugated steel/gypsum wallboard roofdeck, a wall with paneling on one side and 5/8" Firestop on the other, and two back-to-back wood stud walls. These tests were to provide information requested by Sales.

U.L. Flamespread Label

We received approval from U.L. to use regular wallboard instead of Firestop to label Pre-Dec and Eternawall. This saves the cost of the more expensive Firestop formula as well as the cost of the fire resistance label. Now only the flamespread label is required.

Round Edge Wallboard

Our patent claims have been rejected by the examiner. We plan to rewrite the claims and establish some limits as to the curvature in order to overcome the examiner's objection. We are also preparing a method to accurately measure the degree of roundness. All of this is regarded as important in view of the various round and bevel edges that are being marketed to reduce ridging.

Improved Firestop

Our patent will issue shortly. Our current Firestop patent expires in two years so this will allow us to continue to license some of the Firestop line for another 17 years. As soon as the patent issues, we will advise our licensees and send them a new agreement similar to the old one with a royalty schedule as follows: \$.65/M for 1", \$.55/M for 5/8", \$.45/M for 1/2", and \$.35/M for 3/8" Firestop.

Shaft Wall System

Our patent application was filed on March 22 under Serial No. 126,823. We have a license agreement with The Celotex Corporation under this pending patent application at a royalty rate of \$5/M.

Gypsum Joint System

An action has been received on this patent application with the usual rejection of all claims. We will have to be more definitive in our description of the adhesive used with the gypsum filler. This is considered an important patent in view of the ever increasing costs of manufacturing joint system with limestone and casein. Revisions will be pursued through Synnestvedt and Lechner so we can have the patent allowed.

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S U M M A R Y

The highlights of gypsum research in the first half of 1970 have been:

1. The development of a formula and continuous method of manufacturing a predecorated ceiling board for mobile homes. The first shipments of the product, which is called "PreDec", were made in February. We have already shipped over two million feet this year.

The most important thing about PreDec is that we make about 23% profit. We were fortunate in having some conveying equipment at Acme and some mixing equipment at Brunswick that could be used to manufacture PreDec, so the investment was only about \$20,000. We should sell 10 million feet of PreDec per year, and if we do the return on investment will be about 650%.

2. We have recommended that the company enter the field of mastic adhesives after an extensive investigation of formulas and manufacturing methods. These water base adhesives, which are dispensed from tubes, are used to install plywood paneling and gypsum wallboard. The product was field tested and has been judged acceptable. We should return \$80,000 annual profit with a \$60,000 investment. For the most part, we will be using our existing joint system facilities to expand the company sales and profits with this new product.
3. Acme is closer to a complete change from limestone to air separated gypsum as the basic filler in their joint system products. We are already beginning to realize savings that will eventually reach \$100,000 per year at Acme. Based on this progress, it has been recommended that a joint system plant be built at Sigurd with air separated gypsum as the major filler. The cost of a joint system manufacturing facility at Sigurd will be about \$75,000. Sales has projected that we can return \$46,600 per year on sales of \$417,200.

We have learned through experience that our chances for success in developing a new product is much greater when there is a ready market for the product. This was shown in the past 6 months by the instant success of PreDec as compared to the disappointing performance of our Radiant Heat Panels. We still believe that sales of the Radiant Heat Panel will grow, but it will probably be on a gradual basis and over a period of years as the market for electric heating increases. We have de-emphasized radiant heating in order to concentrate on products where we have ready made markets such as firedoor filler, mastic adhesives, and cost savings programs such as gypsum filler for joint system. One exception to this is the project to develop a tapeless joint system. This product would be used in factory built homes, an important future market. We are also trying to bolster sales of present product lines by conducting essential fire and sound tests or by developing partition

systems that will give us substantial technical advantages in selling our major products. A more detailed account of each project is included in the body of this report. Also shown are the 6 months sales and profit figures for some of the products that have been developed by gypsum research. These products contributed 8.7% to the Division sales and 44.3% to Division profits in the first half of 1970.

Every project undertaken by the Research Department has a profit objective. All projects are approved and reviewed by Sales and Manufacturing Department Managers to assure that our efforts are being spent in the best interest of Georgia - Pacific.

SIX MONTH SALES AND PROFITS OF PRODUCTS DEVELOPED THROUGH RESEARCH

January 1 - June 30, 1970

<u>Product</u>	<u>Sales Volume</u>	<u>List Sales</u>	<u>Gross Profit</u>
Denscote Base (all)	6,442 MSF	\$ 226,978	\$ 28,445
Tile Backer Board	5,622 MSF	379,005	142,942
1/4" Sound Deadening Board	3,382 MSF	103,547	19,730
Radiant Heat Panels	119 MSF	45,834	616
PreDec Wallboard	2,178 MSF	124,681	28,593
Ready Mix	401,126 Pails	1,228,156	135,956
Ready Mix	3,272 Cartons	7,908	(649)
Triple Duty	2,205 Tons	273,744	31,805
Denscote Plaster (all)	1,380 Tons	75,711	10,853
Ram Process Plaster	94 Tons	8,400	4,542
Tooling Plaster	.2 Tons	10	3
Thermostats	480 Each	2,863	708
Insulated Nails	140 "M"	1,076	204
Bestex A	860 Tons	110,498	4,975
Bestex B	68 Tons	11,532	591
Bestex C	132 Tons	21,495	(1,345)
Bestex D	156 Tons	<u>17,956</u>	<u>330</u>
TOTAL		<u>\$2,639,394</u>	<u>\$ 408,299</u>

PRODUCT IMPROVEMENT

1. Gypsum Filler for Joint System

The main reason we are so interested in using gypsum rather than limestone as a filler for joint system is to reduce the raw material costs at Acme. We presently pay about \$20 per ton for limestone at Acme, and we can make the gypsum available for \$3 per ton, or perhaps less. There are some other side benefits to be gained such as having higher quality products and less complicated formulas with fewer raw materials to inventory. In spite of the advantages, we have had some problems in making this transition. The gypsum formulas contain vinyl adhesives, and as such are different, so we have had to do a lot of formulating to make them acceptable. We have also encountered some resistance from sales in making such a drastic change. The gypsum vinyl formulas aren't compatible with our competitive casein/limestone formulas, therefore causing complications. This has necessitated a lot of field testing. The latest trials, however, indicate that our gypsum products are not only satisfactory; they are superior to the old casein limestone formulas, and we stand to gain more business in addition to reducing the raw material costs. All of this has been very timely as Acme's volume of joint system had been slipping as a result of the joint system business in their shipping area being so competitive. In addition to the raw materials costs, our labor costs at Acme are high, and the lower volume of business only makes the situation worse. We are planning to meet this competition in order to get the volume up and we'll need lower costs to get the job done. A modernization of the equipment at Acme will be considered along with the program to reduce raw material costs.

Our success at Acme with the gypsum formula has induced us to look at Sigurd as a potential joint system producer. We are not currently competitive on the west coast with joint system. If Sigurd had to use limestone at \$18 to \$20 per ton, they wouldn't be able to compete in the market place, but the gypsum formulas will allow us to compete in the northwest and in certain areas of the southwest as well. After all the figures were put together, a Sigurd joint system plant looks like a good moneymaker.

As we gain more experience using gypsum in joint system, we may wish to consider the economics of a similar change at Chicago and Akron plants. Marietta will not be considered because of the low cost limestone they have available. We expect the savings at Acme to exceed \$100,000 annually when they have made the complete transition. The potential savings at Chicago and Akron would be less because of the higher ratio of gypsum/limestone costs at those locations. Even if the savings are half what they are at Acme, it will still be worthwhile looking into.

2. New Textures

We have never been much of a factor in the marketing of joint system textures that are applied to walls and ceilings. The business is substantial, but we have never had competitive products. With Sigurd as a potential joint system producer it will be essential to have a line of texture products that we can offer. The reason is the large amount of texture used on the West Coast, and the fact that it is sold in conjunction with the other joint system products. We have assigned a high priority to this project so we'll be ready to go with textures as soon as possible at Acme and before the Sigurd plant starts. Most of the effort will be with gypsum as the filler, but limestone textures will also be investigated. We will be seeking:

- a. a polystyrene aggregated texture for ceilings
- b. a vermiculite aggregated texture for ceilings
- c. a perlite aggregated texture for ceilings
- d. a non aggregated texture for walls

The formulating is well underway, and we expect to begin field testing by late summer.

3. Speed Set Joint Compound

In the last 6 months of 1969 we reformulated our old One Day Joint Compound and Sales renamed it "Speed Set". This product overcame the previous problems of coarseness and poor workability and also eliminated the necessity to prime before texturing. The initial experience with Speed Set indicated that it gained viscosity after initial mixing and was overly plastic. Some revisions were made to overcome these objections, and the reports coming from the field now are very favorable. A new bag was designed in order to escape the unfavorable reputation of the old One Day Joint Compound.

4. Round Edge Board

Tolerances and specifications for our Round Edge Wallboard were established after consulting with our patent attorneys. Our Round Edge Board is distinctively different than the patented edges of U.S.G. and National Gypsum, so we are outside their claims. In addition, our edge has some advantages over the others. These are; 1) smaller groove so less joint compound is required to prefill the groove, 2) the score mark gives us more control over the curvature so our edges are more uniform than U.S.G.'s, and 3) the smaller groove permits taping with "Speed Set" without having to prefill the groove first. We are seeking a patent on our edge and have offered to license others to manufacture our type round edge board. The

PATENT SECTION

1. Round Edge Board

The patent application for our method of manufacturing round edge wall-board was submitted to the patent office in March. We also offered to license all other gypsum companies to manufacture round edge board by our method. So far, we have no takers.

2. Firestop Improvement

We had received an action from the patent examiner rejecting our patent claims on the clay-vermiculite-glass fiber Firestop formula. A number of tests have been involved to counter the examiner's objections. Our current patents will expire within 3 years, meaning that royalties of approximately \$250,000 per year will cease unless some means can be found to extend them. If we can have the improvement patent allowed, we should retain about 25% of our royalties. This makes our efforts on this patent worthwhile.

3. Gypsum Filler for Joint System

We have been preparing a patent application covering the method of using gypsum as a filler in joint system. This has substantial economies and we want to protect our advantage. If we can force other companies to consider using gypsum in order to compete with us, we may have some licensing possibilities.

4. Radiant Heat Panel

We will not pursue a Canadian version of our Radiant Heat Panel unless there is some definite licensing possibility in Canada.

S U M M A R Y

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The last six months has been a difficult period for business in general and particularly for the building materials industry. This type of business climate tests the strength of a corporation, and the manufacturer who can produce and sell his products most efficiently is able to weather the storm better than his competitors. Our job in research is to supplement the efforts of others in equipping our Division to meet the challenge of difficult market conditions. It is also our job to develop new products and to find new ways of using our present products so we can continue to grow in spite of the market conditions. Our last six months progress toward these objectives are summarized as follow:

1. In 1968 we made a formula change to Type X 5/8" Firestop that saved us \$140,000 in raw material costs during 1969. Now we have achieved a weight reduction for 5/8" Type X Firestop which will save another \$45,000 annually beginning January, 1970. The lighter weight will mean better customer acceptance, too.
2. We found a way to use gypsum as the basic filler instead of limestone in our joint system. This is expected to save Acme at least \$36,000 next year. This will also pave the way for us to expand our markets for joint system products.
3. We are determined to find a way to use gypsum as the filler in firedoors. The market for firedoors is substantial and the economics are all in our favor if we can satisfy the product requirements. We will be making up some doors with gypsum filler at Curtis' New London plant in January.
4. We have a demountable partition system that just might be better than any competitive system. This may be our entre' to sell more wallboard for commercial construction.
5. We are investigating the possibility of manufacturing a line of mastic adhesives. Our experience in joint system adhesives and our captive market for panel adhesive (Distribution Division) make this an attractive venture.
6. The growth of electric heating is expected to boom in the seventies. We installed a pilot plant to manufacture Radiant Heat Panels at Wilmington and are considering another installation on the West Coast. We are looking for the sales of Radiant Heat Panels to reach several million dollars during the next few years.

7. With factory built homes on the rise, we are accelerating our investigation of a tapeless joint system. This has great potential for factory homebuilders who can't stand the long drying periods required for conventional joint system.
8. A special predecorated board for mobile homes has been developed and a small line for manufacturing this product is being assembled at the Acme, Texas plant. We expect to be marketing the product shortly after the first of the year.
9. We have participated heavily in the Gypsum Association program to prove the value of a gypsum wallboard fire barrier for roof construction. If successful, this would be another outlet for gypsum wallboard.

Since 1963 approximately \$1,250,000 has been invested in gypsum research (total of 7 years research budgets). New products developed since 1963 contributed \$815,069 to the Division profit in 1969, so the annual return of investment was 65%. This doesn't include costs savings or sales increases which are only reported for the year in which they occur. The graphs on page 3 and 4 show the increasing contribution of new products to the sales and profits of the Division.

We were under our 1969 budget of \$243,000 by \$30,000. This was largely due to less outside testing than had been anticipated. \$228,000 has been budgeted for 1970 which will permit us to carry out all the present project objectives. At the request of management, we postponed the capital investment for a building to be used in product application testing and evaluation. This will be a valuable addition to our facilities, so we are hopeful that it can be constructed in 1970.

We took a step in the direction of offering greater opportunities to our research people when George Fowler was transferred to the Blue Rapids plant. Keeping the doors open between departments will not only stimulate individual opportunities, but be a long term benefit to the company by qualifying more people for key jobs and promoting greater understanding between departments. We have hired Mr. James H. Groat, ~~and~~ Portland State graduate with homebuilding experience to replace George Fowler. We've also started an industry/education co-op program with Mt. Hood Community College. Each 3 or 6 months we will get a new student with the first one returning to school. This program will supply us with technicians and evaluate cooperative education for the first time in the Northwest.

We look to 1970 and the years ahead with great expectations and the confidence that we'll make some significant contributions to the strength and growth of our Division.

NEW PRODUCTS

SIX MONTH SALES AND PROFITS OF PRODUCTS DEVELOPED THROUGH RESEARCH

July 1 - December 31, 1969

<u>Product</u>	<u>Sales Volume</u>	<u>List Sales</u>	<u>Gross Profit</u>
Denscote Base (all)	8,419 MSF	\$ 306,022	\$ 57,487
Tile Backer Board	3,998 MSF	269,241	115,113
1/4" Sound Deadening Board	3,573 MSF	108,937	26,003
Radiant Heat Panels	144 MSF	53,808	9,363
One-Day Joint Compound	76 Tons	11,307	1,276
Triple Duty Joint Compound	2,341	298,292	50,307
Ready Mix - 5 & 1 gal.	276,146 Pails	857,309	117,975
Ready Mix - 5 & 4 gal.	4,338 Cartons	13,122	1,553
Bestex A	846 Tons	110,109	6,098
Bestex B	33 Tons	5,478	(404)
Bestex C	206 Tons	33,842	(2,313)
Bestex D	48 Tons	7,323	(61)
Denscote Plaster	1,566 Tons	89,137	6,613
Ram Process Plaster	66 Tons	5,901	3,379
Denscal HP	211 Tons	13,441	3,996
Thermostats	326 Each	1,950	515
Insulated Nails	204 M	<u>1,569</u>	<u>300</u>
TOTAL		\$2,186,788	\$ 397,200

is John - Mansville's Fesco board. The object is to reduce the weight of the panel. The lay-in radiant heat tile would be a system for commercial building, either as the basic source of heat or a supplementary heat source. Experimental radiant lay-in tiles have been fabricated with and without vinyl facing and with a variety of different backing boards. An insulating backer is of more value here, since it could be thicker and possibly eliminate additional insulation over the panels. Thus far, only preliminary work has been done on these products. We won't go much further until we get some indication from sales as to whether these products fit into our marketing plans and are worth pursuing.

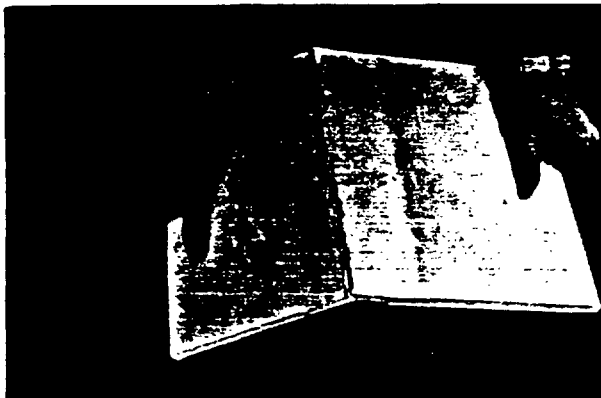
TAPELESS JOINT SYSTEM

Earlier in the year Don Klus discovered a method of using a two component resin (epoxy or polyester) to reinforce joints in gypsum wall-board and eliminate the tape. It was shown that an application of the proper thickness would result in a joint that was stronger than the board. In one demonstration an 8' x 8' panel was subjected to the ASTM E-72 racking test. All the joints were treated with the polyester resin material. The panel failed when the nails pulled through the boards, but the joints did not fail. This is the result obtained with taped joints. If the joints were not properly reinforced, they would have cracked during the test. It has been found necessary to have dry resin film thickness at the joint of at least 0.015" in order to be of sufficient strength. We also found that it was advisable to have a band of resin reinforcement about 1" wide or 1/2" on each side of the joint. If the resin reinforcement is located only between the edges of the boards, the paper plies at the edges will separate and there will be insufficient joint strength. A special board with a 1/2" to 3/4" wide by .050" to .060" deep taper was made. This seems to insure sufficient width and depth of the resin reinforcing without wasting the material. Another advantage of the narrower joint is that it is much easier to finish.

Considerable time was devoted to the formulation of the tapeless compound. The first formulas were very tacky and difficult to apply. The current formulas are now better working, and this may not be a serious drawback. Other characteristics evaluated were the optimum resin content, type and quantity of hardeners, effect of temperature on hardening rate, etc. Quite a bit more work will have to be done

to explore all the possible combinations of resins and hardeners. If we apply for a patent, we will probably have to evaluate a number of different resins as well.

The field testing of the tapeless joint compound has been confined to garages. Thus far we have finished three garages in order to assess the material and the method of application. We are at the point now where we feel we are ready to enlarge the scope of the field testing. We have arranged with Schulte Mobile Homes of Middlebury, Indiana to do a complete 52' x 24' modular home unit with the tapeless system. We are not ready to expose the system to the normal field applicators, but we believe that we are far enough along to do a factory built house. The important differences are 1) conditions can be better controlled in the factory, and 2) our system has more to offer to the factory homebuilder because of the fast cure time which is possible. This field trial will take place early in 1970. The picture below shows that the joint formed by the tapeless compound is stronger than the board.



IMPROVED PRODUCTS

5/8" TYPE X FIRESTOP

Some very practical improvements were made in our 5/8" Firestop. This was accomplished by a successful fire test of a wood floor protected by 5/8" Type X Firestop on the underside. We had previously received U. L. approval to use the Type X (instead of Type XXX) 5/8" Firestop on wood frame walls. U. L. refused to grant the one hour protection to ceilings, necessitating this test. The test has resulted in the following benefits:

1. A one hour rating for a wood joist floor-ceiling with 5/8" Type X Firestop.
2. Approval to use 24" to 54" wide board and elimination of the taping as a qualification of the rating. This lends a great deal of flexibility to the use of 5/8" Firestop for ceilings.
3. A weight reduction from 2,375 lbs./M to 2,300 lbs./M. This will make possible an annual savings of about \$45,000 because of lower raw material costs and freight savings. The lower weight will also help gain better customer acceptance.

GYPSUM FILLER FOR JOINT SYSTEM

Right after we had decided to begin field testing a gypsum formula with Monsanto's vinyl adhesive, Monsanto raised the price of the adhesive from \$.48/lb. to \$.60/lb. This upset the economics of using the gypsum filler, and we advised Monsanto that we were not interested in the adhesive at the new price. They came back to us with a \$.52/lb. price based on our use of a reasonable volume. The transition to gypsum Ready Mix did not involve the Monsanto adhesive, so this change was made. The annual savings will be about \$14,000 based on Acme's 1969 shipments of Ready Mix. We have resumed the investigation to changeover the All Purpose, Bedding, Topping, and Joint Compound to gypsum using Monsanto's vinyl adhesive. If this can be accomplished, it will mean another \$22,000 in savings. This doesn't include Triple Duty, which will offer an additional \$34,000 savings if we can use gypsum in it. All the computations were on the basis of fine ground gypsum at \$6/ton. A mechanical handling system for the gypsum would

add another \$2 to \$3 savings per ton of joint system produced. The total potential raw material savings at Acme is \$80-\$90,000 annually if we are successful with all these changes. The reduction in the number of formulas (All Purpose, Joint Compound, Bedding, and Central Mix are all the same) will make it easier for the plant to inventory finished products. The simpler formulas will also mean less raw materials inventories.

Based on the use of gypsum as the primary filler, we have submitted a proposal for a joint system plant in Sigurd, Utah. A conservative projection is for sales of \$650,000 and profits of \$100,000 from this operation.

SETTING TYPE JOINT COMPOUND

Our sales of One Day Joint Compound have dwindled to less than 200T per year. The market for this product has grown because of the round edge board which is being used. The setting type joint compound is being used for the prefill coat in round edge board construction. The One Day was re-formulated and a finer grade of molding plaster is being used for the base. The product name has been changed from "One Day" to "Speed Set" and the bag has been redesigned. We are expecting increased sales in 1970 as a result of the improvements in the formula.

LOWER COST VINYL LAMINATING ADHESIVE

We are currently paying \$.29/lb. for the adhesive used to laminate vinyl to wallboard in the manufacture of Eternawall. We have been seeking a lower price adhesive as a means of reducing our costs of lamination. Thus far, two emulsions show promise; Union Carbide's 7-76-C and DuPont's Elvace 1873. These emulsions will cost us about \$.17/lb. Based on an annual production of 8 million square feet of Eternawall and an adhesive usage of 15 lbs./M, the projected annual savings is \$14,400. As soon as Wilmington comes on stream with their vinyl laminator, these savings should double.

PATENTS AND LICENSING

PATENTS

1. Radiant Heat Panel

A patent application was filed covering the composition of our Radiant Heat Panels.

2. Gypsum Filler for Joint System

Synnestvedt and Lechner are preparing an application covering the use of gypsum as the primary filler in joint system.

3. Round Edge Wallboard

Synnestvedt and Lechner are preparing a patent application covering the method of forming round edge board devised by the Wilmington plant. This will be sort of a nuisance patent to keep us from being shut out by other patented edges.

4. Tapeless Joint System

We are preparing a patent application on the tapeless method of joint finishing. We are waiting to see what happens on the first field trial, but this is a real breakthrough and we should probably seek protection even if commercial possibilities are limited at the moment.

5. Demountable Partition System

A patent search indicates that this partition construction is patentable. We are, however, waiting for the results of field tests which are planned before an application is prepared.

Our philosophy is to seek patent protection only when it will give us a technical advantage that has good prospects of profit. Each situation is reviewed periodically during preparation and application of the patent to be sure the investment in patent protection is justified.

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S U M M A R Y

General

We seem to be at the end of an era in the Gypsum Industry. The steadily increasing supply of gypsum products with little change in demand has resulted in a fiercely competitive marketplace. This new climate is being reflected in our approach to research. Our greatest needs now are better economics for the existing products and completely new outlets for gypsum. These primary objectives will be apparent in this report of the activities of the Research Department for the first six months of 1969.

New Products

The performance of new products developed through research is shown on page 4. The sales from these products represent 9.1% of the Division Sales and 10.5% of the Division profits for the first six months of 1969. This compares with 5.2% of sales and 4.0% of profits for the same period in 1968.

In January we began to market the newly developed Radiant Heat Panel from our Wilmington plant. Sales for the product have not developed as rapidly as we would like thus far, but the electrical industry predicts a fantastic growth for electric heating in the next few years. We are convinced that our Radiant Panels will be a part of this growth. Until the demand is greater, profits will be restricted, but the availability of the panels should be an asset to the sales of our regular wallboard.

Progress has been made toward the use of gypsum in firedoors. Our goal is to be marketing an Underwriters gypsum firedoor by the end of the year.

One disappointment occurred when we decided to abandon the molded grainboard. The chances of economically producing molded grainboard had become so slim that future investment in the project could not be justified.

Improved Products and Cost Savings

The release of a Type X 5/8" Firestop has lowered our raw material costs and has resulted in a savings of \$54,515 in the first 6 months. We may surpass the estimated annual savings of \$100,000.

The substitution of gypsum for limestone as the major filler in joint systems at Acme is close to becoming a reality now. Field and market testing of the individual products are underway. Annual savings on the order of \$25,000 are expected at Acme. Larger savings were anticipated, but Monsanto unexpectedly increased the price of the adhesive we are using. Our ability to use gypsum as the major filler in Joint System may also enable us to produce these products economically at Sigurd.

A significantly improved One Day joint compound is being offered, and we expect to see a sharp upturn in the sale of this product.

Sales Services

We have obtained two column fire ratings for the 5/8" Type X Firestop by passing the 3 hour test at Underwriters. This will help us sell more of the Type X rather than the Type XXX. This is very desirable in view of the lower cost of the Type X.

SIX MONTH SALES AND PROFITS OF PRODUCTS DEVELOPED THROUGH RESEARCH

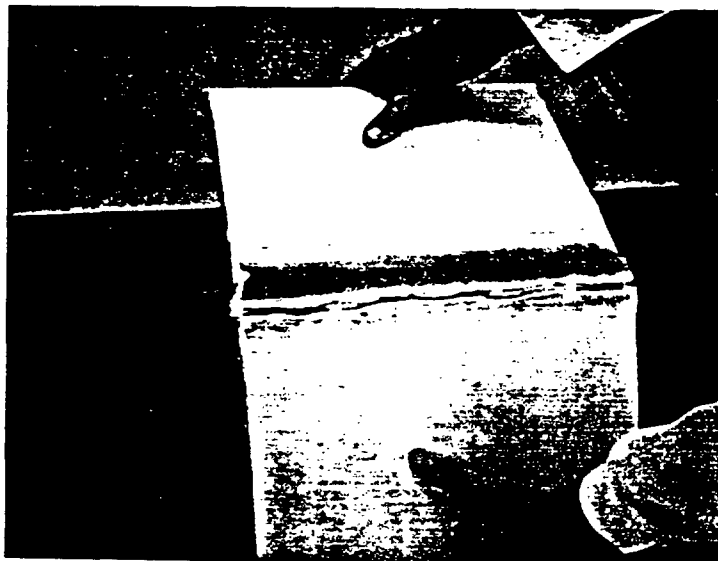
January 1 - June 30, 1969

<u>Product</u>	<u>Sales Volume</u>	<u>List Sales</u>	<u>Gross Profit</u>
Denscote Base (all)	10,736.1 MSF	\$ 408,083.46	\$ 76,263.25
Tile Backer Board	3,939.9 MSF	286,878.04	130,920.44
1/4" Sound Deadening Board	4,552.8 MSF	135,154.72	30,738.15
Radiant Heat Panels	48.1 MSF	16,972.80	3,483.21
Radiant Heat Board 1/2"	1.7 MSF	307.73	38.31
Triple Duty Joint Compound	2,875.7 Tons	373,279.04	58,523.36
One-Day Joint Compound	60.2 Tons	9,110.81	1,183.74
Ready Mix	247,094.3 Pails	796,882.31	107,688.90
Bestex A	644.6 Tons	84,851.46	3,815.14
Bestex B	33.8 Tons	5,822.44	181.31
Bestex C	124.3 Tons	21,041.26	(1,662.75)
Bestex D	29.9 Tons	4,542.70	107.03
Denscote Plaster (all)	1,510.6 Tons	87,066.11	1,245.74
Thermostats	128.0 Each	697.32	154.31
Insulated Nails	72.5 M	537.07	87.26
Ram Process Plaster	31.5 Tons	3,124.31	1,839.02
Denscal HP	221.6 Tons	<u>12,878.62</u>	<u>3,253.22</u>
TOTAL		\$2,247,230.20	\$417,859.64

III. New Method of Joint Treatment

An evaluation of a number of different resins has turned up one particular polyester which is better than any of the others. The addition of filler to the resin makes it fairly easy to apply and it still imparts sufficient strength to make the joint stronger than the board in applied thicknesses of at least 0.015". This is a two component polyester resin with the set controlled by the amount of catalyst. This method of joint treatment appears to be a natural for prefabricated housing.

A more comprehensive test program is in progress to thoroughly evaluate this system and its economics. Below is a picture of two boards treated with the tapeless compound. The boards, which are held together with the tapeless compound, were placed on a table with the joint lined up with the edge of the table. As shown in the picture, the break occurred in the board rather than at the joint.



I M P R O V E D P R O D U C T S S E C T I O N

I. One-Day Joint Compound

During some work toward the improvement of our One-Day it was found that the old product contained coarse particles that made it totally unsatisfactory. At our recommendation, the manufacture of One-Day was discontinued until such time as we could make a satisfactory product. A formula was developed which provides for superior working properties to the old formula and in addition does not require priming prior to decoration that was necessary with previous material.

A double whizzer air separator was purchased at Acme and installed on the Raymond Mill. This air separated land plaster was subsequently calcined to provide a base stucco for One-Day which was free of coarse particles. The finer stucco along with the improvement in formulation was successfully field tested and has been released. Our sales of One-Day joint compound had decreased to the point where we sold only 300 tons last year. The quality improvement of One-Day plus the increasing market for setting type joint compounds (for round and bevel edge board) should result in a substantial increase in the sales of this product. There is a slight increase in the raw material cost of the new formula, but the additional sales should more than offset this.

II. Water Resistance of Tile Backer Board

We found some pieces of tile backer from one of our western plants that did not pass the ASTM specification for water resistance; in fact it wasn't even close. A discussion with manufacturing resulted in a comparison of tile backer from each of our plants with competitive products. These tests showed:

- A. That only a few plants were making a product which came close to the 5% maximum water absorption.
- B. A few plants were producing tile backer with practically no water resistance.
- C. Two out of three competitive products were well within the specifications.

As a result of these findings, it was recommended that tile backer be made at only those plants which can come close to the required water resistance. Some suggestions were offered in the hopes of improving the results at the plants where the product is manufactured.

III. Gypsum Filler for Joint System

A complete line of joint system products using a gypsum filler were developed by Mr. Robinson. These products were based on a modified polyvinyl alcohol developed by Monsanto Chemical Company called RS-6219. This adhesive imparted the water resistance necessary to be able to use gypsum as a filler without getting into decoration problems.

The second phase of this project was to have a fine gypsum land plaster available as the primary filler. This was accomplished by the installation of a double whizzer on the Raymond Mill at Acme. This air separation provides a gypsum filler with practically the same particle size as the limestone filler we use.

Based on the \$.48 per pound price quoted by Monsanto, we calculated savings for each product and visualized annual savings at Acme approaching \$100,000. On this basis, we set out to manufacture and field test topping, All Purpose, Triple Duty, and a central mix (dry powder ready mix) with the RS-6219 and gypsum filler. Monsanto pulled the rug out from under us when they suddenly and unexpectedly raised the price of RS-6219 to \$.60 per pound. There are still savings that can be made in some products, but nothing compared to what we had anticipated. We are now proceeding on a somewhat slower basis, but still with the objective of replacing the casein products at Acme with gypsum filled vinyl compounds. The potential advantages are:

- A. Greater profits through reduced raw material costs.
- B. Greater sales as a result of higher quality vinyl products.
- C. Fewer complaints and rejects due to simpler formulas with less to go wrong.
- D. Lower inventories because of fewer raw materials required.

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F O R E W O R D

This is the semiannual report of the Gypsum Division Research Department for the period of July through December 1968. We have reported annual as well as semiannual results since this is the year end. As in the past, we have used profits generated by products developed through research as the chief measure of our performance. This does not include cost reductions or sales increases coming from research. Both of these are reported in the year in which they occur but not thereafter. The percent contribution of new products to the profits of the Division dropped slightly in 1968. This was due to sharply lower profits on Ready Mix and Triple Duty which were brought about by the market preparation for the Chicago and Marietta Joint System plants. We are confident that this is a temporary hesitation in the trend of an increasing new product contribution to Division results. This upward trend is shown by the graph on the next page. The 1968 return on our investment in gypsum research was -

1968 Profits From New Products Developed Since 1961 =
*Investment In Research Since 1961

$$\frac{\$618,340}{\$1,150,000} = 53.8\%.$$

* Does not include capital investments.

A summary of 1968 activities, a detailed account of the last six month's research activities and the prospects for 1969 are included in this report.

1968 MARKET PERFORMANCE OF PRODUCTS DEVELOPED THROUGH RESEARCH

<u>Unit</u>	<u>Product</u>	<u>Sales Volume</u>	<u>List Sales</u>	<u>Gross Profit</u>
MSF	Dens-Cote Base (all)	22,184	886,890	226,264
MSF	Tile Backer Board	6,575	490,300	218,960
MSF	1/4" Sound Deadening Board	5,575	171,177	40,272
MSF	Radiant Heat Panels	7.8	2,910	1,020
Tons	One Day Joint Compound	270	34,255	2,441
Pails	Ready Mix	308,691	1,030,007	46,900
Tons	Triple Duty	5,874	809,777	42,505
Tons	Grabit	143.5	18,504	5,108
Tons	Bestex A	1,208	158,005	1,747
Tons	Bestex B	46	7,330	(1,819)
Tons	Bestex C	287	46,660	(5,493)
Tons	Bestex D	37	6,925	1,644
Tons	Dens-Cote Plaster	3,196	174,331	28,614
Rolls	Dens-Cote Tape	6,737	14,961	3,123
Tons	Ram Process Plaster	99.5	8,998	4,924
Tons	Denscal HP	170	9,767	2,144
			\$3,870,797	\$618,354

S U M M A R Y

RESEARCH BUDGET

\$238,000 was budgeted for gypsum research in 1968. We overspent by \$10,000 because of higher than expected pilot plant development costs in conjunction with molded grainboard. The chart on page 7 shows the distribution of the investment in gypsum research. A budget of \$247,000 has been approved for 1969.

NEW PRODUCT DEVELOPMENT

1. An all out effort on the radiant heat panel project has enabled us to progress to the point of having a limited number of panels available from Wilmington by January 1. In February we expect to be continuously producing panels on a profitable basis.
2. The new grainboard belt has just arrived in Brunswick and some other equipment revisions have been completed. We are at the final stage in determining whether molded grainboard can be manufactured and marketed economically.
3. The development of a gypsum fire door has been resumed. One of the problems has been to get test doors made for evaluation. The acquisition of Curtis Door should provide the means for getting over this hurdle. We need a lightweight gypsum block which will have the necessary physical properties and still be within our cost limits.
4. A completely new joint finishing technique has been discovered by Don Klus. It involves the use of a synthetic resin which has sufficient integral strength to eliminate the need for a reinforcing tape. As with most breakthroughs, much remains to be done to make the method practical for the contractor and profitable for Georgia-Pacific.

IMPROVEMENT OF EXISTING PRODUCTS

1. An unsuccessful fire test was turned into a favorable result when Ray Hinkel persuaded Underwriters' to grant us a type x 5/8" Firestop by interpolating from the test which failed. The board which U.L. has extended to us will save the company \$95,500 based on the sales of 5/8" Firestop in 1968. This formula will then be made available to our licensees for a \$2000 base fee and the standard royalty rate.
2. Based on our development and field test experience, an air separator will be installed at Acme to furnish a fine ground gypsum filler for ready mix. The substitution of fine ground gypsum for limestone will save 11¢ per five gallon pail or \$6,600 based on next years projected ready mix sales at Acme. If Acme is successful, a ready mix plant at Sigurd will be proposed. Sigurd is already making some textures with gypsum as the filler. The primary objective is the new business to be gained by having joint system available on the West Coast.
3. The hard end wallboard project has been discontinued because it did not create any spontaneous enthusiasm from the field and because the plant seemed to be unable to keep the process operating continuously.

SALES SERVICE

1. The one hour rating for the Dens-Cote/metal stud system was achieved. This is the rating Sales has been so anxious for us to get.
2. At the request of Marketing, a paper tape joint reinforcement method has been developed for the Dens-Cote system. This will be another alternative application for us to promote.
3. Pilot fire tests were made on partitions for Hill Rom Corporation and Angeles Metal Systems. These were requested by Marketing on the basis of developing future Firestop sales.

been to get some doors made so they can be tested. The acquisition of Curtis Door has provided us with a means for getting test doors made and will reciprocate by developing a low cost fire door for Curtis to sell along with their regular doors.

Some progress has also been made in formulating a fire door material. The use of Denscal as opposed to molding plaster requires less resin reinforcing in the foam and results in a lower raw material cost. It has also been found that a finer cell structure produced by higher speed agitation of the slurry will give greater strength at the same density. A number of fire door slabs will be cast using the new techniques and sent to Curtis. We will also ship some 1/4" sound deadening board which will be used to make a hollow core fire door. Doors will be made from both products and shipped to Tigard for testing.

Thus far, we have tested one competitive fire door (1 hour rated) in comparison with a layer of gypsum filler. Our filler performed significantly better in temperature transmission than the door with Kaylo (calcium silicate) filler. We have not yet run the hose stream portion of the test, but we can't conduct a fair test until we can make some doors with our filler material.

4. New Joint Treatment Method

It has been found that some epoxy and polyester synthetic resins are as strong as paper joint tape, even in thin applications. Sample joints have been made and found to be stronger than the board in many cases. This will be a major breakthrough if these resins can be adapted to the joint treatment application. A patent search did not reveal any prior art, so it appears that we may be able to get a patent. This project was delayed to permit work on manufacturing equipment for the radiant heat panel. We will resume this development as soon as possible. Evaluation of different resins, formulation to improve application properties and evaluation of methods of application will be the major areas of investigation.

IMPROVED PRODUCTS SECTION

1. Type X 5/8" Firestop

In the first half of 1968 a 5/8" board weighing 2275 lbs and containing 4 lbs of glass fiber/M and 20 lbs of raw vermiculite was tested on wood studs in an effort to get an hour rating. The test lasted only 57½ minutes. Subsequently, a series of tests were conducted here on the pilot furnace using various Firestop formulas at various weights and with varying quantities of raw vermiculite. We came to the conclusion that we would have a difficult time passing the test regardless what changes were made.

Ray Hinkel was able to convince U.L. that they should extend a 5/8" type x formula based on our unsuccessful test and the competitive tests that have been run. We proposed to let U.L. choose the weight and thickness limitations and Underwriters' agreed to conduct a study for no more than \$500. Another fire test would cost over \$2000, so we made application for the study after having assurance that U.L. would extend a board with reasonable specifications. The study was completed and we now have U.L. approval for a 5/8" type x board with the same formula we tested, but with 2375 lbs minimum weight and 0.615" minimum caliper. We could have gotten a 2350 lbs weight minimum, but the minimum caliper would have been 0.630". It was felt that it would be less restrictive to accept the extra 25 lbs than the increase in thickness.

The lower raw material cost will more than make up for the higher minimum weight, so we will change over to the 5/8" type x formula. We do not expect to get much demand for the 5/8" type xxx, so it will only be manufactured on special order. The transition to the type x formula will begin to take place in January 1969.

2. Gypsum Filler For Joint System

a. Ready Mix

Field trials were conducted on a ready mix with fine ground gypsum replacing limestone as the main filler. To have been able to make a direct substitution would have saved 17¢ per five gallon pail. Unfortunately,

the substitution of gypsum for limestone did not result in a satisfactory end product, so other formula changes were necessary. After the other changes which were deemed necessary, there is still an 11¢ per pail savings. It is our opinion that the gypsum formula is superior to the old limestone formula. The favorable field trials in Portland, Seattle, Dallas and Omaha seem to confirm that we have a satisfactory product. Some of the trials were made with an air separated gypsum and indicate that this material will be as good as the ground gypsum used in the initial trials. Acme will install the air separator which came from New Orleans. As soon as we have the fine gypsum available, we will begin making the transition at Acme. If their experience is good, we will recommend a ready mix plant at Sigurd using gypsum as the filler.

b. Textures

Two textures, Bestex A (no aggregate) and Bestex D (vermiculite aggregate), have been formulated using a gypsum filler. The gypsum used in the textures is regular landplaster since it is not necessary to have a special fine grind. Field tests have been only moderately successful, so reformulation is underway to make the refinements which will render the products acceptable. A number of competitors are furnishing a texture with expanded polystyrene. This aggregate has some advantages (it is white and is very lightweight), but special equipment is required to expand and grind the polystyrene. Our objective is to evaluate the texture market by making the vermiculite texture available before investing in equipment to use polystyrene. We have purchased enough raw materials at Sigurd to make 5 tons of texture which will be used for the market testing.

c. Other Joint System Products

Investigation is underway to develop Triple Duty, All Purpose and Laminating Compound formulas with gypsum. These formulas, along with the others, will be limited to Acme and Sigurd since it is cheaper to use limestone at the other manufacturing locations.

3. Hard End Wallboard

We applied resin to both ends of several million square feet of board at Acme. During this time nothing was said to see what reaction would come from the field. Much to our surprise, we did not receive any comment from the field other than a couple complaints when the boards stuck together. We received even more complaints from the plant because of their inability to keep the end sprays functioning. In view of the lack of enthusiasm from both Sales and Manufacturing, it has been decided to abandon the hard end project.

4. Joint System Formula Improvements

Thirty different emulsions were evaluated as alternate binders for ready mix. These were boiled down to four. One, Union Carbide W-130, was field tested and has been added to the approved list. Another, Monsanto TS-85, is ready for field testing. Two others appear to be satisfactory, but field trials will have to be arranged. Purchasing likes to have a number of alternate sources for such raw materials so they can bargain for the best possible price. However, our inability to get field trials has stymied complete evaluation of these alternate sources.

Another vinyl adhesive from Monsanto called RS-6319 has been found. This adhesive is a particularly effective binder and offers water resistance which is something the other vinyls lack. Some experimental work is being done to see if this adhesive can be used to improve our Triple Duty and One Day joint compounds. We can especially stand some better working properties for One Day and if the decoration problem can be solved, we might even be able to increase the sales of the product.

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-Cote 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.

12 MONTHS 1967 MARKET PERFORMANCE OF NEW PRODUCTS

<u>Product</u>	<u>Sales Volume</u>	<u>List Sales</u>	<u>Gross Operating Profi</u>
Dens-Cote Base (all)	18,106.6	\$801,372.60	\$272,235.77
Tile Backer Board (all)	4,824.7	409,567.83	197,884.02
Gypsum Sound Deadening Board	764.0	30,168.65	9,617.16
One Day Joint Compound	292.9	50,168.98	11,210.74
Ready Mix	6,782.0	837,517.99	127,674.46
Triple Duty	4,885.0	735,909.21	172,559.93
Grabit Adhesive	74.4	11,073.37	4,207.96
Bestex A Texture	1,043.3	170,678.85	28,072.27
Bestex B Texture	41.0	8,115.44	72.46
Bestex C Texture	222.7	42,805.84	(2,083.65)
Bestex D Texture	1.0	165.00	9.35
Dens-Cote Plaster (all)	3,043.9	185,353.80	45,584.34
Dens-Cote Tape	1.2	18,099.07	5,332.58
Model Densite	.1	2.20	.33
Ram Process Plaster	37.3	6,050.22	3,380.30
Dnescal PR	.5	35.20	11.40
Denscal HP	0.	0.	0.
Tooling Plaster	0.	0.	0.
High Expansion Plaster	0.	<u>0.</u>	<u>0.</u>
 TOTALS		 \$3,307,524.00	 \$875,769.00

6 MONTHS 1967 MARKET PERFORMANCE OF NEW PRODUCTS

<u>Product</u>	<u>Sales Volume</u>	<u>List Sales</u>	<u>Gross Operating Prof:</u>
Dens-Cote Base (all)	10,452.3	\$468,296.17	\$169,231.36
Tile Backer Board (all)	2,694.7	232,895.11	113,571.94
Gypsum Sound Deadening Board	438.6	15,317.34	4,872.29
One Day Joint Compound	180.1	25,468.63	5,590.25
Ready Mix	3,632.4	427,326.03	63,066.03
Triple Duty	2,692.7	388,806.70	84,917.45
Grabit Adhesive	45.1	5,362.79	1,915.58
Bestex A Texture	616.2	101,691.66	18,215.63
Bestex B Texture	24.8	4,933.60	63.52
Bestex C Texture	121.2	22,560.45	1,241.59
Bestex D Texture	1.0	165.00	9.35
Dens-Cote Plaster (all)	1,370.3	83,743.11	21,304.96
Dens-Cote Tape	1.1	11,117.65	3,716.43
Model Densite	.1	2.20	.33
Ram Process Plaster	58.3	3,894.27	2,397.30
Denscal PR	.5	35.20	11.40
Denscal HP	0.	0.	0.
Tooling Plaster	0.	0.	0.
High Expansion Plaster	0.	<u>0.</u>	<u>0.</u>
 TOTALS		 \$1,791,526.00	 \$481,125.00

reduces end splitting of the paper and makes the end of the board harder and therefore less subject to damage in handling. It is our opinion that reducing beading at the end joints is attacking the problem where it is most prevalent. Furthermore, our method will not involve new materials or extra operations as does the U.S.G. method.

A spray system appears best for producing the hard end wallboard. The apparatus for applying the hard end treatment has been purchased, test operated in Tigard and sent to Acme, where it will be installed in their wallboard line between the end sawing and end bundling operations. Mr. Hollingsworth suggested adding a green dye to the resin treatment for identification and to use as a promotional aid. Tests are currently in progress to determine whether the green dye has any tendency to migrate through to the finished surface.

4. Lower Cost Sheathing - R&D 90

In view of the narrow profit in sheathing, an all out effort is being expended to reduce costs whenever possible. One approach was to make the edges square instead of tongue and groove. Sales, however, felt they could not sell a square edge sheathing because of the FHA requirement that the edges be tongue and groove. Reducing the weight and quality of the paper is another consideration being acted on by manufacturing. Still another potential cost reduction is to try some wax-rosin emulsions to see if they will make the core water resistant less expensively than the asphalt wax emulsion we now use. Trials are being conducted at the Akron, N. Y. plant to determine whether there are any savings to be gained from the emulsion.

5. Reduce Limestone Costs in Joint System - R&D 275

Two different limestones are used in our Acme Joint System products. One of these (Purestone) is cheaper than the other by about \$5 per ton. The more expensive limestone (Thompson Weiman marbledust) is used in the high volume products such as Topping and Triple Duty. A coarser version of Purestone was tried to make it more like the marble dust but there is still a difference in the working characteristics which we feel would adversely affect the working properties of the products. Any gain in raw material savings could easily be wiped out by a possible reduction in sales, so it is not worth the risk to make the change.

Another possibility for cost reduction is the substitution of gypsum for limestone in Joint System. While this is a more difficult objective to achieve, the potential saving is much greater than a mere limestone substitution would offer. There are two reasons why gypsum is not used as a filler in Joint System. Gypsum counteracts the alkali in the casein products and keeps the casein from going into solution. The casein must go into solution in order to provide adhesion. This would not be a problem in Triple Duty or Ready Mix since these products contain vinyl adhesives. The other problem is the inherent absorbency of gypsum. This causes the joint system

to be more absorbent than the wallboard paper and results in decoration problems. One approach is to use anhydrous gypsum. Another is to treat dihydrate gypsum with a waterproofing agent to give it the required properties. Both methods are presently under investigation.

D. P. K.

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S U M M A R Y

This report covers the activities of the Research Department for the first six months of 1967. This period has been marked with a number of unusual situations created by the move to Tigard.

Our Research budget for 1967 is \$221,400. In the first six months we have spent \$100,362. We will probably be under-budget by an even larger amount at the end of the year because of the loss of personnel. A chart showing the distribution of Research expenditures for this period is shown on Page 2.

The market performance of new products is shown on Page 3. The sales from products developed through Research represents 4.4% of the total sales for the Division. The profits from these products represent 4.2% of the Division total. Both sales and profits from new products are higher than for any previous six month period. The improvement in the profit figure has been helped by Ready Mix joint compound finally becoming profitable. Another factor was the new texture formulas that have increased the profitability.

In September of 1966 we introduced a new 5/8" Firestop with a lower weight limit. Based on the plant figures for weight reductions, the savings generated from this improved product in the first six months were approximately \$35,970. It is felt that even further savings can be generated when the plants are able to take fuller advantage of the lower weight limits. A breakdown of these figures by plants is shown on Page 4.

Other fire and sound testing is conducted as a service to the Sales Department. The fact that the sales of 1/2" Firestop was up 27.3% and 5/8" Firestop up 11.4% over the first six months of 1966 is an indication of the value of this expenditure.

These results are realized from the project work which follows the guidelines and objectives set forth by our Division Management. The project work of today will produce the results of the future. A progress report of the current R & D programs comprises the body of this report and is divided into the following sections.

Product and Process Improvement

Sales Service

New Product Development

Fundamental Research, Laboratory

Service and Testing

MARKET PERFORMANCE OF NEW PRODUCTS

<u>Product</u>	<u>Units</u>	<u>List Sales</u>	<u>Before Taxes</u>
Vinyl Tape Tile Backer	-	\$ 257.70	\$ 59
Dens-Cote Plaster Smooth Finish	1,533.5	94,968.56	5,983
Dens-Cote Plaster Sand Finish	23.4	1,375.73	181
Dens-Cote Plaster Sand Finish	108.3	4,874.88	165
Dens-Cote Tape - 300'	.1	3,104.26	173
Dens-Cote Tape - 100'	.1	3,784.16	394
1/4" Sound Deadening Board	325.4	14,851.31	1,888
Tile Backer-Water Resistant 1/2"	1,808.1	145,111.98	24,428
Tile Backer 5/8"	203.8	18,959.34	3,483
Tile Backer-5/8" Firestop	96.4	10,867.33	1,423
Wood Grained Gyp. Bd. 3/8"	336.5	19,118.64	(943)
Wood Grained Gyp. Bd. 1/2"	51.7	4,197.69	792
Dens-Cote Base 3/8" x 48" Pinholelath	1,302.1	48,621.39	4,730
Dens-Cote Base 1/2" x 48" Pinholelath	5,834.0	256,603.60	26,982
Dens-Cote Base 1/2" x 48" Firestop	262.4	14,390.67	1,431
Dens-Cote Base 5/8" x 48" Regular	138.1	6,836.59	585
Dens-Cote Base 5/8" x 48" Firestop	101.4	6,085.15	579
Triple Duty Joint Compound - 25# Bag	1,586.0	248,723.44	16,511
Triple Duty Joint Compound - 50# Bag	801.3	94,468.09	6,847
Ready Mix Joint Compound - 5 Gal.	3,071.7	394,235.35	14,868
Ready Mix Joint Compound - 1 Gal.	75.5	15,614.61	1,214
One-Day Joint Compound - 50# Bag	2.5	390.00	5
One-Day Joint Compound - 25# Bag	139.3	24,548.85	1,809
Bestex A	425.9	68,791.89	2,589
Bestex B	16.2	3,181.84	(3)
Bestex C	117.5	22,862.47	(274)
Grabit Adhesive	27.0	3,957.58	409
Ram Process Plaster	21.0	2,155.95	283
		<u>\$1,532,939.25</u>	<u>\$116,530</u>

approved, several of which are more economical than the clay we have been using. Based on last years sale of 1/2" and 5/8" Firestop, the annual savings which will be realized from these less expensive clays is \$43,000. The Purchasing Department has made even further inroads in getting better prices for some of these clays, so future savings will be even more than \$43,000 per year.

4. Glass Fiber in Firestop - R&D 131

We have had some comments from our Firestop licensees and subsequently from some of our own plants to the effect that they experience some difficulty in incorporating the formula amount of glass fiber in our Firestop products. Mr. R. W. Hinkel has suggested that it may be possible to use less glass fiber in the new Firestop formula, particularly if we are able to reduce the length from 1/2" to 1/4". In addition to easing the plant situation, this would offer some rather large potential for raw material savings, so we are pursuing the project with all possible speed. It will be necessary as a first step to purchase a fiber glass cutter which will cut 1/4" lengths. It is planned to have Wilmington purchase a cutter so we can make all of the necessary trial runs there prior to our move to Tigard.

5. Evaluation of Rock Deposits at Lovell - R&D 2

We have been assisting with the evaluation of samples of ore from the deposit at Lovell, Wyoming.

Joint System

1. Vermiculite Aggregate Texture - R&D 275

Field and market testing of two versions of a spray-on vermiculite texture have been successfully completed. The only difference in the two textures being field tested are that one has 8% vermiculite and the other has 10%. This type of texture is very popular on the West Coast and at the present time we do not even have a product to sell. The cost analysis of these formulas has been completed and it would appear that they will be more profitable than the Perlite textures we are currently selling. It is now up to Sales to initiate a New Product Request, based on the results of the field testing and the cost analysis which has been made available to them.

Industrial

1. Denscal - R&D 308

During the first few months of 1967 we assisted with the trial runs of the new Denscal plant at Blue Rapids. Mr. Maturo spent practically

PLANS FOR THE FUTURE

The past six months has been a period of planning and re-adjustment in preparation for the move to Tigard. Arrangements to move families and equipment; the planning of the new Research Center in Tigard; the recruiting of personnel replacements; and the other problems that develop in such an undertaking have taken precedence over some of the normal project work. We have tried to maintain continuity of some of the major projects such as the molded grainboard, radiant heating panel, fire and sound test programs and Firestop improvement patent application.

Messrs. E. F. Morrone and R. F. Martin have resigned and have left. In addition, Mr. A. Schnable will not be making the move to Portland. We were able to retain one Drexel Co-op student, but this program will terminate in September. This has necessitated some fast recruiting in order to start rebuilding the Department. With the excellent cooperation of the Portland Personnel Department, we have been able to find three excellent replacements for the permanent people we have lost. Mr. A. K. Stalker of Beaverton, Oregon was hired in May and has been training in Paoli since May. Mr. Stalker formerly worked in the wood treating industry. Mr. Michael Robinson of Tigard has recently accepted a position and will start in September. Mr. Robinson is a June graduate from Oregon State. We also arranged to transfer Mr. D. F. Klus from our Grand Rapids plant to Tigard in September. Mr. Klus, after four years experience in Manufacturing, has expressed a desire to work in Research and Development. During the next six months we will make the move to Tigard. We will be involved in setting up our equipment and training new personnel, but hope to accomplish this with a minimum of interruption to our major projects.

Our objectives for the remainder of 1967 are -

1. To bring the Brunswick pilot plant of the molded grainboard project to a successful conclusion.
2. To complete the Underwriters' testing of the radiant heating panel.
3. To reduce the glass fiber content of 5/8" and 1/2" Firestop. The anticipated annual savings from this are \$47,000.
4. To maintain a fire and sound testing schedule that will keep us in a favorable competitive position.
5. To continue the investigation to determine whether it is feasible to use gypsum wallboard as a core material in plywood grainboard.

6. To rebuild our research organization by training the new personnel.
7. To set up our equipment in Tigard so that we can return to the normal development work and provision of Sales and Manufacturing services.

There are many worthwhile projects such as the development of a gypsum firedoor filler, continued investigation of particle size of wallboard stucco, supplying of data for Sales, and participation in Gypsum Association and ASTM testing programs which are being held in abeyance until the move is consummated and our operation has returned to normal. This doesn't mean that we won't continue to be alert for new products or new applications which may occur. Every effort is being made to put our time to the best possible use and in the best interests of the company during this difficult period.

S U M M A R Y

Sales of products developed through research have climbed to a new high of \$2,512,400 in 1966. Profits from new products were only slightly higher than last year because of the unprofitable status of ready mix. The large ready mix facility being installed at Akron and the smaller facility at Acme will put ready mix on a profitable basis.

A 1/4" gypsum sound deadening board was added to the line during the past six months. This board will be sold in competition with wood fiber and mineral fiber sound deadening boards. A new vermiculite texture and an improved Dens-Cote plaster are being market tested and should be ready for release shortly.

Improvements in stucco grind will help make weight reductions possible and therefore reduce costs. Lower Underwriters' minimum weights will also result in cost savings. Reformulation of our entire texture line will save on raw material costs.

Fire and sound testing continue to give impetus to the sale of Firestop. In 1965 6.7% of our wallboard (not lath) sales were Firestop. In 1966 Firestop represented 9.1% of our wallboard sales. In addition, Firestop improvements during the first six months of 1966 enabled us to offer additional coverage to our Firestop licensees for a fee of \$2,000. Thus far, five licensees have accepted the additional coverage.

The year of 1967 promises to be a year of great challenge to the Research Department. The objectives we will be concentrating of during 1967 are:

1. To develop a process for manufacturing gypsum grainboard.
2. To develop a gypsum wallboard radiant heating panel and a system of installation.
3. To achieve a 150 to 200 lbs./M square foot reduction in the Underwriters' minimum weight for 1/2" Firestop.
4. To determine the optimum grind for wallboard stucco to pave the way for further weight reductions in wallboard.
5. To find less expensive clays for use in Firestop. This could save \$25,000 annually based on last year's Firestop sales.
6. To continue the development of a gypsum filler for firedoors.
7. To conduct fire and sound test programs to provide Sales with the ratings needed in the promotion of wallboard products.

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F O R E W O R D

This report covers the activities and accomplishments of the Research Department for the last six months of 1966. Since this is the year-end, some results will also be reported for the full year of 1966.

\$210,000 was budgeted for research in 1966. The total expenditures were \$166,777. The lower expenditure is a result of abandoning projects on acoustical tile and synthetic gypsum for which \$37,700 had been budgeted. Due to a transition in Accounting personnel, we do not have a distribution of the 1966 research expenditures. \$235,000 has been budgeted for research in 1967. The projected distribution of these expenditures is shown on page two.

The market performance of new products on pages three and four show the sales and profits emanating from products developed through research. The charts on page five show the growth of sales and profits from new products. In 1966, the sales from new products were 3.9% of the Division total and the profits were 2.7% of the total.

Product improvements or services to Sales can not be measured directly in terms of sales. About \$30,000 was spent for fire testing in 1966. The fact that our 1/2" Firestop sales increased 83% and our 5/8" Firestop sales increased 17% compared to 1965, is an indicated that our money for fire testing is well spent. The graph on page six shows the growth in Firestop sales since 1964.

Some organizational changes have been made during this period. Mr. Matruo was transferred to Blue Rapids to assist in getting the Denscal operation underway. Arrangements were made to get two students from Drexel Institute as technicians through their co-op program. Each six months replacements are furnished. This program has help immensely with the project work and it was hoped that this would be the basis for future hiring of technical personnel. We plan to investigate the possibility of starting a similar program in Portland. We are still seeking another permanent research engineer and will direct our search to the West Coast.

The main section of this report is devoted to the progress of the various projects. Each project is listed under one of the following categories:

1. Product and Process Improvement
2. Sales Service
3. New Product Development
4. Fundamental Research, Laboratory Service and Testing

Market Performance of New Products (Last 6 Months)

<u>Product</u>	<u>Sales Volume</u>	<u>List Sales</u>	<u>Estimated Gross Profit</u>
Denscote Base (all)	8,625 M sq. ft.	\$ 367,179	\$ 59,699
Tile Backer Board (all)	1,551 M sq. ft.	129,183	50,608
Firestop Tile Backer	30 M sq. ft.	3,034	1,326
Tru Grain Wallboard	178 M sq. ft.	12,632	1,427
One Day Jt. Compound	215 Tons	36,531	5,749
Ready Mix Jt. Compound	73,762 Pails	302,023	(3,059)
(5 gal.)	66,055 Pails		
(1 gal.)	7,707 Pails		
Triple Duty Jt. Compound	1,656 Tons	254,887	52,347
Grabit Adhesive	53 Tons	7,910	2,336
Bestex A	28,920 Bags	57,769	(2,222)
Bestex B	1,689 Bags	7,331	(127)
Bestex C	3,640 Bags	14,835	(1,785)
Denscote Plaster	1,426 Tons	81,813	9,086
Denscote Tape	3,707 Rolls	6,523	2,737
Vinyl Tape - Tile Backer	384 Rolls	379	80
Model Densite	1 Tons	47	16
Tooling Densite	2 Tons	204	89
High Expansion Plaster	2 Tons	138	21
Ram Process Plaster	8.8 Tons	924	424
 TOTAL		 \$1,283,342	 \$178,752

Market Performance of New Products for 1966

<u>Product</u>	<u>Sales Volume</u>	<u>List Sales</u>	<u>Estimated Gross Profit</u>
Denscote Base (all)	17,230 M sq. ft.	\$ 732,007	\$126,540
Tile Backer Board (all)	2,828 M sq. ft.	231,486	88,028
Firestop Tile Backer	30 M sq. ft.	3,034	1,326
Tru-Grain Wallboard	537 M sq. ft.	37,681	3,612
One Day Jt. Compound	495 Tons	83,426	13,725
Ready Mix Jt. Compound	138,718 Pails	567,021	** (3,018)
(5 gal.)	126,226 Pails		
(1 gal.)	12,492 Pails		
Triple Duty Jt. Compound	3,106 Tons	487,486	109,895
Grabit Adhesive	118 Tons	17,508	5,523
Bestex A	58,789 Bags	114,821	* (1,352)
Bestex B	2,482 Bags	10,600	* (10)
Bestex C	7,881 Bags	31,629	* (2,537)
Denscote Plaster	3,017 Tons	173,173	22,238
Denscote Tape	12,268 Rolls	17,475	7,205
Vinyl Tape-Tile Backer	548 Rolls	1,551	870
Model Densite	5 Tons	233	84
Tooling Densite	3.1 Tons	286	117
High Expansion Plaster	32 Tons	2,059	537
Ram Process Plaster	8.8 Tons	<u>924</u>	<u>424</u>
 TOTAL		 \$2,512,400	 \$373,207

* Losses shown reflect standard costs based on the highest purchase price for casein. Based on the present casein price, the Bestex A sales would generate a profit of \$11,757 for the year.

** New Ready Mix plant when completed should permit savings of \$.50/5 gallon pail.

be used to apply a clear, abrasion resistant, washable coating to our grainboard. This will permit the purchase of a variety of more appealing grain patterns than we now have. The coater will also be used to help develop a vapor barrier wallboard and pre-decorated products.

JOINT SYSTEM

1. Improve Texture Products - R&D 275

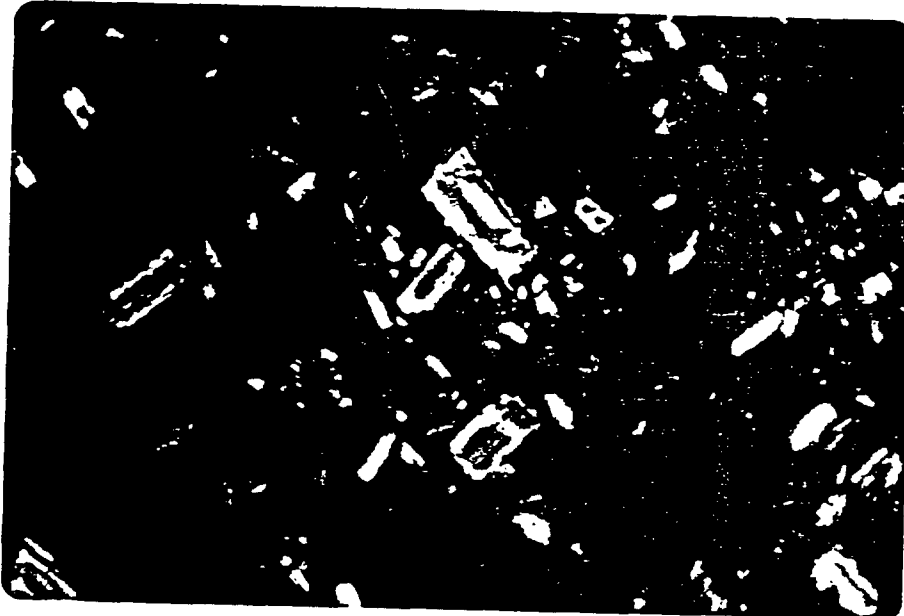
A new basic texture formula has been adopted after a successful series of field trials. The estimated raw material savings are \$7 per ton of texture.

A new vermiculite aggregate texture is being market tested after several successful field trials. This texture gives a different appearance (very coarse) and would be competitive with other similar products which are available.

INDUSTRIAL

1. Denscal Plant - R&D 308

We have been providing assistance in the preparation of the start-up of the Denscal operation. An operating plan and a product specification have been submitted. Below is a photomicrograph of Hydrocal crystals which will be used for comparison with Denscal since both are manufactured by the same process.



200 X Magnification
of Hydrocal

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FOREWORD

This report covers the activities and accomplishments of the Research Department for the first six months of 1966.

The annual research budget for 1966 is \$210,000. As of June 30, the research expenditures stand at \$80,470. The main reason that we are trailing the budget is that the projects for acoustical tile and synthetic gypsum have been dropped and \$43,000 has been budgeted for them. However, a \$75,000 investment in a molded grainboard process has been approved for 1966, and if this becomes a reality the figures will change substantially in the last half of the year. The distribution of research expenditures are shown on the two following pages, in two different ways. The figures shown are only for the six month period and cannot be projected for a full year. One reason is that certain projects emphasized during the period can influence the figures greatly. Another factor is that most of our fire and sound test expenses, which represent a formidable part of our budget, are invariably incurred in the last half of the year. The figures therefore, are indicative of the six month results only.

On page four is a compilation of the net sales and gross profit for the past six months emanating from new products which have been developed. This total represents 3.9% of the Division net sales and 2.9% of the operating profit for the period. The lower profit figure is almost entirely due to the ready mix and Bestex texture products where \$336,113 worth of sales produced only \$312 profit. This unfavorable economic situation should be helped measurably by the new ready mix plant which is being installed at Akron and the texture reformulation work which is aimed at cost reduction.

Research activities which cannot be accurately evaluated are those of a service nature to either the Sales or Manufacturing Departments. Fire and sound testing is a large portion of the work which is done as a service to Sales to promote the sale of board products, particularly Firestop. The fact that 1/2" Firestop sales for the first six months are up 158% and 5/8" Firestop sales are up 23% over the same period last year, is a strong indication that we are getting a good return from our fire and sound test expenditures. Last year quite a lot of time and money was spent in the improvement of our present joint system products and in the development of Triple Duty. Our joint system sales (excluding ready mix) are up 52% over last year, so this would indicate that an emphasis on this product line last year was well placed.

The main section of this report is devoted to the progress of the various projects. A new format has been established for this section. Instead of being divided into projects completed, nearing completion, and underway, it is being separated into- Process and Product Improvement; Sales Service; New Products Development; and Fundamental Investigation, Laboratory Service and Testing.

Market Performance of New Products for 1966 (First six Months)

<u>Product</u>	<u>Sales Volume</u>	<u>List Sales</u>	<u>Estimated Gross Profit</u>
Dens-Cote Base (all)	8,605 M sq. ft.	\$364,828	66,841
Tile Backer Board (all)	1,278 M sq. ft.	102,303	37,420
Tru-Grain Wallboard	358 M sq. ft.	25,049	2,185
One Day Joint Compound	279 T	46,895	7,976
Ready Mix Joint Compound	64,956 pails	258,998	41
5 gallon	60,171 pails		
1 gallon	4,785 pails		
Triple Duty Joint Compound	21,450 T	232,519	57,548
Grabit Adhesive	65 T	9,598	3,185
Bestex A	29,869 bags	57,052	870
Bestex B	793 bags	3,269	133
Bestex C	4,241 bags	16,794	(752)
Dens-Cote Plaster	1,591 T	91,360	13,152
Dens-Cote Tape	8,561 rolls	10,952	4,468
Tile Backer Vinyl Tape	164 rolls	1,172	790
Model Densite	4 T	186	68
Tooling Densite	1 T	82	28
High Expansion Plaster	30 T	<u>1,921</u>	<u>516</u>
 TOTALS		 \$1,222,978	 \$194,469

5. Scoring and Breaking Properties of Gypsum Wallboard - R&D 298

At the request of Manufacturing, a project was undertaken to improve the scoring and breaking properties of gypsum wallboard. This subject is the source of a great deal of argument on quality between Sales and Manufacturing. The first step was to devise a positive method of being able to distinguish between board which has good, fair, or poor scoring and breaking properties. After a method was found, the effect of various conditions and additives were evaluated. It was found that perlite fines in the amount of 2 ~~cu. ft.~~ /M sq. ft. of board would improve the scoring and breaking. Furthermore, it was found that if the perlite were expanded to 4 lbs./cu. ft. it would actually be possible to save on costs at the same time.

A plant trial was held in which regular grade perlite was used. This was unsuccessful in improving the scoring and breaking properties, but seemed to permit a much lighter weight board to be produced. This will be repeated with the perlite fines, but now will be widened in scope to evaluate the effect of perlite as a means to reduce the weight and improve wallboard economics in addition to improving the scoring and breaking.

6. Accelerator Grind - R&D 2

Some time has been devoted to evaluation of grinding equipment and particle size analysis of gypsum which is used for wallboard accelerator. The objective is to find a less expensive accelerator than the ground block which is currently used. This is being handled by the Technical Department with our assistance.

Joint System

1. Protein Joint System Formulation - R&D 275

When the price of casein escalated sometime ago, a crash program was put into effect to reduce the cost of our Joint Compound, Bedding, Topping, and All-Purpose. The emphasis was placed on the larger volume items and did not include the smaller volume texture products. At the same time such a small quantity of texture products were sold, we could not justify spending a great deal of time to reduce costs. Our texture business has grown, however, and now it does behoove us to work on the cost structure of these products.

The re-formulation work to date appears to be very encouraging. This involves the substitution of starch for part of higher priced casein. If this is successful, an annual savings of \$7,000 will be realized.

Industrial

1. Denscal Plant - R&D 2

Assistance has been provided in the planning of the Denscal equipment and its installation at Blue Rapids.

FUNDAMENTAL RESEARCH, LABORATORY SERVICE AND TESTING

1. ASTM and Gypsum Association Work - R&D 4

Through our membership in the Gypsum Association and ASTM we are obligated to assume our fair share of this test work which is carried out by the Technical Committee. In addition to our industry obligation we will receive the benefits of the various test programs which reduce our own efforts. In many instances the testing done by the Association is far less expensive because the cost is shared by other companies.

During the past six months we made exploratory tests of the method for defining type X wallboard. This method was originated by us. Another series of tests to evaluate combustibility by the potential heat method was farmed out to an independent Laboratory. Tests to develop a performance standard for wallboard are just beginning. A proposal has been made to ASTM by National Gypsum Company to reduce the minimum weight of 1/2" board to 1700/M and 5/8" board to 2100/lbs. M. We are supporting this proposal.

2. Patent Application Data - R&D 6

The patent application on processing of synthetic gypsum was rewritten on the basis of the examiners comments. This necessitated tests to establish limits of the amounts and types of neutralizing agents which are claimed.

The patent application on Grabit masonry adhesive was abandoned on the basis of the expense necessary to continue our case as compared with the minor importance of the product.

Our patent application on the One Day Joint Compound formulation has also been abandoned as a result of the examiners rejection. Since our application was filed, a patent has been issued to Shawinigan Resins Corporation, which covers a formula very similar to our One Day Formula. Shawinigan Resins (now a division of Monsanto) furnishes the resin binders used in One Day. They patented a number of compositions involving the binder, as well as the binder itself.

Application in which no action has been received from the patent office are those on Dens-Cote and Dens-Cote base.

We are considering patent protection for one new idea which is the improved Firestop formula. The necessary tests have been started so that an application can be prepared as quickly as possible. An improvement patent is sought so that we will retain our technical advantage on fire rated wallboard. This may enable us to continue receiving the royalty payments we are presently enjoying. The preparation of this data will require a lot of research time but we believe the long term advantage justifies the time which will be spent.

3. Synthetic Gypsum - R&D 221

An economic study was made to allow us to decide whether it would be feasible

S U M M A R Y

The last six months net sales and estimated gross profits resulting from products developed through research were \$1,222,978 and \$194,469 respectively. Other sales increases during the period which we feel have been influenced by research achievements are: 1/2" Firestop - up 158%; 5/8" Firestop - up 23%; and dry joint system products - 52%. These figures are based on the first six months of 1965.

The most notable accomplishment during the past six months was the development of a new 5/8" Firestop, significantly lighter in weight and with greater fire resistance. This is considered a major breakthrough, offering potential annual savings of \$48,000 and increased future sales of 5/8" Firestop. Another outstanding achievement was the design and assembly of an instrument to accurately measure and record the increase in temperature of a gypsum product during the hydration from $\text{CaSO}_4 \cdot 1/2\text{H}_2\text{O}$ to $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. This gives us a valuable tool to study the hydration reaction, which is the basis of the wall-board manufacturing process.

Services to others occupied quite a bit of Research and Development time. Some of these were: the coordination of Laboratory renovations, and the establishment of the Quonset Hut as a pilot plant for the Chemical Division group who will be here September first; a series of tests on wall-board and foil adhesives to assure Sales that we could meet the specifications of National Homes, Inc.; testing of a metalclad wall system of Donn Products; and the accumulation and organization of the technical data concerning all of the ramifications of the Dens-Cote system.

In the last six months of 1966 we expect our research program to proceed along the following lines:

1. The 1966 fire test program will be completed, with the reduction in weight of 1/2" Firestop and the development of a 3-hour floor-ceiling rating having high priority. We will be spending a lot of time testing and collecting data to help us process a patent application on the new Firestop formula.
2. The 1966 sound test program will be completed, and of particular interest will be the evaluation of 1/4" gypsum board as a sound deadening component.
3. Providing an agreement can be made with U. S. Mold Coatings, Inc., the development of this molded grainboard will have a high priority.
4. Product development of Ram Process plaster, gypsum/plywood studs, and the gypsum firedoor filler will continue. Likewise, the efforts to improve our grainboard line and Dens-Cote smooth finish plaster will continue.
5. Some manufacturing oriented projects which are underway include the investigations to reduce wallboard weight, improve scoring and breaking properties, and reduce accelerator costs. Other

wallboard investigations include the ASTM and Gypsum Association work which is currently in progress to develop performance specifications for gypsum wallboard.

6. Some fundamental work included in our plans are microscopic observations, temperature rise studies, and some differential thermal analyses. This work is expected to teach us more about hydration and calcination which are basic to gypsum manufacturing processes.

Through the Personnel Department we have hired two Drexel students under their co-op plan. We feel that we are gaining both long and short term benefits from participation in this program. We are seeking a chemist or chemical engineer as a replacement, and a mechanical engineer as an addition to our staff. We are attempting to build more experience into the Department in the areas of analytical type research and structural systems. If this can be accomplished, we should have a well balanced and capable staff which can handle all of the current items and serve as the basis for future growth.

GEORGIA-PACIFIC CORPORATION
BESTWALL GYPSUM DIVISION

R&D REPORT FOR LAST 6 MONTHS OF 1965

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FORWARD

This report covers the activities and accomplishments of the Research Department for the past six months. Since this is the year-end, some of the figures shown encompass the results for all of 1965 as well as for the six month period.

The total research budget for 1965 was \$184,000. The total expenditures were \$186,790 and the approximate distribution of this expenditure is shown on page 4. The total budget for 1966 will be \$210,000 and plans are to proportion this expenditure in approximately the following manner:

Fundamental or exploratory investigations	15.0%
Wallboard and Joint System	12.6%
Lath and Plaster	3.8%
Industrial Gypsum Products	9.6%
Fire, Sound, and Structural Systems	24.5%
Acoustical Tile	10.3%
Plant Problems	1.6%
Other	5.8%

The budget provides for the addition of two new men, one of which has already been obtained. Mr. Maturo, was transferred to Paoli from the Grand Rapids plant and will be handling all of the research on industrial gypsum products. Another addition to the Research Staff is planned later in 1966.

The market performance of new products on page 2 shows the sales and estimated gross profit from the products which have been developed through research. The graph on page 3 shows the growth of Bestwall sales and profits from research since 1961. These figures do not include cost savings, product improvements, or the effect of such work as fire and sound testing. The sale of Firestop continues to increase with 1/2" up 157% and 5/8" up 15.6% in 1965 compared with 1964 sales. Joint System production, an area where a lot of effort has been devoted to product improvement, shows an increase of 5.1% in sales not including Ready Mix which has also gained. A new product called "Triple Duty Joint Compound" will be released nationwide after undergoing comprehensive field testing and finally being marketed in four sales districts to further evaluate its potential. Even with such a limited distribution, approximately 800 tons of Triple Duty were sold during the past 6 months.

The main section of this report is devoted to progress of the individual projects during the past six months. Those which have been completed are listed first, followed by those which are nearing completion, and finally those in which work is underway.

1965 MARKET PERFORMANCE OF NEW PRODUCTS

<u>PRODUCT</u>	<u>SALES VOLUME</u>	<u>LAST SIX MONTHS</u>	
		<u>GROSS SALES</u>	<u>ESTIMATED GROSS PROFIT</u>
Dens-Cote Base (all)	8460 M sq.ft.	\$ 351,227	\$ 91,696
Dens-Cote Plaster (all)	1665 tons	98,612	11,251
Tile Backer Board	1278 M sq.ft.	98,875	29,884
Tru-Grain Wallboard	523 M sq.ft.	36,059	3,404
Firestop 120 Tile	443 M sq.ft.	59,557	12,532
Triple Duty Joint Comp.	800 tons	141,840	23,236
Ready Mix Joint Comp.	39,501 cans	154,172	5,228
One Day Joint Comp.	125 tons	35,316	6,153
Bestex A, B and C	14,385 bags	36,516	874
Model Densite	17 tons	807	274
Ram Process Plaster	6.6 tons	650	278
High Expansion Densite	1.1 tons	59	-
Dens-Cote Tape	11,579 rolls	12,145	4,862
Tile Backer Tape	227 rolls	1,608	746
Grabit Adhesive	137 tons	11,217	3,116
TOTALS		<u>\$1,038,660</u>	<u>\$193,534</u>

YEAR 1965

<u>SALES VOLUME</u>	<u>GROSS SALES</u>	<u>ESTIMATED GROSS PROFIT</u>
14,223 M sq.ft.	\$606,683	\$172,493
2698 tons	160,809	17,837
2091 M sq.ft.	161,651	50,407
809 M sq.ft.	54,051	4,151
755 M sq.ft.	102,846	22,893
915 tons	162,540	29,296
60,840 cans	239,819	17,286
346 tons	74,543	14,215
17,915 bags	50,067	2,247
35 tons	1,659	557
6.6 tons	650	278
1.2 tons	64	-
20,806 rolls	21,040	8,301
436 rolls	3,042	1,532
191 tons	20,105	6,273
	\$1,659,569	\$347,766

PROJECTS COMPLETED

1. DRY VINYL JOINT COMPOUND - R&D 211

Objective:

To develop joint system products with vinyl or other synthetic resin binders.

Investigation:

This product was under development for about four years without any degree of success. At one point the objective was a vinyl topping compound, but Sales advised us that they were not interested in this product, and dropped the project from their list. In spite of our previous lack of success and the low level of sales interest, two factors caused us to continue the experimentation. One factor was the sharply increasing cost of casein, which started early last year. The increase in casein cost induced us to consider other binders, even the higher priced vinyl binders. The second reason was a formulation breakthrough made by Mr. Morrone which permitted certain previous bonding limitations of vinyl joint compounds to be overcome.

After successful field testing with one customer, the vinyl joint compound was tried by other contractors in the Wilmington Sales district. Finally it was released for sale in the entire district. Some slight formula modifications were made from time to time to improve the product. After a few months, the product was released for sale in the Brunswick, Detroit, and Cleveland sales districts to gain field experience in different climates. It was sold at a price slightly higher than our regular joint compound. During the past 6 months, 800 tons of dry vinyl joint compound has been sold in these limited market areas. Just recently, successful field trials were held in Chicago and on the West Coast. All of this experience has shown good acceptance for the product. Ageing and other testing in the Laboratory indicates that the product has no significant weakness.

Conclusions:

On the basis of the experience and testing which has been so successful, it has been decided to release the product nationally under the trade name "Triple Duty Joint Compound". The contractor advantages we plan to promote are:

- a. The single product can be used for taping, finishing, and texturing operations.
- b. It has lower shrinkage than regular casein products.
- c. It is easy to sand.

- d. It has excellent application properties.
- e. It has complete viscosity stability.
- f. It has outstanding resistance to spoilage.

The latter two advantages are of greater interest to contractors, since Triple Duty can be mixed in large quantities and put into pails for subsequent use - like Ready Mix. The company advantages for this product are:

- a. A more consistent product can be furnished, because synthetics are more uniform than casein. This should result in fewer complaints.
- b. The product is more resistant to being affected by adverse weather conditions and the like, so this should also contribute to a reduction in complaints.
- c. Easier and better manufacturing control can be achieved, because it requires fewer ingredients and there is no alkaline reaction to control, as we need to do with casein products.
- d. There is a better profit potential. Although there isn't much difference in the cost of Triple Duty and regular joint compound at the present time, the price trend for casein is rising and the price trend for vinyls is falling.



2. READY MIX - R&D 211

Objective:

To improve the quality and cost structure of Ready Mix Joint Compound.

Investigation:

In the last report it was noted that a new Ready Mix formula was being field tested in St. Louis. During the past six months the field testing was extended to Brunswick. Subsequently, both the Fort Dodge and Brunswick Ready Mix operations were converted to the new formula because of better acceptance in the field. Recently, Akron was also converted to the new Ready Mix.

Conclusion:

Since the new formula was adopted, our complaints on Ready Mix have largely disappeared, and the new product has received much better acceptance even by those who were satisfied with the old formula. In addition to the improved acceptance, the freeze-thaw and cold bonding properties have been improved. A raw material savings of \$.20 per pail also has been realized which will benefit the profit picture.

3. DENS-COTE PROJECTS - R&D 219

Objective:

To improve our Dens-Cote line by developing new products and by finding new uses for the current products.

Investigation:

A formula consisting of tubed stucco, graded sand, and a small amount of lime was developed to be used as a basecoat application of a two-coat system. The finish coat is the same lime-putty gauging which is used over regular basecoat plaster. Field testing was conducted in the Detroit and Syracuse areas, and the reaction to this product was quite favorable.

In cooperation with the Purchasing Department, an improved glass fiber tape was found. This tape is J. P. Stevens 10 x 10 mesh as opposed to the Owens-Corning 7 x 11 mesh, which we have been furnishing. The J. P. Stevens tape is stiffer and therefore easier to handle than the old tape. A number of rolls of the new tape were tried in the field and received very good acceptance. This was done in the "nick of time", as Owens-Corning has just announced that they are withdrawing from the glass fiber tape business.

Another facet of thincoat plaster which has been undergoing investigation is its application in radiant heating systems. This system involves the application of Dens-Cote Base to the ceiling joists; stapling the electric

SUMMARY

The last six months and full year gross sales resulting from products developed through research were \$1,038,600 and \$1,659,569 respectively. The corresponding gross profits were \$191,534 and \$347,766. Other annual sales increases which we believe have been favorably affected by research efforts were: 1/2" Firestop - up 157%; 5/8" Firestop - up 15.6%; Dry Joint System - up 5.1%; and Ready Mix - up 290%. The research projects completed during the past six months, that should result in more sales volume, are as follow:

1. The development of a vinyl binder joint compound called "Triple Duty". The formal release of this product will be announced at the G. D. C. I. Convention in March.
2. The improvement in quality and cost of our ready mix joint compound. This new formula has been adopted and we believe that it is a contributing factor to our increasing ready mix sales.
3. Successful fire tests have produced new fire rated assemblies and a 5/8" Firestop version of our Tile Backer board. This Firestop Tile backer has been added to our Underwriters' listed products and will be promoted for partitions where water resistance and fire protection are both required.
4. One new product was added to our Dens-Cote family and a new application for Dens-Cote was approved. The new product is "Dens-Cote Base plaster", which is the first coat material of a two coat system. The normal lime-putty guaging is used for the finish coat. Texture Finish Dens-Cote, developed in 1964, has been approved for use in radiant heated ceilings.
5. Sound transmission ratings were obtained for ten different partition assemblies. Most of these were tests mutually sponsored by Owens-Corning and Georgia-Pacific. These partitions consist of Fiberglas Noisestop and Firestop applied to metal studs. In addition to the financial assistance in conducting the tests, we will have the benefit of Owens-Corning's efforts to add to our own in promoting these partition systems.

Looking ahead, a 1966 research program has been planned which should protect our future, as well as providing for our immediate needs. Some of the objectives of this program are:

1. To provide a sound technical basis for producing a lighter weight wallboard.
2. To gain a better understanding of our products and processes through the use of the polarizing microscope.
3. To improve the fire endurance properties and the economics of our Firestop products.
4. To pursue the development of such new products as a fire rated gypsum acoustical tile, a combination gypsum/plywood stud, and a precast gypsum firedoor filler.
5. To improve our predecorated product line and our Industrial gypsum product line.

It is felt that we are currently making good progress in all areas with the exception of structural systems and components. This weakness will be overcome when we can hire and train a mechanical engineer. This addition has been incorporated into our 1966 budget. Some new Laboratory furniture and equipment have also been included in next year's budget. This will enhance our abilities and provide for more efficient use of our space. Research is primarily a long range approach to the profits of the company. This may be demonstrated by the fact that the original research on Firestop and Densite, two current mainstays, was conducted over ten years ago. By the same token, it may take a number of years before our present research work begins to pay off.

GEORGIA-PACIFIC CORPORATION
BESTWALL GYPSUM DIVISION

R&D REPORT FOR FIRST 6 MONTHS OF 1965

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FOREWORD

This report covers the activities of the Research Department for the six months ending June 30, 1965. One organizational change was made during this period: Mr. R. F. Martin was hired as a research chemist from several candidates interviewed. This addition will help us resume some long-term projects which have been delayed because of insufficient manpower. Another reason for adding to the department is to obtain qualified young men with good potential and train them, with a view toward greater research effort in the future.

The 1965 research budget is \$170,000, and \$60,000 of this amount is slated for fire and sound testing. To date a total of \$90,213 has been spent.

A record of the past six months' market performance of products developed through research is shown on page 2. Some of the efforts cannot be evaluated directly in terms of sales or profits. An example is the seven fire ratings attained during this period. This gives Georgia-Pacific just about every rating that our competitors have, and several which our competitors do not have. Some measure of the value of this work may be shown by the 52.1% increase in 1/2" Firestop sales, and 23.6% increase in 5/8" Firestop sales for the first 6 months of this year as compared to the same period last year.

Some significant cost reduction programs have recently been completed. A formula revision of the four basic joint system items will save 10¢ to 17¢ per bag. This will offset increased costs and save about \$108,000 per year, based on the first half 1965 sales of these four products.

The transition to a finer filament glass fiber has just been completed. Some plants have reduced their usage of glass fiber in regular (not Firestop) wallboard by 25%, and other plants have made a 50% reduction. A 25% reduction at all plants would save about \$83,000 per year, as estimated from 1964 wallboard production figures.

On page 3 is the distribution showing how the research dollars were spent for the six months' period.

The bulk of this report is devoted to the progress of the individual projects. This section is categorized into those projects which were completed during the past six months; those which should be completed shortly; and those which have either just been started or which will require quite a bit more time to complete.

1965 SIX MONTHS' MARKET PERFORMANCE OF
NEW PRODUCTS

<u>PRODUCT</u>	<u>SALES VOLUME</u>	<u>LIST SALES</u>	<u>ESTIMATED GROSS PROFIT</u>
Firestop 120 Tile	312,000 sq. ft.	\$ 43,289	\$ 10,361
Grabit Adhesive	54 tons	8,888	3,157
One Day Joint Compound	221 tons	39,227	8,062
Dens-Cote Plaster	1,033 tons	62,197	6,586
Dens-Cote Base (all)	5,763 M. sq. ft.	255,456	80,797
Dens-Cote Tape	9,227 rolls	8,895	3,439
Ready Mix Joint Comp.	17,654 - 5 gal.pails 3,685 - 1 gal.pail	85,647	11,133
Tile Backer Board	813,300 sq. ft.	62,776	20,523
Tile Backer Tape	209 rolls	1,434	786
Model Densite	18.3 tons	852	283
Tooling Densite	1.7 tons	108	26
High Expansion Densite	0.1 tons	5	-
Bestex A, B, and C	3530 bags	13,551	1,373
Tru-Grain Wallboard	286,000 sq. ft.	17,992	747
Vinyl Joint Compound	115 tons	<u>20,700</u>	<u>6,060</u>
		\$621,017	153,333

PATENT INFORMATION

Patents Issued - None

Patent Applications being Prepared - High Expansion formula with outstanding resistance to ageing.

Patent Applications Filed

Dens-Cote Plaster

Dens-Cote Base

Patent Applications Previously Submitted - Processing of Synthetic Gypsum - Second rejection by patent office being considered.

Grabit Adhesive - First rejection by patent office answered.

One Day Joint Compound - No action.

PROJECTS COMPLETED

1. NEW TYPE OF GLASS FIBER - R&D #131

Objective: Evaluate Owens Corning fine filament 636 glass fiber for use in our wallboard products.

Investigation: It was previously reported that reduced amounts of 636 glass fiber were being tried in our regular wallboard products. These plant trials with reduced quantities of fiber were successfully completed during the past six months.

Conclusion: A 25% reduction in the glass fiber content was made in the wallboard formulas of those plants where no paper fiber is being used in the core. A 50% reduction in glass fiber content has been made in those plants which use paper fiber. The savings previously estimated for a company-wide reduction of 25% was 83,000 per year. With some plants reducing their fiber content by 50%, the savings will obviously be greater.

2. JOINT SYSTEM TEXTURE - R&D 261

Objective: To develop a complete line of texture products suitable for spray application.

Investigation: Three different products had been undergoing field performance evaluation for the past year. The products being field tested were: Bestex A, which is a non-aggregated texture for spray or hand application; Bestex B, which is a lightly aggregated texture for giving a sand type finish; Bestex C, which is heavily aggregated to give a coarse or simulated acoustic appearance; and Bestex D, which is also a coarse texture with rust inhibiting qualities for direct application to concrete slab ceilings.

Conclusion: After successful field experience, Bestex A, B, and C have been released and added to our line of Joint System materials. Trials of Bestex D were not as favorable, and further work will be necessary, if Sales still feels that this product is required.

3. SYNTHETIC GYPSUM - R&D #221

Objective: To further prove that it is possible to use synthetic gypsum in the manufacture of gypsum wallboard, and to establish what equipment and operating conditions are desirable or necessary in this process.

Investigation: A one-week run was conducted at the New Orleans plant, in which about 500 tons of synthetic gypsum were purchased from Coastal Chemical Corporation at Pascagoula, Miss. and converted into the manufacture of wallboard. The synthetic was neutralized, dried, calcined, and tube milled prior to being transferred to the board stucco bin. Variations in the amount and type neutralizer used and variations in calcination temperatures were tried. In the board making process, the grind of the synthetic transferred to the mixer was varied by means

of a hammermill. The amount and type of accelerator used was also varied. The machine speed used was 40 fpm and was subsequently increased to 60 fpm. The slower machine speed was to enable the synthetic gypsum to fully hydrate, since past experience has shown that synthetic gypsum hydrates at a slower rate than ~~natural~~ gypsum.

Conclusion:

1. It was confirmed that the hydration of the synthetic gypsum proceeds at a slower rate than with natural gypsum. The hydration appeared to be improved by using a lower temperature for calcination. The longer hydration time required means that a longer belt section prior to the dryer would be necessary to maintain normal manufacturing speeds.
 2. Highly tubed stucco did not perform satisfactorily on the board machine; however, a small amount of tubing is highly desirable.
 3. It appears to be necessary to use aluminum sulfate to provide sufficiently quick hydration, even at the reduced machine speed. A ratio of 60% ground block and 40% aluminum sulfate appeared to be optimum.
 4. It appears to be desirable to include a hammermill in the system to provide a fine grind stucco.
 5. The board manufactured was satisfactory in every respect. Approximately 100,000 sq. ft. of this wallboard has now been shipped, without any comment whatsoever from the field.
4. PROTEIN JOINT COMPOUND FORMULATIONS - R&D #275

Objective: To make revisions or improvements where necessary or advisable in our Joint System formulations.

Investigation: The work on this project was intensified when the price of casein began to rise sharply last December. At that time, it was 19¢ a pound, and the present price is 38¢ per pound. We were already evaluating a new alkali system which permitted less casein to be required. This alkali system is a combination of soda ash and borax. The alkalies are not new, but we have never been able to use them previously, because the water retention agent we were using was not compatible with borax. We have just recently begun to use a water retention agent called Natrosol which is compatible with borax. The reduction in the amount of casein and the use of borax, which has some preservative properties, has enabled us to use a milder preservative in lesser quantities. This has resulted in some economies in preservative usage, in addition to the savings in casein.

Conclusion: This work was intensified as soon as the price situation regarding casein began to get out of hand. The Lab work was concluded, and a comprehensive field testing program was commenced. Field trials were held in Cleveland, Rochester,

Kansas City, Wilmington, Philadelphia, Denver, Chicago, and Houston. In every case, the results were favorable. As of April 1, Akron was converted to the new formulas. On May 1, Acme also made the transition. Based on a casein price of 38¢ per pound, the per bag savings varies from 10¢ to 17¢, depending on the product and whether the manufacturing point is Acme or Akron.

5. TWO-HOUR FIRE RATED INCOMBUSTIBLE FLOOR & CEILING - R&D #279

Objective: Test a concrete and bar joist floor & ceiling construction protected by 1/2" Firestop to gain a 2-hour rating.

Investigation: National Gypsum Company was the first to obtain this rating with their Super-X 1/2" Fireshield board. Subsequently, USG also obtained a rating with their Type C Firecode wallboard. Last October, we made an attempt to achieve the rating with our regular 1/2" Firestop, but we were unsuccessful. It was obvious that a special board with improved performance would be required, in order to pass the test. The installation of our pilot furnace was completed in December 1964 and, by January 1965, it was operational. A long series of exploratory tests were conducted in the pilot furnace, so we could determine what was needed to achieve this rating. The exploratory tests brought out the following facts:

1. A new type of glass fiber from Owens Corning, designated 636, was found to perform better than the 710 or 799 glass fiber formerly used.
2. Firestop from Wilmington was found to perform better than Firestop from Fort Dodge.
3. 1/2" Firestop from Wilmington, with either 799 or 636 glass fiber types, was found to outperform samples of National's Super X and USG's Type C boards obtained in the field.

A special run of 1/2" Firestop using 636 glass fiber was conducted at the Wilmington plant, and this board was rechecked in the Lab. The results were again favorable, and the full scale test at Underwriters was arranged.

Conclusion: On May 11, the test was passed giving us the 2-hour rating. At the same time, a lower weight limit for 1/2" and 5/8" Firestop was established. The minimum for 1/2" Firestop was reduced from 2000 to 1930 lbs/M., and the minimum for 5/8" Firestop was reduced from 2525 to 2415 lbs/M. This is based on our using 636 glass fiber, which we intend to do.

6. ONE HOUR FIRE RATED WOOD FLOOR & CEILING WITH 1/2" FIRESTOP - R&D #287

Objective: To test a wood joisted floor, protected by 1/2" Firestop on the underside at Underwriters' Laboratories, in order to gain a one hour fire rating.

PROJECTS NEARING COMPLETION

1. DRY VINYL JOINT COMPOUND - R&D #211

Objective: To develop joint system products with vinyl or other synthetic resin binders.

Investigation: A joint compound consisting of polyvinyl alcohol and spray dried polyvinyl acetate as the binders, and Natrosol as the water retention agent was formulated and tested extensively here in the Laboratory. On the basis of favorable lab results, a field test was conducted in Hartford, Conn. This customer was selected because of his interest in a vinyl joint compound. The material was followed through all phases of the joint treatment, and then examined again after it had been decorated; Results in all cases were satisfactory to us and to the customer. On this basis, he was shipped another truckload. After this second truckload was used, another investigation was made, and it was found that the bond of the vinyl joint compound to the tape was not quite as good as it should be. This was traced to a problem with the USG tape that they were using. Since the vinyl compound bonded satisfactorily to Bestwall tape, they began to use our tape and continued to place orders for the vinyl product. Subsequent laboratory investigations indicated that a plasticizer, such as Dibutyl Phthalate would add significantly to the bond under humid conditions, regardless of what tape might be used. This change was put into effect on the third truckload, and another inspection was made after it had been used. In the meantime, the new plasticized formula was tried in several areas around Philadelphia, Wilmington, Washington, D. C., and Baltimore. All of the trials except the one in Wilmington drew favorable comments on the workability and performance of the material. After these tests, it was decided to release the product in the Wilmington Sales District, so that it would be exposed to wider market coverage. At the same time, additional trials will be held in other parts of the country.

There is very little difference in the economics between the dry vinyl joint compound and our regular casein joint compound. If the products are priced the same, there appears to be sufficient advantages to the dry vinyl joint compound to induce customers to request it in preference to the casein products.

2. READY MIX JOINT COMPOUND - R&D #211

Objective: To improve the quality and cost structure of Ready Mix Joint Compound.

Investigation: Quite a number of problems developed with Ready Mix after it was initially introduced. Some of these problems were viscosity control, inadequate humid bond, insufficient resistance to cracking, and unsatisfactory workability. Quite a lot of additional work has been done in cooperation with the plants, and some formula revisions have been made. It is felt that all of these problems are under control at the present time, based on recent market reactions. Further work is being done

toward a reduced formula cost. Successful initial field tests were conducted on the latter in the St. Louis market, and we will continue to furnish St. Louis to gain further experience with this lower cost formula.

Also under investigation are lower cost containers. The Purchasing Department has contacted several manufacturers of containers, to see if we can get a cheaper container than the metal pail presently used. We are searching in two directions: First, to obtain some sort of corrugated package which could be used in conjunction with Ames Tools. For this use the package must be sufficiently rigid, in order to transfer the material from the container by means of a pump. The second type of package under consideration is a waterproof bag which would be strong enough to contain the product in loading and shipping. If bags of this kind can be developed, they should be quite inexpensive.

A small amount of time was provided to give technical assistance to the Engineering Department in their design of a Ready Mix plant for Acme.

3. DENS-COTE TAPE - R&D #219

Objective: To develop sources for Dens-Cote tape and to prepare a raw material specification for this product.

Investigation: Several tapes of different mesh sizes, and from different manufacturers, have been received. Thus far, it appears that a very fine mesh tape (18 x 14) offers greater joint strength and better resistance to cracking than the present 7 x 11 tape. Some further work remains to be done, to establish what the results will be for mesh sizes falling in between these two. A second consideration is the ease of application of the tape, and still another consideration is the cost of the tape. We are working closely with Purchasing, so that eventually some standard tape specifications can be established.

4. USE OF DENS-COTE OVER MASONRY SURFACES - R&D #219

Objective: To approve the use of Dens-Cote plaster over masonry wall surfaces.

Investigation: Some trial jobs were held, wherein our Texture Finish Dens-Cote was used over concrete block walls. This application proved to be quite satisfactory, and we have approved the use of texture finish Dens-Cote for this purpose. There is some concern as to whether the smooth finish can be used in this manner and, in any event, no field trials have yet been conducted. Laboratory investigations have shown that Dens-Cote for use over smooth monolithic concrete does not provide a satisfactory bond; so we will not recommend it for this purpose.

S U M M A R Y

The major accomplishments by the Research Department during the first half of 1965 were:

1. The two hour rating for a concrete & steel floor and the one hour rating for a wood floor using 1/2" Firestop. These tests enabled the minimum weight of 1/2" Firestop to be reduced from 2000 lbs/M. to 1930 lbs/M., and 5/8" Firestop from 2525 lbs/M. to 2415 lbs/M. In addition to the promotional value of these fire rated assemblies, the lower weights will reduce the manufacturing costs and freight charges.
2. The two hour fire rating and 47 STC sound rating gained for a metal stud partition with 2 layers of 1/2" Firestop on each side. Neither National Gypsum nor USG has this rating.
3. Several fire ratings were obtained for wood stud, metal stud, and gypsum stud partitions; all of which have 50 STC or better sound transmission values. The combination of resistance to sound and fire protection makes these partitions especially attractive for apartments and other multi-family dwellings.
4. Substantial cost reductions have been and will continue to be realized from research effort in two areas: First, the amount of glass fiber used in regular wallboard has been reduced, since the new finer filament fiber has proven satisfactory. Secondly, the formula revisions for four basic products of the Joint System line will help offset what could have been an increased cost structure due to the casein shortage.
5. A successful one week plant run confirms that we can manufacture wallboard from at least one source of byproduct gypsum. Although this gives us an alternate supply of our basic raw material, at the present time there are no known sources of synthetic gypsum located close enough to our plants to make its use economically attractive.

There was one very disappointing result during the past 6 months. This was our inability to print black accent lines on the Deluxe Tru-Grain so that it could be released as planned. After repeated failures, we have had to admit defeat for the present time. This Deluxe Tru-Grain was to compete with USG's Ultra-wall and National's Fashion Grain. This unfavorable result brings out a weak point in our structure; i.e., we cannot emphasize every area of product research. In certain instances, nothing is done until a competitive situation develops, and sales pressure dictates that a concentrated effort should be made. Often the competitor has already spent several years of research on the product and has a background of experience on the subject. At this point, it can be difficult to catch up in a reasonable period of time. In some special situations, such as fire testing and joint system, we have been able to keep pace with our two largest competitors, because we have concentrated our effort in these directions. It is felt that our emphasis has been properly placed, but we must recognize that we cannot put our emphasis

in every direction; and we stand to fall behind wherever there is little or no effort. Time has been devoted to certain projects that show unusual promise, such as the acoustical tile development. If all of the time was spent catching up with competition instead of exploring new ideas, we would never have any industry firsts. We have endeavored to divide the time proportionately to approach an optimum balance of our immediate and future needs.

The progress made would not have been possible without the assistance and cooperation of the various other departments. With such combined effort, even greater progress should be possible in the future.

Tentative plans for the next 6 months shape up as follows:

1. The acoustical tile development will be continued on a high priority basis.
2. The particle size evaluation just resumed will be pursued to gain all the information desired. This work is being done primarily to gain a better understanding of our products but could be a stepping stone to some significant development in the future.
3. The development of both thincoat plaster and drywall radiant heating systems will be emphasized, in view of the increasing amount of electric heat in new construction and the interest in radiant heating.
4. Mr. Morrone has become involved in the training of new joint system quality personnel and will continue to have this responsibility until the program is complete. The development work on joint system will be handled simultaneously with the training. The evaluation of synthetic binders for these products will be stressed, in view of the high casein price.
5. Fire and sound testing will once again be an important segment of our program. Specific objectives are the cost reduction of 5/8" Firestop, development of a fire rated tile backer (water resistant) board, and one hour fire rated partitions using 1/2" instead of 5/8" Firestop.

BESTWALL GYPSUM COMPANY

R&D REPORT FOR 6 MONTH PERIOD ENDING DECEMBER 31, 1964

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FOREWORD

This is a report of the activities of the Research Department for the last six months of 1964. During this period there were no personnel changes in the department. The major change which did take place was the restoration of the Research & Development test facilities in a new building. Our large scale testing facilities had been removed during the consolidation of Bestwall's general offices in Paoli. In the new building, better equipment and more space have been provided for us to perform our function.

The 1964 expenditure is estimated by the Cost Department at \$133,880 as opposed to the figure of \$150,000 which had been projected for 1964. In 1965, more reliable figures will be available because of the new accounting system which will be in effect. A better analysis of research expenses will therefore be possible. With the information available this year, the chart on the following page was prepared and shows the approximate distribution of research costs in 1964.

Also included in this report is a record of the market performance of products which have resulted from the efforts of the Research Department. There is no sure method of evaluating certain accomplishments, such as fire rated constructions or sound rated constructions which were developed to provide assistance to Sales. The fact that our sales of 1/2" Firestop are up 48.7% in 1964 and our sales of 5/8" Firestop are up 34.2% in 1964 over 1963, are indications that we are reaping some benefits from this work.

This report is divided into three sections:

- Projects Completed
- Projects Nearing Completion
- Projects Underway

These sections appear in the order named and indicate the progress to date for the projects within each section.

*1964 MARKET PERFORMANCE OF NEW PRODUCTS

<u>PRODUCT</u>	<u>SALES VOLUME</u>	
	<u>Last 6 Mos</u>	<u>Year</u>
FIRESTOP 120	251 M sq. ft.	557 M sq. ft.
GRABIT ADHESIVE	53 T	75 T
ONE DAY JOINT COMPOUND	284 T	548 T
DENS-COTE PLASTER	911 T	1,629 T
DENS-COTE BASE	4,952 M sq. ft.	8,774 M sq. ft.
DENS-COTE TAPE	7,302 rolls	13,764 rolls
READY MIX	13,203 cans	15,617 cans
TILE BACKER BOARD	321 M sq. ft.	345 M sq. ft.
TILE BACKER TAPE	139 rolls	139 rolls
MODEL DENSITE	4.5 T	4.5 T
TOOLING DENSITE	0.8 T	0.8 T
HIGH EXPANSION DENSITE	2.1 T	2.1 T
BESTEX "C"	527 bags	527 bags

TOTAL

PATENT INFORMATION

Patents Issued - None

Patents Applied For - None

Patent applications previously submitted:

Processing of Synthetic Gypsum

One Day Joint Compound

Grabit Adhesive

Dens-Cote Plaster

Dens-Cote Base

MILL BASE SALES		ESTIMATED GROSS PROFIT	
<u>Last 6 Mos</u>	<u>Year</u>	<u>Last 6 Mos</u>	<u>Year</u>
\$ 34,380	\$ 76,751	\$ 9,875	\$ 22,432
10,048	14,259	5,778	8,181
45,826	92,459	11,862	24,346
49,124	88,032	8,478	16,228
209,280	370,667	79,988	143,909
7,465	13,770	3,129	5,801
57,488	68,496	8,662	10,279
25,058	26,742	9,344	10,390
1,273	1,273	769	769
158	158	63	63
41	41	14	14
99	99	25	25
<u>2,848</u>	<u>2,848</u>	<u>1,018</u>	<u>1,018</u>
443,088	755,595	139,005	243,455

*Cost figures computed by the Financial Department from the machine accounting records.

PROJECTS NEARING COMPLETION

1. JOINT SYSTEM TEXTURES * R&D #261

Objective: To develop a complete line of textures suitable for spray application.

Investigation: Earlier field trials of a formula in the Fort Dodge market were unfavorable. It was found that the texture, when applied & dry, had a sheen which under certain types of light appeared like shiny spots on the ceiling. This was overcome with a revised formula, and a series of trials in the Brunswick area and elsewhere were conducted. These trials were moderately successful, but the texture still lacked adequate hiding properties. It was found that the texture as applied piled up in local areas instead of flattening out and resulted in small areas which were not covered by texture. The necessary formula revisions were made, and another series of trials were conducted. This time we returned to Kansas City, where some of the earlier unsatisfactory trials were held. The simulated acoustic texture was given the most attention, since this type is the most popular. Field trials of the simulated acoustic texture have all been quite favorable, and it has been released under the trade name of Bestex C. Other proposed products for the spray texture line are currently undergoing field performance trials. These are:

Bestex A - Non-aggregated texture for spray application. This texture is often applied to walls when one of the other textures is used on the ceiling.

Bestex B - Sand finish type texture for contractors who prefer a lighter texture.

Bestex D - Coarse, rust inhibiting texture for direct application to concrete slab ceilings.

A great deal has been learned in the course of this investigation which adds to our experience in the application of decorative materials. If the current field testing meets our expectations, the Bestex A, B, & D should be released within the next few months.

2. NEW TYPE OF GLASS FIBER - R&D #131

Objective: Evaluate Owens-Corning's fine filament 636 glass fiber for use in our wallboard products.

Investigation: The 636 glass fiber consists of .00026" diameter filaments. This compares to 710 fiber which has .00040" filaments and 799 fiber which is a mixture of the two filament sizes. There are twice as many individual filaments per pound of 636 glass fiber than there are of 710 glass fiber. This

PROJECTS UNDERWAY

1. RAM PROCESS PLASTER - R&D #132

Objective: To develop a special pottery plaster for use in ram pottery making process. One of the requirements for the product is that the molds can be purged of excess water with air at 120 p.s.i.

Investigation: This project has been marked with a number of unsuccessful attempts to produce an acceptable product. Another experimental formula was tried at Phaltzgraff Pottery in York, just recently, and again our product did not quite pass the requirements, as it was unable to withstand the 120 p.s.i. purging for the full 15 minutes. This is a test used by the pottery people to be sure the castings will not explode and injure someone while they are in actual use. The casts made with our material withstood the purging for only a few seconds at 120 p.s.i. This is the closest we have ever gotten to a successful product, and it is believed that further efforts are justified, since we are so close to having an acceptable product. It is our understanding that the volume of ram process plaster and particularly the regular pottery plaster sold along with it is substantial.

2. VINYL JOINT COMPOUNDS - R&D #211

Objective: To develop joint system products with vinyl binders instead of casein binders.

Investigation: This has been under investigation for some time, but the economics has always favored the protein binders. Also the inability of obtaining an adequate bond at low temperatures (below 45°F.) with the vinyl products has slowed the progress. A vinyl base topping compound was developed, but when presented to Sales their survey showed little interest in this product, particularly in view of the premium price we would have to ask for it. This work has recently been intensified, in view of the price instability of casein and the present sharply higher casein prices. Our objective is a vinyl base joint compound (for taping & finishing) which can be sold at the same price as the casein counterpart. This product can also be used as a finishing material over One Day Joint Compound, if we are successful. We have experienced some incompatibility problems in using our present products to finish over One Day joint system.

3. PREPARED TROWEL FINISH PLASTER - R&D #228

Objective: To develop a finish plaster which can be used in lieu of the conventional lime-putty finish. USG is presently supplying a product in the Houston market, so the chief purpose of this product is to meet that competitive situation.

small acoustical tile specimens of various formulations were made. The Standing Wave tester was repaired so that specimens could be compared acoustically with tiles of known sound absorption properties by comparing normal incidence sound absorption values. It was found that an inter-connecting cell structure was possible, and this, of course, gave better sound absorption. The 7/8" thick tile samples compare favorably with competitive acoustical tile having an NRC of 65-75. Painting the surface of these tile samples with a non-bridging paint does not change the absorption. A cast density of 16-18 lbs/cubic foot has been used thus far. A study of the effect of density, the effect of different resins, and the effect of 1" glass fiber will be the next steps in the tile project. Following the establishment of a preliminary formula, a fire endurance test in our small furnace and an absorption test at a recognized acoustical testing laboratory will be recommended. We are shooting for a 2 hour fire rated lay-in tile with an NRC of 70 or better. Raw material costs of this proposed tile should be less than 4¢ per square foot 1" thick. No estimate of manufacturing costs has been made as yet. It does, however, appear that the economics can be favorable, in view of the selling price of more than 20¢/sq. ft. for this type of tile (Armstrong's 2 hour rated Fire-Gard).

6. PROTEIN JOINT COMPOUND FORMULATIONS - R&D #275

Objective: To make revisions or improvements where advisable in our Joint System product formulations.

Investigation: Previous work consisted mainly of the substitution of hydroxyethyl cellulose for alginate as the water retention agent in joint system, and the testing of a new alkali system which consists of soda ash and borax. The hydroxyethyl cellulose (Hercule's Natrosol) offers improved mixing & application properties, and the borax provides quicker solution of the casein and a more efficient binder system. In the old formulas, borax was not compatible with the alginates, so its use was dependent on our ability to use Natrosol as the water retention agent. Other hydroxyethyl cellulose products had been tried in the past, but their hygroscopicity always prevented successful use. This adverse characteristic has been overcome in Natrosol.

Even before this work was completely finished, a casein shortage developed, and the price of casein began to skyrocket. Starting at 19¢/lb. in December, the price will reach 36¢/lb. by March. Because of this, we were directed to intensify the work being done and to start a search for binder substitutes for casein. Since the new alkali system offers a quicker method of reducing cost by reducing casein content, it will be given first priority. The other approach involving binder substitutes and binder combinations has also been started, but this is a longer range program and will be given secondary attention.

Investigation: The details of the construction have been worked out, and the test has been arranged to be run at Ohio State. All of the materials are at Ohio State, so this partition can be tested as soon as we can get on the schedule.

12. PRECOATING OF GYPSUM WALLBOARD - R&D #286

Objective: Apply a coating of joint system material to the surface of the wallboard as an in-process operation.

Investigation: It was found that a thin uniform layer of joint compound could be spray applied over a wallboard surface. In certain cases, the area of the wallboard is given a coating of joint material as the last step in its installation and before painting. This operation was initiated by Mr. E. B. Hummer, and its prime purpose was to bring the surface textures of the wallboard & the surface covering of the joints, nailheads, etc. closer together. In other words, the shear coat provides a more nearly monolithic surface. Other advantages to be gained, from our standpoint, are that more paper defects could be tolerated - and perhaps a lower cost (grayback instead of ivory) paper could be used. The major problem is how to apply such a coating in the proper thickness and sufficient uniformity in our manufacturing process. However, before that stage is reached, a more precise appraisal of the coating and any problems it may present must be assessed. We are in the very early stages of this investigation and, at the moment, our attention has been diverted to other projects of higher priority.

13. READY MIX JOINT COMPOUND - R&D #211

Objective: Reduce the formula cost of our Ready Mix, in order to improve the profit on this item.

Investigation: A comparison of Bestwall Ready Mix vs. ESG and other competitive products revealed that the competitive products have lighter weight pails. A difference of about 4 lbs/5 gallon pail was found. In exploring this, it was found that substitution of 3% highly absorbent Attagel Clay for 10% Kaolin Clay reduced the pail weight by $4\frac{1}{2}$ lbs. In the process, more water is required; and the net result is a 10% reduction in raw material usage. A series of tests is underway to evaluate this new formula, and indications thus far are that some quality advantages will be gained in addition to the improvement in Economics.

S U M M A R Y

The last 6 months in the Research Department have been highlighted by the reinstallation of our large-scale testing equipment in a new building, which was provided for that purpose. The major accomplishments during this 6-month period were:

1. The first 2-hour fire rated wood floor & ceiling assembly was granted to Bestwall, from our successful test of this construction at Underwriters' Laboratories.
2. The first 1-hour rated wood stud partition with 1 layer of fiberboard and 1 layer of 5/8" Firestop was achieved as a result of another successful test; this time at Ohio State University.
3. A sound test program was completed which gives us a full range of sound transmission class (STC) values, to promote wood stud, metal stud, and gypsum partitions.
4. A new line of striated wood grain products has been readied for release early in 1965.
5. A vastly improved high expansion plaster has been developed and added to our industrial product line.
6. A series of particle size analyses has been completed recently. This study has provided our first knowledge of the particle size & gradation of our materials in the subsieve (finer than 44 micron) range. This is the start of a build-up of information that can be a basis for future developments.

Having our equipment restored and some newer facilities which we did not have available previously, will enhance our ability to undertake developments and furnish information that can serve as a basis for the immediate & future growth of Bestwall Gypsum Company. A budget for next year in the amount of \$170,000 was prepared. This includes \$60,000 for new fire & sound test programs, as well as continuing our present programs on the same basis as last year. Also, allowance has been made for the addition of one new man to the Research Department staff.

The present plans for early 1965 call for the following work to be undertaken:

1. A large scale run of synthetic gypsum which will provide the final basis for deciding the future use of this process development.
2. The release of a full line of spray textures.
3. An extensive exploratory fire test program using our small furnace and the subsequent scheduling of large scale tests at U. L. and Ohio State based on our findings.

4. The reduction of the glass fiber usage in regular wallboard based on experience with the finer filament glass fiber.
5. The pursuit of a cost reduction program in the joint system product line, by means of formula revision.
6. The search for new binders to supplant casein in joint system products.
7. The development of comparative information on a dozen different thincoat plaster products which have been submitted.

Projects absent from the present schedule are the particle size studies, the gypsum acoustical tile, the pre-coating of gypsum board, and other more basic work. It is our fervent desire to pursue this work, as soon as time can be spared from areas of higher priority. These higher priority items are of more immediate significance to the Company, but spending our entire effort here completely ignores the projects which protect our future. It is our opinion that the longer term projects, when successful, result in far greater potential than the projects designed to fulfill immediate needs. It is our hope that a program encompassing both the immediate & future needs of the Company will be possible.

BESTWALL GYPSUM COMPANY

SEMI-ANNUAL RESEARCH AND DEVELOPMENT REPORT

Jan. 1, 1964 to June 30, 1964

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FOREWORD

This report covers the activities and accomplishments of the Research Division for the first 6 months of 1964. There has been no personnel change in the Research Division during this period.

It was estimated last January that the total 1964 R&D expenditures would approximate \$150,000. The first half figures show that \$65,895 has been spent thus far.

The Research Division had its third anniversary in June. A rundown of the last 6 months' market performance of products resulting from our efforts since that time follows. Some of the accomplishments, such as fire ratings acquired, cannot be directly assessed. However, the fact that our 1/2" Firestop sales are up 106% and our 5/8" Firestop sales up 27% for the first 6 months of 1964 over a like-period in 1963 is a good indication of the value of this effort.

The major portion of this report is devoted to the progress made on the various projects during the past 6 months. It is divided into three sections, namely:

1. Projects Completed
2. Projects Nearing Completion
3. Projects Underway

*MARKET PERFORMANCE OF NEW PRODUCTS

JANUARY THRU JUNE 1964

<u>PRODUCT</u>	<u>SALES VOLUME</u>	<u>MILL BASE SALES</u>	<u>ESTIMATED GROSS PROFIT</u>
1. Firestop 120 Ceiling Tile	306,000 sq.ft.	\$ 42,371	\$ 12,355
2. "Grabit" Masonry Adhesive	22 Tons	4,211	2,403
3. One Day Joint Compound	264 Tons	46,633	12,484
4. Dens-Cote Plaster	718 Tons	38,908	7,750
5. Dens-Cote Base (all)	3,821.6 M.Sq.Ft.	161,387	63,921
6. Dens-Cote Tape	6,462 Rolls	6,305	2,672
7. 1½" Drywall Screws	872 Gross	2,321	305
8. Ready Mix Joint Compound	2,414 Pails	11,008	1,617
9. Water Resistant Board	23,700 Sq. Ft.	1,684	1,046
10. Model Densite	1 Ton	35	14
11. High Expansion Densite	.7 Ton	<u>31</u>	<u>7</u>
		5314,894	\$104,776

*Obtained from Paoli machine accounting records.

PATENT INFORMATION

Patents Issued - None

Patent Applications Prepared -- Dens-Cote Plaster
Dens-Cote Base

Patents Applied For - None

Patent Applications Previously Submitted -- Processing of Synthetic Gypsum
One Day Joint Compound
Grabit Adhesive

PROJECTS COMPLETED

1. READY MIX JOINT COMPOUND - R & D 211

Objectives To develop a ready mixed or paste type joint compound to be competitive with other similar products on the market.

Investigation: About two years ago, a basic ready mix formula was developed and successfully field tested. At that time, it was decided that the product would not be put into the line, because (1) the product was not economical due to the freight involved in shipping the pails of ready mix to the potentially good markets; the freight involved in shipping the dry premix from Acme to other plants for conversion to the paste compound; and the relatively high cost of the formula. (2) The questionable market potential. Surveys indicate that the demand was spotty and confined to a few areas which would be least economical for us to ship. (3) The relatively large investment required for equipment to mix, fill pails, store and transfer emulsion, and provide storage for raw materials and finished products.

The second phase of this investigation was begun because of renewed interest from certain parties in Sales, a second basic joint system plant put on stream at Akron, and our own realization that ready mix was becoming a product we would have to reckon with sooner or later. In order to overcome the necessity to purchase large tanks and provide warm storage for binder (PVA emulsion), a ready mix formula which contained a dry binder was developed. This formula cost was also high, but it did circumvent the large equipment expenditure. A small facility was set up at Akron to furnish the requirements of a large high-rise job. The job never materialized; the ready mix froze and thawed several times during the subsequent winter; and it was obvious that the area serviced by Akron was not a good ready mix market, in view of the meager sales.

In spite of this bad taste from ready mix, it had become apparent that ready mix was the preferred joint system in some markets. It is becoming a factor in other markets and is being used for touchup and by "do-it-yourselfers" even in the areas where other joint system products are preferred. Our previously expanding joint system business has leveled off the past two years, and it is felt that lack of a ready mix product has been one cause. It was decided that ready mix should be available from Acme, Akron, Brunswick, Fort Dodge, and Wilmington. This constituted the third phase of the ready mix investigation.

Result: Brunswick and Fort Dodge have already been put into operation, and Akron is continuing to furnish their own requirements as well as supplying Wilmington. Based on the performance of these operations, the other facilities at Acme and Wilmington will be installed. The cost of the equipment including mixer, lid closer, pail filling ram & pump, accessories and installation of the equipment is about \$6000 per plant. The pail filling device which is rather inexpensive has improved the capacity of these installations. Some economies in the formula have also been realized, so that the ready mix operation should be more profitable

than originally expected. We returned to the emulsion binder, in view of its lower cost and also because it gave a better end product than the dry resin binder. If the volume can justify the purchase of emulsion in large quantities, a further savings of up to 20¢/pail can be realized. A photograph of a 5-gallon pail of ready mix is shown below:



PROJECTS NEARING COMPLETION

1. JOINT SYSTEM TEXTURES - R & D 261

Objective: To develop pre-aggregated textures for spray application. Specifically, these textures are:

1. Simulated Acoustic (coarse aggregate)
2. Sand Finish (fine aggregate)
3. Masonry (coarse aggregate with rust inhibition properties)

A further object is to develop textures that can be used over surfaces where One Day Joint Compound has been used for the joint finishing, without the necessity of first using a primer.

Investigation: The three products listed above were developed to the trial stage sometime ago. This was during the reorganization of the Sales Department, and the trials never materialized. In some instances the material was lost or used and never reported on. Additional trials were requested, and these were slow to be scheduled. In desperation, it was decided to make these textures available in the area served by the Fort Dodge plant. A quantity of each of the various textures, including a plain (non-aggregated) texture designed to cover One Day without a primer, was shipped to Fort Dodge. Wherever possible, the trials were witnessed by Laboratory personnel. The trials provided some differing opinions but, in general, some unfavorable characteristics prevented their acceptance. These were:

1. When dry, the textures developed a sheen that made the ceilings appear blotchy under severe lighting conditions.
2. The textures would build up locally instead of flattening out as they were applied. This was not too detrimental for the simulated acoustic but caused the sand finish to be coarser than desired.
3. The plain texture covered the One Day satisfactorily in some cases but not in others, so it also failed to achieve our expectations.

On the basis of this experience, it was decided to return all of this texture to Akron and rerun it at a later date. The texture project was brought back to the experimental stage, and means were sought to overcome the objections. It became evident at this time that we should develop the basic textures needed for addition to the line, without regard to their ability to cover applications of One Day Joint System.

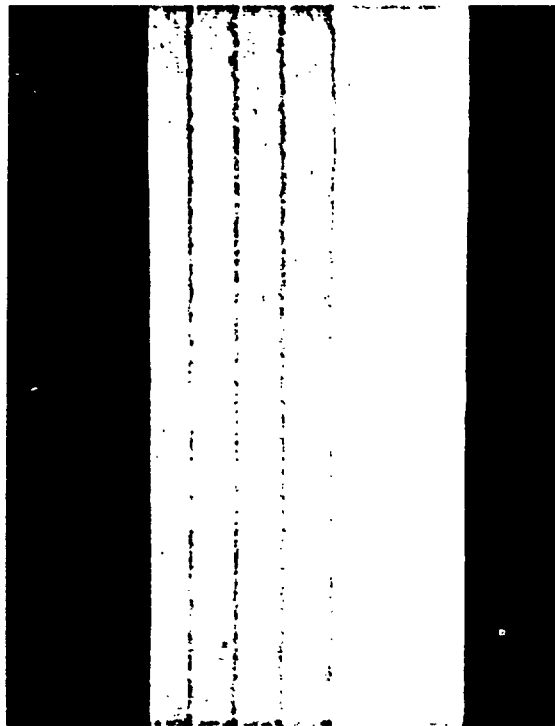
After reformulating the products on this basis, some trials were conducted in the Brunswick area. The trial of masonry texture did not materialize, but the sand finish and simulated acoustic products were found to be satisfactory and overcame the previous objections. The field testing will be continued with additional trials in Kansas City and Hartford, Conn. Trials previously conducted at these locations drew unfavorable comments, so this will confirm whether the necessary corrections to the formula have been made. If these trials are successful, we will consider

approving the two products for release. As yet, insufficient trials of the masonry texture have been conducted to determine whether this product is going to be acceptable.

2. HUMMER SYSTEM - R & D 209

Objective: To develop improved laminated gypsum ribs for Hummer partition systems.

Investigation: It was previously reported that a $2\frac{1}{2}$ " thick x 3" wide rib had been developed, and field trials were being requested. After some futile attempts to have trial partitions constructed with these ribs, one was finally found in Washington, D. C. for approximately 100 linear ft. of partition. The advantages brought out in this trial were (1) the ease of installing electrical facilities, and (2) the increased stiffness of this partition. Concurrent with this development, Mr. Hummer modified the installation procedures for the Hummer "B" System, so that the ribs could be set in metal U channels similar to the manner metal studs are set in place before the faces are applied. The new rib and the improved method of installation should overcome all of the advantages previously held by metal stud systems. The next phase is to have one large trial job completed with the new ribs, so a more thorough evaluation will be possible. A picture of the new rib is shown below:



We believe that if the face layer of 5/8" Firestop can be held in place longer, there will be a good chance of making the 2 hours. On this basis, the large scale test was recommended. Certain changes in fastening will be made to hold the face layer on longer. The AFE has been approved, and the construction and test are scheduled for late July or early August.

7. DRY VINYL TOPPING COMPOUND - R & D 211

Objective: To formulate a topping compound with a vinyl binder instead of a casein binder. It is intended that the vinyl topping will be a superior product.

Investigation: The investigation was originally directed to the development of a dry vinyl joint compound. Bonding difficulties at low temperatures caused us to direct our efforts to a topping compound, in which the bond is less critical. The advantages of a vinyl formula are:

1. Longer wet life, since it is not subject to putrefaction to the extent that casein topping is.
2. Offers better control from the plant standpoint because of simpler formula and more uniformity of the binder.
3. Requires less mixing water so there is less shrinkage.
4. Offers better working properties than its casein counterpart.
5. Is compatible with One Day, whereas casein topping is not.

Field trials of the vinyl topping were conducted in Nashville, Tenn. and Hartford, Conn. The comments were favorable, and its performance was satisfactory. Also, this product was used for some of the joint finishing in the Laboratory during the renovation of the building. Most applicators commented that it worked like ready mix. It was hoped that the vinyl formula would not be significantly higher in cost than regular topping, but this did not prove to be the case. The vinyl topping has a raw material cost of \$84/ton as opposed to \$65/ton for the regular topping. In view of the advantages of this topping, the Laboratory will propose that the product be released and sold at a premium price.

8. SYNTHETIC GYPSUM - R & D 221

Objective: To confirm the results of the initial trial run which indicated that synthetic gypsum could be successfully utilized for wallboard and plaster manufacture. This process involves conversion of the synthetic gypsum by product of the manufacture of phosphoric acid to a useable form.

Investigation: The basic operations of this conversion process for which a patent has been applied are as follows:

1. Drying of the synthetic gypsum as received. The latest shipment contained 20% free water.

9. GYPSUM ACOUSTICAL TILE - R & D 274

Objective: To develop a gypsum acoustical tile using the resin reinforced foam idea.

Investigation: Some previous work directed toward the development of a lightweight board confirmed a theory regarding the reinforced foams. The theory is that a foam cell containing some resin or other reinforcing material surrounding the cell will act as an aggregate in a gypsum matrix. This would provide greater strength than normally expected of a foam gypsum structure. This theory was confirmed, but the economics of its use in board were not favorable. It was felt that this theory might be applied to a product for which the additional cost could be justified. With the knowledge that acoustical tile, particularly when fire rated, sells for 15 - 25¢ per sq. ft., some exploratory work was done. Sample 2' x 2' tiles at 15 - 17 lbs/cu. ft. density were made, using reinforced foam and glass fibers to provide sufficient compressive and transverse strength. Sound absorption tests conducted by an outside laboratory indicate that our product is just about as good acoustically as Armstrong's 2 hour rated Fire-Gard tile. A fire test in our small scale furnace indicates that it performs better than either our Firestop 120 or Armstrong's Fire-Gard, both of which have 2 hour ratings. The estimated raw material cost, excluding paint, is 4¢ per square foot for 3/4" thickness, allowing 25% for waste.

This acoustical tile appears to offer good potential and when presented to Sales, it was suggested that we assign a project to proceed with its development. This all occurred during the building renovation, and there was no space to set up for casting full size slabs. As soon as the new building is ready, the necessary foaming, mixing and casting equipment will be installed. In the meantime, our old Standing Wave equipment for testing sound absorption has been sent out for repair so that it can be used to test the sample tiles which will eventually be made.

10. PROTEIN JOINT COMPOUND FORMULATIONS - R & D 275

Objective: To make improvements where advisable or necessary to our Joint System products.

Investigation: A water retention agent from the hydroxyethyl-cellulose family has been found which offers improved qualities and cost savings for our line of Joint System products. This product, called Natrosol, will be used as a substitute for Kelsize, which is a Kelp product. In conjunction with this substitution, one of the preservatives will be eliminated. This preservative was necessary because of the degenerative effects of the Kelsize.

The improvements in quality expected are:

1. Easier mixing
2. Better working
3. Greater insurance against staining problems which stem from preservatives.

The savings vary with the formula, but based on the last six months' sales, the anticipated annual savings would be \$22,300.

The savings do not include ready mix in which we have already incorporated Natrosol. A slow changeover to Natrosol in all products is already underway and should be completed by the end of the year.

11. SOUND RATED CONSTRUCTIONS - R & D 276

Objective: To conduct a sound test program to establish sound ratings for various partition and floor & ceiling assemblies. Most of this is being done at Donn Products' Ohio Research facilities.

Investigation: A rather complete group of sound ratings has been attained with sound transmission Class (STC) values of 50 or better for wood stud, metal stud, and laminated gypsum partition constructions. Other partitions of each type attained ratings in the 45 - 50 STC range. Two new constructions were originated in the course of the testing. One is a metal stud partition with an STC of 52 and the other is a 2½" x 3" gypsum stud partition with an STC of 50. These can be promoted as firsts for Bestwall.

All of the data recently developed is being put into shape for distribution to the trade and to our sales people. Some further tests are planned, and this data will be added at a later date. Our problem in dispersing this information will be to present it in such a manner that it will be understood by all. On the basis of some of the sound ratings obtained, fire tests will be proposed for identical constructions. It is felt that sound and fire ratings go hand in hand, and wherever one is needed, so is the other.

12. DIMENSIONAL CHANGE OF GYPSUM PRODUCTS AT HIGH TEMPERATURES - R & D 277

Objective: To measure the dimensional changes which occur in gypsum products at temperatures up to 2000°F. and assess the significance of the data obtained. A Gaertner Dilatometer was purchased to make these determinations.

Investigation: Our initial work will involve fire rated board with the idea that we may be able to predict what happens to this board in an actual fire test. During the calibration of the instrument, the element burned out, so it has been returned for repair.

13. COOPERATIVE RESEARCH PROGRAM WITH JOHNS-MANVILLE - R & D 278

Objective: To enter into such cooperative ventures as are considered to be of interest to both companies. The first venture agreed upon is a fire test of Soundike-Firestop installation.

SUMMARY

The highlights of the Research Activities for the past six months have been:

1. The introduction of a ready mix joint compound;
2. The development of a water resistant wallboard;
3. The second successful trial in the manufacturing of wallboard from synthetic gypsum;
4. The 2 and 3 hour fire ratings for columns;
5. The 2-hour rating for the Firestop 120 Ceiling with light & vent openings;
6. The 1½ hour rating for the concrete ceiling with 1/2" Firestop underneath; and
7. The sound test data attained thus far for the various partitions tested.

Our efforts in certain areas have been retarded, since our shop facilities were removed during the renovation of the building. These facilities will be restored in the new building which is under construction. The installation of certain new equipment, the remodeling of some of the old equipment, and the additional space available will enhance our ability to provide information and conduct project investigations.

Our present plans for the last half of 1964 call for:

1. The continuation of our fire and sound testing program;
2. Attempts to complete the aggregated textures, new grainboard, and industrial gypsum product development;
3. The pursuit of potential cost savings in conjunction with the finer filament glass fiber and new water retention agent for joint system; and
4. Embarking on new projects such as the development of a gypsum acoustical tile.

It is also hoped that we can devote a certain amount of time to the search for knowledge, which is not necessarily directed to present objectives but which may serve as a basis for future developments.

BESTWALL GYPSUM COMPANY

SEMI-ANNUAL RESEARCH AND DEVELOPMENT REPORT

JULY 1, 1963 TO DECEMBER 31, 1963

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FOREWORD

This report covers the activities and accomplishments of our research program for the last six months in 1963. Our personnel was changed somewhat when Mr. E. A. Smith left the Company in August to attend medical school. Mr. N. F. Morrone was transferred from the Quality Department, bringing the Research Division back to six men including the writer. We believe that Mr. Morrone's talents can be put to broader use in the Research Division.

On the basis of the record of last year's R&D expenditures, projects presently underway and future projects being contemplated, a budget for 1964 was prepared and submitted to Management. The purpose of the budget is to have a record of the expenses, and to see that our money is wisely spent. Our total 1964 Research expenditure is expected to approximate \$150,000.

Included in this report is the market performance of products which have been developed through research. The fire ratings and other technical information developed for Sales and certain product improvements cannot be clearly assessed. However, we trust that these accomplishments have made us more competitive and therefore have favorably affected our Sales.

The major portion of the report is devoted to the progress of the various projects. For clarification, it is separated into three sections:

- (1) Projects Completed
- (2) Projects Nearing Completion
- (3) Projects Underway

MARKET PERFORMANCE OF NEW PRODUCTS

JULY THRU DECEMBER 1963

<u>PRODUCT</u>	<u>SALES VOLUME</u>	<u>MILL BASE SALES</u>	<u>ESTIMATED GROSS PROFIT</u>
1. Fireston 120 Tile	95,000 sq.ft.	\$ 13,572	\$ 4,372
2. Grabit Adhesive	37 tons	6,899	3,977
3. One Day Joint Compound	388 tons	64,501	18,293
4. Ready Mix Joint Compound	482 pails	2,136	61
5. Dens-Cote Plaster	67 tons	3,894	1,220
6. Dens-Cote Tape	1452 rolls	1,452	591
7. Dens-Cote Base (T.C.Lath)*	240,000 sq.ft.	9,720	3,620
8. 1½" #8 Drywall Screws	372 boxes	<u>1,098</u>	<u>284</u>
		\$103,272	\$32,418

*Amount of Dens-Cote Base which normally would be sold with 67 ton of Dens-Cote Plaster. Actually, increase in volume of Dens-Cote Base over the first half of 1963 was 220,000 sq. ft.

PATENT INFORMATION

Patents Issued - None

Patent Applications Submitted (Method of Processing Synthetic Gypsum)
(One Day Joint Compound)
(Grabit Adhesive)

Patent Applications Being Prepared: Synthetic Gypsum (Canadian)
Continuous Calcination (2)

1. JOINT SYSTEM SPRAY TEXTURES - R & D 261

Objective: To develop pre-aggregated textures for addition to our line of Joint System products. Another objective is to eliminate the necessity for a primer over surfaces where One Day Joint Compound is used prior to texture applications. Three new products and one improved product are our goal. The new products are:

1. Simulated Acoustic Texture
2. Sand Finish Texture
3. Masonry Spray Texture

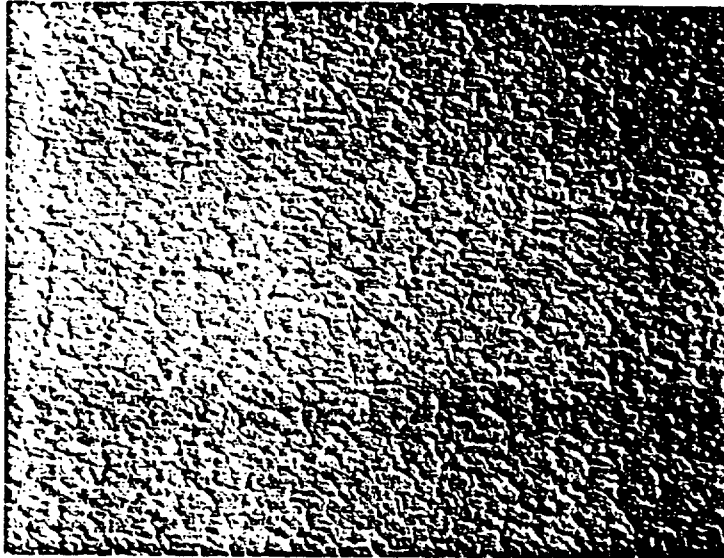
Our standard texture is to be improved so that it will hide One Day Joint Compound and Topping Compound and can be hand or spray applied.

Investigation: All four products have been formulated and appear to give the desired finish. In addition, Laboratory tests show that all of these products will hide applications of One Day where a final coat of topping compound is used in conformance with specifications. In addition, all of these textures will be whiter than competitive products and have excellent application properties. The plain texture, in particular, has been tremendously improved to the extent that it hides as well as paint and has versatility in making a variety of textures possible from the one product.

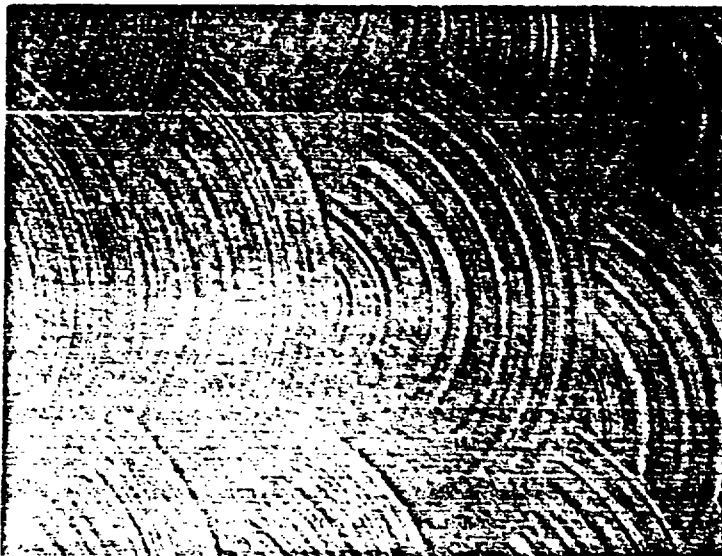
The type of surfaces possible with this texture, as well as those from the simulated acoustic and sand finish products, are shown in the attached photographs. The masonry spray texture also requires that it have rust inhibitive properties. There is no similar competitive product, so this will be a first for Bestwall, if this texture is successful in actual use.

Thus far, very few trials have been made. A number of trials which were scheduled were either postponed or cancelled during the re-organization of the Sales Department. A limited release for the plain, sand finish, and simulated acoustic textures is being considered, in order to expedite the field performance evaluation. Texture products represent only 4% of our Joint System sales, and it is felt that this figure should be as high as 10%. We believe these new textures will help bolster our Joint System sales.

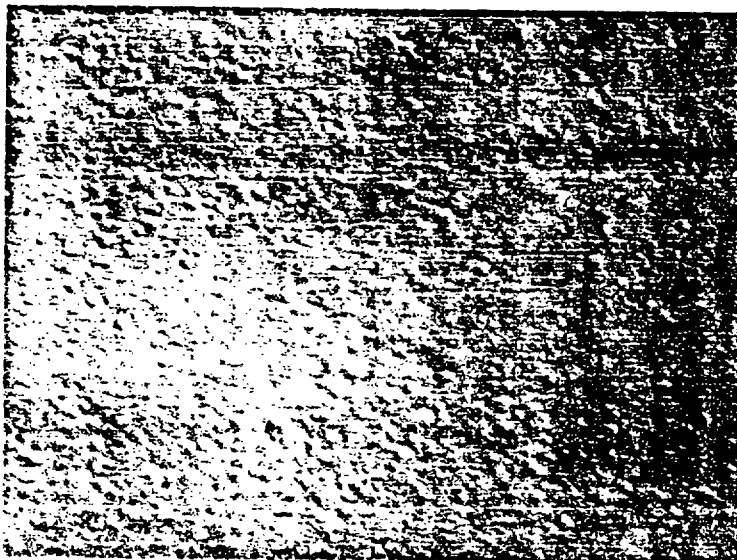
PLAIN TEXTURE (No Aggregate)



Roller Stipple Finish

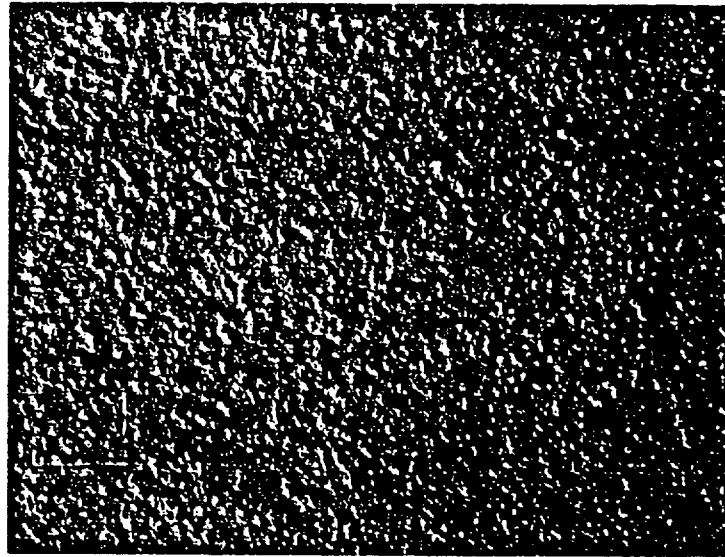


Brush Swirl Finish

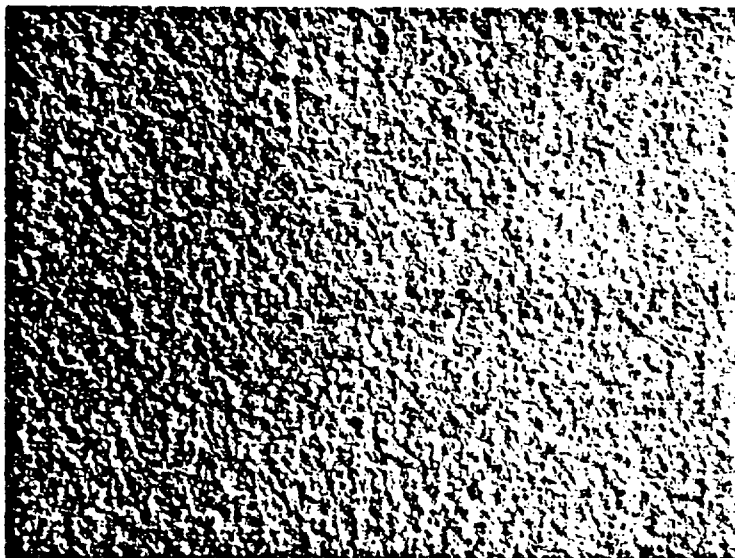


Spray Orange Peel Finish

AGGREGATED TEXTURES



Spray Application
Sand Finish



Spray Application
Simulated Acoustic

2. Ready Mix Joint Compound - R & D 211

Objective: To develop a ready mix or paste type joint compound to be competitive with other similar products on the market.

Investigation: A formula utilizing a dry binder was developed and field tested. The field reports were favorable. Even though the economics were not completely favorable, a small facility in Akron was approved to furnish the requirements of a large Detroit job. Unfortunately the contractor ultimately decided to use dry joint system on this job. As a result, only about 500 pails of ready mix were sold from Akron, whereas preparations had been made to furnish 3000 pails. We did not gain much from this limited experience, but it did tell us that there is very little potential for ready mix in the area served by the Akron plant.

The purpose of the dry binder as opposed to an emulsion binder was to eliminate the necessity for purchasing tanks, pumps, etc., to handle the emulsion. Other means have been found to purchase and handle emulsion which do not require the large investment for equipment formerly required. The emulsion formula offers a possible saving of 30% per pail. Costs using this formula have been worked out, and the economic picture is improved but still is not too favorable. Some of the poorest areas economically (Atlanta, Chicago, and West Coast) have the best potential market-wise, according to field surveys. On the other hand, the best areas economically (Akron and Acme) are the poorest market-wise. However, every year ready mix makes more impact on the joint system market and becomes more of a competitive factor. This competition is important insofar as joint system sales are concerned, but even more important is its influence on board sales. The future course of this project is undecided at present, but it is felt that it will be only a question of time before we are forced to meet this competition.

3. Cooperative Tests on Hof-Kor Honeycomb Panels - R & D 257

Objective: To test a partition of Hof-Kor prefab panels consisting of a paper honeycomb core faced with 5/8" Fireston Eternawall to achieve one hour rating. Union Bag-Camp Corporation, the manufacturer of the honeycomb, is sharing in the cost of this test.

Investigation: On the second try, the fire endurance test was passed. However, two hose stream tests have failed due to inability of the fasteners to hold the board in place. The probable causes are: the small heads of the Kolorpin fasteners, and the trapping of moisture in the board core by the vinyl facing, and the limited number of fasteners. Larger headed Kolorpin fasteners have been located, but it has not yet been determined whether there is sufficient interest to make another try to pass the hose stream test. The Sales Department is to advise us of their further interest.

PAOLI LABORATORY
RESEARCH AND DEVELOPMENT REPORT
PERIOD OF JANUARY 1963 THROUGH JUNE 1963

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FORWARD

This report covers the activities and accomplishments of our research program for the past six months. No basic changes in organization have occurred during this time. We have, however, begun to assign projects to a single individual rather than dividing the responsibility between two people. The former approach was being utilized until such time as the new men had gained sufficient experience and had become familiar with our procedures. At least one priority project has been assigned to each man as well as other projects of lesser priority. Each man is responsible for maintaining progress in his assigned projects. Assistance is provided where necessary by contacting the group leader.

A budget was put into effect in January 1963 in order to make available a record of the total expenditure for R&D and the amount spent for each project. The budgeted versus actual expenditures are being reported quarterly. These will be studied to determine whether our emphasis is being placed in the proper areas and whether our money is being spent wisely. This year's figures should give us a good basis for preparing next year's budget.

The field testing stage of our development programs was revamped during the past 6 months. There have been a number of instances where we have gained little or no information from trials. Another problem has been the difficulty we have had in obtaining field tests. We have brought this problem to the attention of the Sales Department and solicited their cooperation in planning a more effective field testing program. After several discussions, it has been decided to institute a standard procedure for requesting, conducting and reporting results of field trials. To simplify the reporting, a standard report form and follow-up form have been prepared. We trust that these measures will enable our field testing to be conducted more efficiently in the future.

Included in this report are the market performance of products developed through research, patent information, and some pictures illustrating the effect of glass fibers in gypsum. The latter are to be used in promotional literature. The major portion of the report is, of course, devoted to the progress of the various projects.

MARKET PERFORMANCE OF NEW PRODUCTS

JANUARY THROUGH JUNE 1963

1. FIRESTOP 120 CEILING TILE

Amount Sold	--	122,000 sq. feet
Dollar Sales Volume	--	\$16,215
*Gross Profit	--	\$ 5,349

2. GRABIT MASONRY ADHESIVE

Amount Sold	--	9 Tons
Dollar Sales Volume	--	\$ 1,739
*Gross Profit	--	\$ 1,019

3. ONE DAY JOINT COMPOUND

Amount Sold	--	634 Tons
Dollar Sales Volume	--	\$113,953
*Gross Profit	--	\$ 33,063

Total Sales Volume of New Products -- \$131,907

Total Gross Profit of New Products -- \$ 39,431

*Estimated by Ardmore Cost Department

PATENT INFORMATION

Patents Issued: None

Patents Applied For: Method of Processing Synthetic Gypsum

Patent Applications Being Prepared: One Day Joint Compound
Grabit Masonry Adhesive

PROJECTS NEARING COMPLETION

1. Thincoat Plaster - R & D 219

Objective: To develop a competitive thincoat lath and plaster system.

Status of Investigation: The original objective was to have one product for both smooth and textured surfaces. Such a product was developed and field trials were commenced. It became apparent during our field testing that smooth finishing properties were more important and textured finishes appealed only in certain markets. In view of this a second formula was developed in which the texturing properties were sacrificed in order to improve the smooth finish application. This product was found to be much more acceptable for those who desired a smooth surface. The former product will be retained for use where textured surfaces are desired. A number of successful field trials have been completed and we have recommended that both products be released for sale in limited markets. Our thincoat plasters have certain advantages over other thincoat products, and can be priced competitively while still maintaining a favorable profit margin.

Paralleling the thincoat plaster development were our efforts to impart the proper suction characteristic to our T. C. pinholath. This has been resolved to the point where all plants are capable of producing a satisfactory lath to be used with our thincoat plaster. Advertising photographs taken during one of our field trials are included in this report.

2. Ready Mix Joint Compound - R & D 211

Objective: To develop a ready mixed or paste type joint compound to be competitive with other similar products on the market.

Status of Investigation: Several field trials of a product containing a dry binder system have been conducted. Other than a few adverse comments on workability, the performance of the product has been satisfactory. On the basis of the trials, we received orders for 1500 pails of the product. The economics of our ready mix are still not completely favorable, and we are striving to improve this situation. We are somewhat limited in this direction because the fixed costs of the container and the freight represent a large percentage of the cost of the product. This leaves the formula and the processing for us to work on. We are even limited here as the improvement in both of these areas is limited since certain possibilities for cost reduction will require large initial expenditures for equipment. Judging from the emphasis Sales has given this project, it appears imperative that we continue to seek a practical solution to the problem. Our present thinking is that if we could install a small operation with minimum expenditure, it would enable us to effectively assess the market potential as well as possible cost savings. This would require that Management approve a low profit item, even if only on a temporary basis. Based on this experience, the market potential would then dictate the wisdom in considering certain equipment expenditures necessary to improve the profit margin.

PROJECTS NEARING COMPLETION

3. Glass Fiber for Wallboard Reinforcement - R & D 210

Objective: To be able to approve several types of glass fiber, particularly 799 (Muzzy Mix) for use in our wallboard.

Status of Investigation: From this evaluation of fiber types we found that types 710, 804, and 799 all were better than the 863 we were using because of improved dispersion characteristics, and that 799 was a special improvement because it offers greater reinforcing value per lb. of fiber. This evaluation has progressed to the point where all of the glass fiber used in our board is either 710 or 799. This work then became intermeshed with an investigation being conducted by the Manufacturing and Process and Control Departments to evaluate the effect of paper fiber. It was found that the regular amount of 799 glass fiber was equivalent to the standard amounts of paper fiber and 863 glass fiber. Some trial runs were made at Wilmington, but due to cutting problems with 799 fiber, an increased amount of 710 fiber was used and the paper fiber eliminated. Doing away with the paper fiber appears to permit machine speed increases on the order of 10% without changing the characteristics of the board. This will be carried further at other plants. In the meantime, 799 glass fiber is still a superior fiber and we are continuing with our effort to enable all plants to use it. Improved quality or further cost savings, or both, are inevitable through the use of the 799 binder glass fiber.

4. One Day Texture Problem - R & D 243

Objective: To find a means of eliminating the need for a primer over One Day Joint Compound prior to texture application.

Status of Investigation: The sale of One Day has been limited because we have had to recommend a primer prior to any joint system texture application. National Gypsum has issued a similar precaution because of the same drawback to their setting type joint system. Two approaches have been studied. The first is to develop a texture which will do its own priming, and the second is to develop a topping which will alleviate the necessity for priming regardless of the texture used. After considerable experimentation, a texture has been found which we believe will eliminate the need for the primer. The development of a topping for use over One Day has not been completed as yet. We are proceeding with field trials of the texture as quickly as possible, since we feel this will greatly enhance the sale of One Day Joint Compound.

5. Accumulation of Fire and Sound Test Data - R & D 249

Objective: To gather all available fire and sound test data on the various constructions and put it into a usable reference form.

PADLI LABORATORY

RESEARCH AND DEVELOPMENT REPORT

Period of July 1962 through December 1962

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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

E. 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

<u>SALES</u>	<u>GROSS PROFIT</u>
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.

- 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.

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.

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S U M M A R Y

GENERAL

The Gypsum Research Center was formally dedicated with an open house held on June 13. We were host to the Northwest Plaster Bureau and a science class from Tigard on two other occasions. We have obtained our Tigard City license (\$20) so we are now a bonafide member of the community.

FACTS & FIGURES

A conservative estimate of our investment in Gypsum Research since 1961 is \$1,000,000 not including the new building. In the past six months the gross profits generated as a direct result of this investment were \$296,474. This is an annual return of 59%. The sales generated from new products amounted to \$1,888,296. The compilation by product is shown on pages 5, 6 and 7. These figures compare with new product sales and profits of \$1,532,939 and \$116,580 for the first 6 months of 1967. The 1968 new product figures represent 5.2% of the division sales and 4.0% of the division profits for the period.

\$238,000 has been budgeted for gypsum research in 1968. As of June 30, \$136,450 of the total has already been invested. This budget excess is mainly due to higher than expected costs which have occurred in conjunction with the molded grainboard project. The distribution of research investment is shown on page 4.

A large portion of our budget is allocated for fire and sound testing. Firestop sales decreased slightly when compared to the same period last year, but 1/4" sound deadening board sales increased from 438 M sq. ft. in the first six months of 1967 to 2,343 M sq. ft. in the comparable period of 1968.

NEW PRODUCTS AND IMPROVED PRODUCTS

We are now confident that molded grainboard can be produced continuously. The next step is the evaluation of shipping and handling properties and the market acceptance of this molded gypsum paneling.

Our radiant heating panel has passed all Underwriters' tests conducted thus far and indications are that we should obtain U.L. approval. This approval is necessary before much field testing can be done.

Some work has been resumed on a gypsum filler for metal fire-doors. This has great potential if we can satisfy the product requirements.

Hard end wallboard was manufactured continuously at Acme for a couple months. Equipment modifications are being tried before we consider installing end treatment equipment at other plants.

The possibility of replacing limestone with gypsum in certain joint system products is under investigation. Field trials are scheduled to test ready mix and two texture products formulated with gypsum filler. In addition to some significant savings at Acme, we are interested in gypsum as a filler so we can manufacture these products at Sigurd. This will put us in a better competitive position on the West Coast with Joint System.

SALES SERVICE

A whole series of excellent sound test ratings have been achieved using 1/4" sound deadening board. One hour fire ratings were also passed for the combination of 1/2" Firestop and 1/4" sound deadening board over both wood and metal studs. No fasteners were used in the field of the face board, so the ratings are applicable to Eternawall as well as regular board. A flamespread of 25 was obtained for fabric backed vinyl Eternawall. These fire and sound ratings should assist in sales promotion of 1/4" sound board, Firestop and Eternawall.

A series of tests was conducted to develop a system of wall-board application to compete with USG's smooth-wall and National's sta-smooth systems. These test results along with the hard end development will enable us to recommend a system for controlling edge joint beading.

Just recently U.L. approval was gained for the Dens-Cote radiant heat system and for our tile backer in the Los Angeles market. These approvals were received on the basis of successful tests.

PATENTS

Patent #3,382,636 covering Dens-Cote base was issued to George Green. Flintkote is the only infringer that we are aware of. A decision has been made to place an injunction against National Gypsum Company for infringement of our patent #2,744,022 covering Firestop wallboard. Information is being developed to prepare a patent application covering hard end wallboard.

THE FUTURE

In addition to pursuing the current projects, we are increasing our capabilities so we can expand our present functions. A capital investment has just been approved to establish a continuous pilot mixing station to simulate a plant wallboard operation. This will permit certain experiments to be conducted at Tigard which now must be handled at one of the plants. Another investment being considered is a research test house which will be submitted for approval in 1969. The primary purpose of this facility is to permit exploratory field trials and product displays to be made at Tigard rather than having Sales search for a location. We also plan to conduct field sound tests in this structure.

Our most important investment in the future are the engineers and technicians we have in the Research Department. We recently hired Mr. George Fowler and Mr. William Gettel and this makes a total of 7 men. We have no plans to expand the staff in 1969. However, with the new men gaining in experience, it should be possible for us to accomplish more in 1969 than in any previous year.

MARKET PERFORMANCE OF PRODUCTS DEVELOPED THROUGH RESEARCH

<u>DESCRIPTION</u>	<u>VOLUME</u>	<u>LIST SALES</u>	<u>GROSS PROFIT</u>
<u>Dens-Cote Base - MSF</u>			
26330-3/8" Base	4.8	174.29	38.79
26332-3/8" Base	1,534.5	56,050.92	15,121.90
26340-1/2" Base	23.1	961.23	271.76
26342-1/2" Base	8,461.9	352,878.33	103,923.30
26345-1/2" Firestop Base	461.1	19,979.09	5,333.84
26350-5/8" Base	150.6	7,511.14	2,528.32
26355-5/8" Firestop Base	<u>72.9</u>	<u>3,933.92</u>	<u>924.53</u>
Totals	10,708.9	441,488.92	128,142.44

Tile Backer Board - MSF

20540-1/2" Tile Backer	2,520.4	184,196.79	85,795.97
20544-1/2" Firestop Tile Backer	25.6	2,253.23	971.62
20546-1/2" Insulating Tile Backer	.8	71.08	32.66
20550-5/8" Tile Backer	248.9	20,753.99	8,236.46
20554-5/8" Firestop Tile Backer	<u>255.2</u>	<u>23,682.96</u>	<u>10,009.83</u>
Totals	3,050.9	230,958.05	105,046.54

1/4" Gypsum Sound
Deadening Board - MSF

20127	<u>2,343.0</u>	<u>75,262.36</u>	<u>19,063.50</u>
Totals	2,343.0	75,262.36	19,063.50

One Day Joint Compound - Tons

30898-Buff, 25 lbs	167.3	19,284.96	1,404.15
30899-White	<u>24.5</u>	<u>3,629.08</u>	<u>525.61</u>
Totals	191.8	22,914.04	1,929.76

MARKET PERFORMANCE OF PRODUCTS DEVELOPED THROUGH RESEARCH

<u>DESCRIPTION</u>	<u>VOLUME</u>	<u>LIST SALES</u>	<u>GROSS PROFIT</u>
<u>Ready Mix - Tons</u>			
30876-5 Gal Pails	3,837.6	436,215.36	4,038.16
30877-1 Gal Pails	145.1	27,481.79	5,571.35
30879-4 Gal Cartons	10.2	1,044.10	(.50)
30880-5 Gal Cartons	<u>63.1</u>	<u>5,942.48</u>	<u>494.02</u>
Totals	4,056.0	470,683.73	10,103.03
 <u>Triple Duty - Tons</u>			
30860-25 lbs	1,969.6	258,949.56	18,550.91
30861-50 lbs	<u>1,274.5</u>	<u>153,104.72</u>	<u>1,820.32</u>
Totals	3,244.1	412,054.28	20,371.23
 <u>Grabit - Tons</u>			
31896	<u>81.5</u>	<u>10,592.72</u>	<u>3,188.28</u>
Totals	81.5	10,592.72	3,188.28
 <u>Bestex A - Tons</u>			
31850-25 lbs	558.9	73,733.96	(1,811.72)
31854-50 lbs	<u>72.4</u>	<u>6,444.90</u>	<u>(1,911.45)</u>
Totals	631.3	80,218.86	(3,723.17)
 <u>Bestex B - Tons</u>			
31851	<u>29.9</u>	<u>4,623.59</u>	<u>(1,372.79)</u>
Totals	29.9	4,623.59	(1,372.79)

MARKET PERFORMANCE OF PRODUCTS DEVELOPED THROUGH RESEARCH

<u>DESCRIPTION</u>	<u>VOLUME</u>	<u>LIST SALES</u>	<u>GROSS PROFIT</u>
<u>Bestex C - Tons</u>			
31852	<u>149.6</u>	<u>23,166.32</u>	<u>(6,114.97)</u>
Totals	149.6	23,166.32	(6,114.97)
 <u>Bestex D- Tons</u>			
31853	<u>19.6</u>	<u>4,069.20</u>	<u>1,384.72</u>
Totals	19.6	4,069.20	1,384.72
 <u>Dens-Cote Plaster - Tons</u>			
10164-Smooth Finish	854.4	46,172.48	7,164.42
10165-Smooth Finish	620.4	34,803.97	3,719.77
10166-Sand Finish	43.8	2,313.99	788.24
10167-Base	<u>192.9</u>	<u>8,850.69</u>	<u>2,488.17</u>
Totals	1,711.5	92,141.13	14,160.60
 <u>Dens-Cote Tape - Rolls</u>			
10983-300' Roll	2,507.3	6,379.58	773.82
10984-100' Roll	<u>1,037.0</u>	<u>976.84</u>	<u>402.10</u>
Totals	3,544.3	7,356.42	1,175.92
 <u>Model Densite - Tons</u>			
40837	<u>.1</u>	<u>2.30</u>	<u>1.35</u>
Totals	.1	2.30	1.35

PRODUCT IMPROVEMENT SECTION

1. Hard End Wallboard

a. Plant Trial

A set of sprays was installed at Acme to apply resin onto the ends of their wallboard. They sprayed resin onto the ends of all of their production of 1/2" and 5/8" board for three months except for intermittent breakdowns. They had repeated problems with the pump which supplies resin to the spray head. The pump is being replaced by a pressure tank and the evaluation of the operation will be resumed.

b. Laboratory Testing

A number of different resins from several different manufacturers were tested. These are of the vinyl acetate homopolymer, vinyl acetate copolymer and combination acetate/acrylic copolymers. The acetate/acrylic copolymers have shown the best results so far. These polymers are more water resistant than the other types and this may be the reason.

c. Patent Work

A patent search did not reveal any prior art and the fact that certain resins are better than others is a basis for invention according to our patent attorney. More tests will be conducted to provide data to support a patent application.

2. Gypsum Filler For Joint System

Now that we have successful experience with vinyl binders, it opens the door to using gypsum rather than limestone as a filler for joint system. We estimate raw material savings of 15-20% wherever this substitution can be made. Ready Mix and our texture line are likely candidates to start with. The profit margin on both can stand some improvement.

Another factor in favor of a gypsum filler is that it would enable us to manufacture certain joint system products at

Sigurd and sell them competitively on the West Coast. This is particularly true of textures since the West Coast is such a large texture market. In other words, it is a means of generating some plus business for Sigurd since we are not competitive with joint system shipped from Sigurd at the present time.

3. Type X 5/8" Firestop

Our major competitors are marketing two 5/8" fire rated wallboards. One is a super fire rated board which will pass the two or three hour ceiling ratings as well as the one hour walls which are more frequently encountered. The second type contains less glass fiber and no vermiculite or perlite, consequently it is less costly to manufacture. Up to this time, our position has been that we would manufacture only the super type which will pass all ratings and not become involved in stocking two different 5/8" fire rated boards. It is estimated that this position is costing us about \$80,000 per year and that we should change our position and develop a 5/8" type x board. A 5/8" Firestop weighing 2275 lbs/M containing 4 lbs/M of glass fiber and 20 lbs/M of raw vermiculite was manufactured at Lovell and tested at U.L. At 57½ minutes the wood stud partition failed to support the load imposed. This is a surprise since our competition has passed this rating with a similar formula. As a next step, we will compare tests of our board versus competitive 5/8" type x boards before deciding whether to try again.

4. New Emulsion For Waterproof Sheathing

Plant trials of a wax/rosin emulsion manufactured by Hercules Chemical were made at Akron, Ft. Dodge and Sigurd. The first two trials at Akron and Ft. Dodge were relatively favorable and it appeared that we were on our way to improving the water resistance properties of sheathing with reduction in cost at some plants. The Sigurd trial, however, turned out badly with the sheathing having core splits and poor water resistance. We have been asked by manufacturing to discontinue this project at the plant level. Since there is no other level at which it can be investigated, the project will be abandoned, at least temporarily.