

GEORGIA-PACIFIC CORPORATION
BESTWALL GYPSUM DIVISION

PLAINTIFF'S EXHIBIT

GP-1325

R&D REPORT FOR FIRST 6 MONTHS OF 1965

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SGP 0015222

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

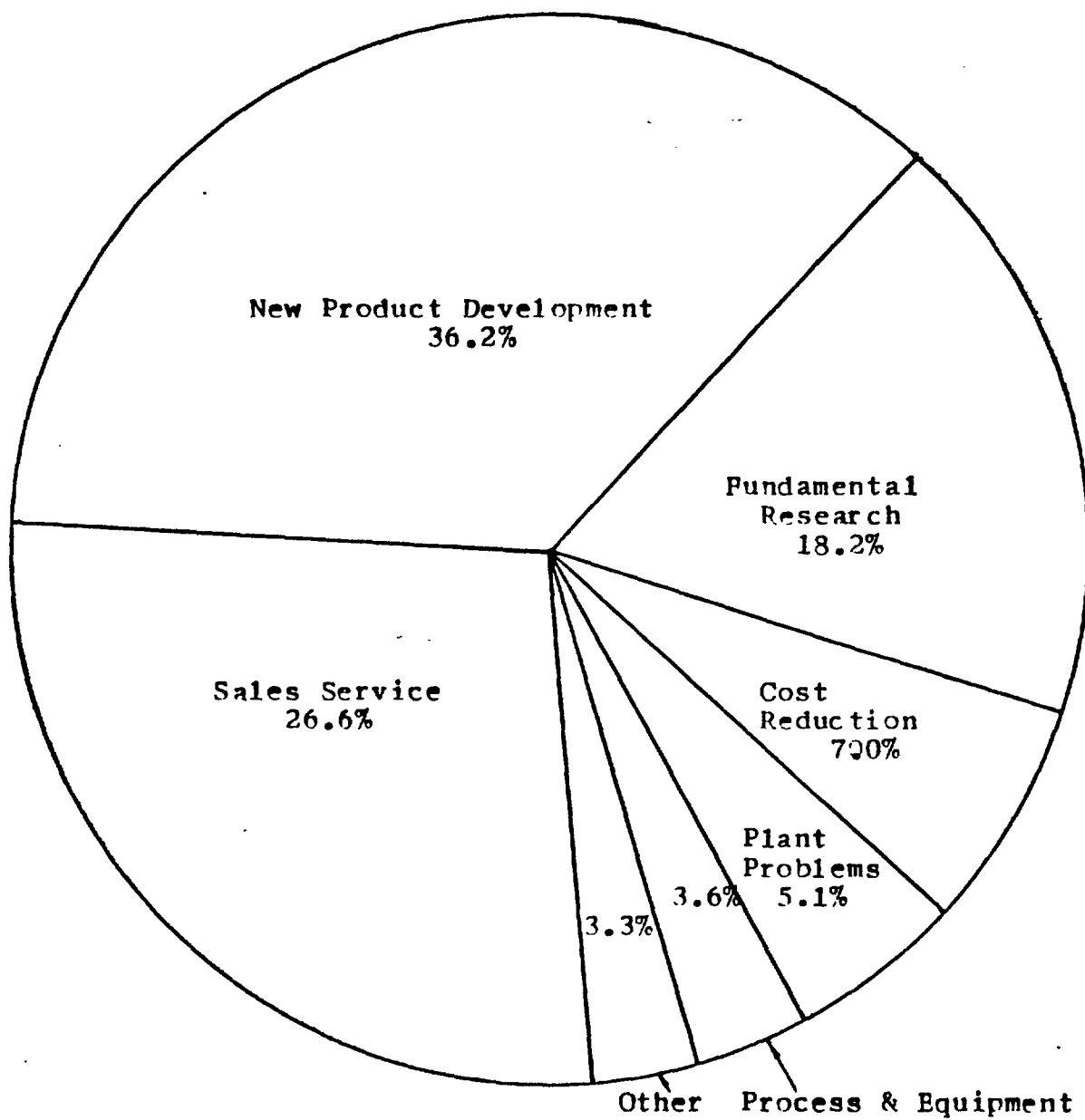
Dens-Cote Base

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.

FIRST 6 MONTHS R & D EXPENDITURES



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 Underwriter's 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.

Investigation: USG has obtained a one hour rating for this construction with their special 1/2" Type C Firecode wallboard. It was felt that we would be unable to get the rating with our regular Firestop, but that the new 1/2" Firestop using 636 glass fiber, manufactured at Wilmington, would have a good chance of passing the fire test. Laboratory tests of this board appeared to be favorable, so a test at Underwriters' was scheduled to be run about the same time as the concrete & bar joist floor & ceiling test, described under R&D #279. The same formula board was used in both tests.

Conclusion: The test was successfully passed on May 7, and this makes us fully competitive with USG for this construction.

7. TWO-HOUR FIRE RATED METAL STUD PARTITION - R&D #288

Objective: Develop a 2-hour fire rating for a metal stud partition, faced with 2 layers of 1/2" Firestop on each side.

Investigation: Since the use of 636 glass fiber in Firestop had not yet been approved by Underwriters', it was necessary to use regular Firestop with 799 fiber in this construction. The test was scheduled to be made at Ohio State University Experiment Station. The first panel tested failed, when one thermocouple was found to have been placed directly over a fastener, so a second panel was tested with thermocouples spaced away from the fasteners. This time the partition passed by 16 seconds. A subsequent panel was constructed for the hose stream test, which was also successful.

Conclusion: We are the only Company to have this rating, other than Pabco who ran their test on the West Coast.

8. LATH & PLASTER PARTITION FOR ONE HOUR RATING - R&D #282

Objective: To conduct a cooperative fire test with Inland Steel Corporation and Neslo Mfg. Company, using their steel studs and resilient clips in our gypsum products to gain a one hour rating for this partition construction.

Investigation: Sales arranged to have Inland Steel contribute 45%, Neslo Mfg. 5%, and Bestwall 50% of the cost of this test. The construction consisted of our plain 16" wide lath, attached to Inland's steel studs and Neslo's resilient clips. The lath was surfaced with 7/16" of sanded plaster and 1/16" lime-putty finish.

Conclusion: The partition was tested at Ohio State and lasted for 1½ hours, thereby exceeding our expectations. A sound test was made resulting in STC rating of 42. A combination of the fire rating and the sound test result should make this partition competitive and assist in the promotion of lath & plaster products.

9. TWO*HOUR METAL STUD PARTITION - R&D #283

Objective: To gain a 2-hour rating for a 3-5/8" metal stud partition, with one layer 5/8" Firestop on one side and 2 layers of 5/8" Firestop on the other side. Donn Products will pay half of the test fee, by previous agreement.

Investigation: This partition was tested at Ohio State. The test was conducted with the single layer facing the fire which is regarded as the severest way to conduct the test, and in order to avoid having the rating apply to only one side of the partition. In the fire endurance test, the panel failed at one hour 48 minutes. It did not appear possible to gain 12 minutes in endurance by nominal changes in the construction. Therefore the hose stream test was run to complete the requirement for the 1½ hour rating.

Conclusion: Sales advises us that there are some locations where the 1½ hour rating can be used. This partition with a fiberglass blanket in the cavity has a sound transmission rating of 50 STC, so it can be used wherever good sound properties and incombustible construction with at least one hour fire endurance is required.

10. WOOD STUD PARTITION FOR ONE HOUR FIRE RATING - R&D #284

Objective: Develop a one hour fire rating for the wood stud partition with a resilient channel and 5/8" Firestop on one side and 5/8" Firestop nailed directly to the other side. This partition has an STC value of 50. Donn Products has agreed has agreed to pay half of the test fee.

Investigation: This partition was tested at Ohio State. The resilient side of the partition was faced toward the fire, inasmuch as this was felt to be the most severe condition. Again, the reasoning is so that acceptance of the rating from both sides will be gained. On the first try, the partition fell 10 minutes short of the one hour rating, when some of the board became loose on the resilient side. Additional fasteners were placed at the edges of the boards into the resilient channels, and the test was repeated. This partition passed the hour, and subsequently another partition was built and passed the hose stream test.

Conclusion: A one hour rating has been developed for this combustible partition, which also has a good sound properties with a glass fiber blanket in the cavity. The fact that additional screws were required for the fire test should not detract from the sound value, since this does not affect the resilience.

11. GYP SUM STUD PARTITION FOR ONE HOUR FIRE RATING - R&D #285

Objective: Test a partition consisting of 2½" x 3" gypsum studs with a layer of 1/2" fiberboard and a layer of 5/8" Firestop on each side to gain a one hour fire rating. This partition already has 51 STC sound transmission rating.

Investigation: The 5/8" Firestop was applied in such a manner that the joints fell between the gypsum studs, and the Firestop was fastened at the top and bottom and at the joints only, so that no fasteners went thru into the studs. The test of this construction failed by a few minutes because of the lack of sufficient fasteners. It was felt necessary to place screw fasteners at third points in the field of the board and into the studs. With the additional fasteners, the partition lasted for one hour and 20 minutes.

Conclusion: This gives the hour rating but, in view of the additional fasteners required, the partition will have to be retested for sound. It is not expected that the sound value will be significantly reduced, however.

12. COMPETITIVE THINCOAT EVALUATION - R&D #219

Objective: To evaluate our Dens-Cote System in comparison with the various competitive products on the market.

Investigation: The competitive products evaluated were Pabcote, as manufactured by Fibreboard Paper Products, Red-Top One Coat, Hand Finish Tufcon, and Imperial One Coat, as manufactured by USG; Kal-Kote Base and Kal-Kote Finish, as manufactured by National Gypsum Company; Hard-Kote Smooth Finish and Hard-Kote Sand Finish, as manufactured by Compton Industries; Tigerskin, as manufactured by Gibsonberg Lime; Plaster Veneer, as manufactured by Northern States Corp., and Uni-Cal, manufactured by National Gypsum. These products were tested for water carrying capacity, setting time, coverage, plasticity, hardness, abrasion resistance, compressive strength, and color.

Conclusion: On the basis of the tests conducted, the various products were separated into four different groups. These groups were as follows:

Group 1 - Contained in this group are all products having good working properties and high strength. The products placed in this category were: Our Dens-Cote and Gibsonberg Lime "Tigerskin."

Group 2 - Those products which were good working and had moderate or soft surfaces. In this category are National Gypsum's Kal-Kote System, USG's Imperial One Coat, and Compton Industries' Hard-Kote Smooth Finish.

Group 3 - Those plasters which were hard and strong but lacked good working characteristics. In this group are USG's hand applied "Tufcon," Fibreboard Paper's "Pabcote," and Northern States' "Plaster Veneer."

Group 4 - Consists of the products which are both soft and poor working. USG's "Red-Top" One Coat and Compton Industries' "Sand Finish Hard-Kote" fall into this category.

This information has been turned over to the Sales Department and by means of a sales bulletin has been passed along to

the salespeople in the field to increase their knowledge of the properties of Dens-Cote as compared to the competitive materials, which they will come up against.

13. RADIANT HEATING PANEL - R&D #235

Objective: To develop a gypsum wallboard panel with electric radiant heating properties. A small amount of work was done to evaluate a material called, "Aplotherm" which is manufactured by Electronics Discovery Corp. Aplotherm is a liquid which when applied to a reasonably flat surface in sufficient thickness, allowed to dry, and energized through conductor strips, produces a radiant heating surface. Electronics Discovery Corp. has tried to interest us in their product and has attempted to persuade us to invest some large sums of money into the development of such a product. For the following reasons we have replied that we are not interested in making this investment:

1. Two patents on radiant coating materials have already been issued to the Chemelex Corporation, and are exclusively controlled by the United States Gypsum Co. Aplotherm appears to infringe one of these patents.
2. Electronics Discovery would have Bestwall bear all the expense of any development work.

From the small investigation which was made, indications were that the Aplotherm material did perform as intended and possibly would be satisfactory conductive coating material. We were interested to find whether Aplotherm fell within the scope of the Chemelex patents mentioned. In order to determine this, a sample of Aplotherm was sent to an independent laboratory for analysis. On the basis of their results, it appears that Aplotherm does fall within the claims in the Chemelex patents and therefore would probably infringe, if we decided to use it. Because of the obvious road blocks, and the lack of any resounding success by USG with their Thermalux, there are no plans to further the investigation of the conductive coating approach to a radiant heating panel.

14. PILOT FIRE TESTING - R&D #76

Objective: To conduct pilot fire tests to establish test methods to test competitive products and to test variations in formula in our Firestop formulas.

Investigation: Quite a lot of time was spent after the furnace was installed to put it in proper operation and to check thermocouples, recorders, burner settings, etc. In addition, methods had to be established to test various partitions and floor & ceiling constructions which we would be considering to determine just what type test setup would give us the most information. Several different methods have been established to test combustible wood constructions and incombustible bar joist and furring channel assemblies. In addition, two pieces of heat resistant glass were purchased and have been built in our test assemblies. This enables us to view the backside of the board

as well as the face side during the progress of a test.

Also included in this project is the testing of wallboard from different plants and the testing of competitive fire rated boards.

Conclusion: This project will remain active as a general pilot fire testing program, for the sole purpose of developing information which we feel will guide us in our work on specific fire test projects. Excellent methods have been worked out by which different boards can be tested on both wood and metal supports. The procedure for conducting the test has been standardized, and a recording system has been set up whereby the results of each test are entered on a standard form which is attached to the temperature chart and recorded in a notebook in the appropriate category as a permanent record of the test.

15. TECHNICAL ASSISTANCE FOR THE LEGAL DEPARTMENT - R&D #6

Objective: To analyze samples of National Gypsum's 1/2" and 5/8" Super-X Fireshield wallboard. This information will be used in the patent infringement suit which has been brought against National Gypsum Company to decide whether they are infringing our glass fiber-vermiculite patent, as well as the general glass fiber patent.

Investigation: Samples of National's 1/2" Super-X board were found to contain about 8 to 9 lbs. of glass fiber, and their 5/8" Super-X was found to contain about 13 lbs. per M. of glass fiber. These boards also contained a quantity of raw vermiculite. The amount of vermiculite, however, was found to be very difficult to pin down. Since the density of vermiculite closely approached the density of some siliceous material which was also present, it was difficult to separate the two. Our analysis of National's 1/2" Super-X board from two different sources showed approximately 2% raw vermiculite. It was decided that this result was sufficiently important to have an outside laboratory check this analysis and confirm our result. This was done and the outside laboratory encountered similar problems, but their result also approximated a 2% raw vermiculite content. Screen analyses showed that the vermiculite extracted from the National Gypsum wallboard was substantially larger in particle size than the vermiculite we use. However, even though the amount used (2%) was outside our claims (3½% to 7½%), the expansion obtained was within the limits cited by the patent.

Conclusion: Even though the amount of vermiculite being used by National was outside of our patent limits, it is felt that they still infringe our patent, because the expansion gained through the use of the vermiculite falls within the limits in the claims of the patent. This information has been passed along to the Legal Department.

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.

5. NEW GRAINBOARD PRODUCTS - R&D #268

Objective: Develop a new line of plank lined woodgrain products to compete with USG's Ultra-wall and National's Fashion Grain.

Investigation: A source for improved woodgrain paper was developed, and a piece of equipment for indenting and printing the plank lines was fabricated at Fort Dodge. It was felt that we were ready to release the product. In addition to knotty pine, autumn mahogany, and figured aspen in the old grainboard line, two new items were added. These were Heritage Cherry and Fruitwood patterns with a 2 mil vinyl coating. All of our efforts to print the black lines on the vinyl covered grainboard paper were unsuccessful. After repeated failures, it has been decided to ship these vinyl covered grainboard products without the lines and see what reaction they meet in the field. We will continue to print the black lines on the figured aspen and autumn mahogany, since it appears we can do this without any problems. We had not planned to put the plank line marking on the knotty pine.

PROJECTS UNDERWAY

1. FLAME SPREAD RATING FOR ETERNAWALL - R&D #215

Objective: To gain a flamespread rating of 25 or less for Eternawall.

Investigation: This project was postponed some months ago, when it was found that Masland would not stand behind the 8 mil vihyl they were furnishing us, until they installed calendaring equipment. The 8 mil material we had received was stretched, and they were afraid it might not be stable. Since it was through the use of thinner vinyl, in addition to a flame retardant adhesive that we were seeking the better rating, the project was stymied.

Masland has now developed a vinyl film, which is in itself flame retardant, so this presents another avenue of investigation. Some of this material was laminated at Fort Dodge, and several small scale tests will be made before a full scale tunnel test at U. L. is recommended. At the same time, Fort Dodge has been using the flame retardant adhesive for their vinyl laminating, to be sure it will perform satisfactorily in continuous use. It should be possible to make a decision on the U. L. test very shortly.

2. TWO-COAT VENEER PLASTER - R&D #219

Objective: To develop a two-coat system of applying veneer or thincoat plaster. This has been requested by Sales to compete with National Gypsum's "Kal-Kote" and USG's "Imperial" two-coat system.

Investigation: The advantages of a two-coat system are:

- 1) In plastering sidewalls, normal joining of upper and lower sections can be accomplished with the finish coat. Joining is very difficult with one-coat products, such as our smooth finish Dens-Cote.
- 2) The finishing material can be lime-putty or a prepared trowel finish much like lime-putty, which plasterers are very familiar with.

Several different basecoat formulas have been tried in the Laboratory and one was selected for field testing. Field trials are planned for Syracuse, N. Y. and Detroit, Mich. A conventional lime-putty finish will be recommended. The development of a special prepared finish material will be undertaken subsequently.

3. DENS-COTE FOR RADIANT CEILING INSTALLATION - R&D #219

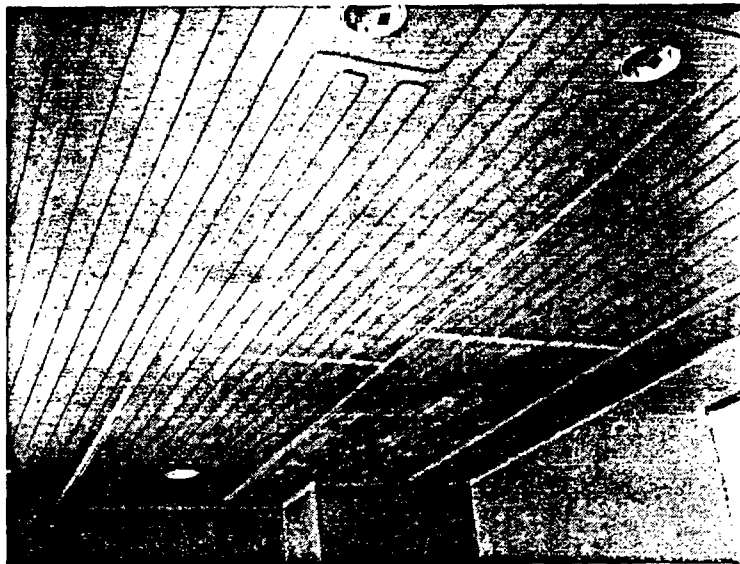
Objective: Sales has requested that the Dens-Cote System be tested and approved for use over electric cables in radiant

heated ceilings.

Investigation: After an exploratory investigation last fall, it was decided to approve the application of texture finish Dens-Cote for two apartment units in Syracuse, N. Y. After one complete heating season, these units were inspected and found to be in good condition, except for a couple small areas where the cables were too close together. We agreed to furnish the materials for a 150 unit apartment on the basis of these two units. It was found that the calculations used in electric heating handbooks to determine electric cable spacing, invariably result in the cables being close together ($1\frac{1}{2}$ " apart) for long narrow areas such as hallways. Calculations indicate that this spacing could result in a temperature of 140°F . This is sufficient to cause slow calcination and would also be more subject to thermal shock; so a specification was prepared for the Dens-Cote application, in which the cable spacing is limited to a minimum of 2" apart. It is felt that closer spacing provides too much heat for these narrow areas, in addition to being subject to cracking from calcination and thermal shock. A field trial involving an application of smooth finish Dens-Cote over radiant cables was held in State College, Pennsylvania.

In addition to the field trials, further work is being done in the Laboratory to investigate the various ramifications of thinfoat plaster radiant heating systems. Also, USG's radiant special heating lath & plaster are being evaluated. USG claims that these products will withstand temperatures as high as 150°F .

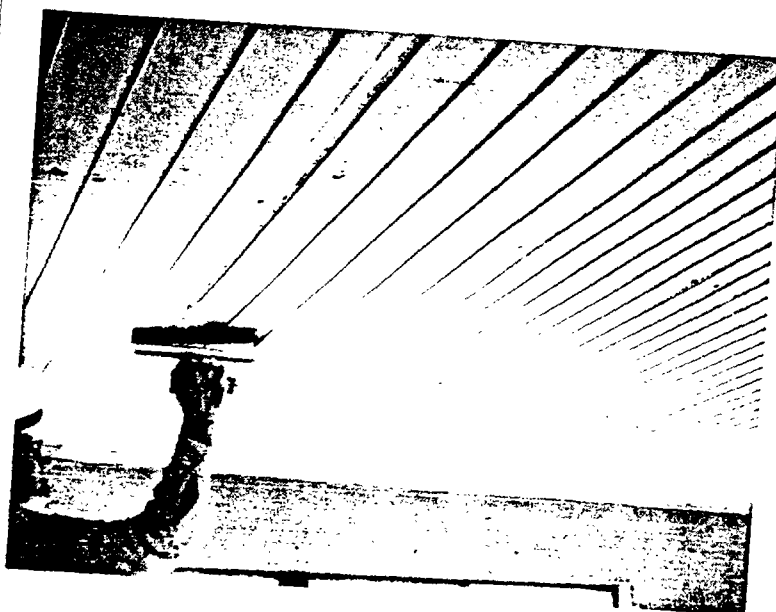
The pictures following were taken from field trial installations?



Cables Stapled in Place

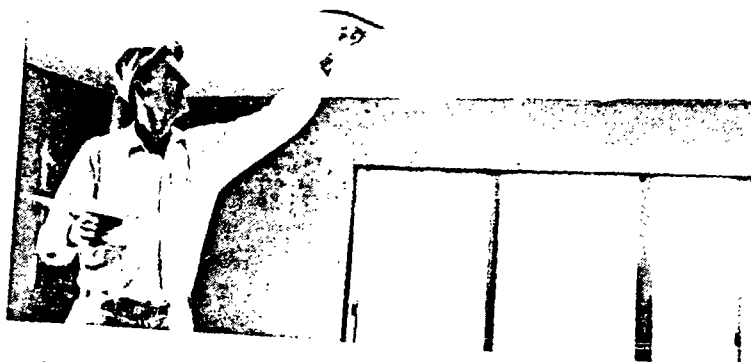


* Mixing



Embedding
Cables

Finish
Coat



4. 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 has been supplying a prepared trowel finish to the Houston market for some time.

Investigation: Two formula with different amounts of lime were tried in Houston. Formula A, with the most lime, was regarded as satisfactory and equal to USG's product. Another larger trial was requested, and more raw materials were purchased so this could be done. Finally we heard that some of the prepared trowel finish was sent to Dallas. A trial in Dallas was approved, on the basis that Acme would be notified, so that someone from the plant could observe the trial. We understand that the trials in Dallas were held, but no one from the plant or the Lab was informed; and the results are inconclusive. There was an indication that more lime would have to be added for the product to be satisfactory. The formula already contains 66% lime, and more lime would result in little more than a resacking of the lime. It appears that a re-evaluation of this project is in order.

5. PARTICLE SIZE STUDIES - R&D #263

Objective: To determine the particle size gradation of the stuccos used in the manufacture of our wallboard & plaster products. Another objective is to determine whether fineness or method of grinding affects other properties, such as density, compressive strength, hardness, expansion, etc.

Investigation: Due to the emphasis on other projects, fire testing in particular, no progress was made on the particle size studies during the past six months. This work has just been resumed. Some board stuccos have already been submitted for analysis. This is in conjunction with the fine grinding being done at the plants to manufacture a lighter weight wallboard. Also, some particle analyses of calcitic limestone will be made to present to the patent examiner, in order to induce him to allow certain claims in the synthetic gypsum patent for which we have applied.

6. GYPSUM ACOUSTICAL TILE - R&D #274

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

Investigation: Progress on this project has been quite slow due to pressure in other project areas. With the hiring of another man there has been more time to devote to the tile, and some significant progress has been made. It has been found that an increase in the density from 15 to 21 lbs/cu. ft. does not appear to adversely affect the acoustical absorption properties. By using 1" instead of 1/2" glass fiber, the transverse strength has been doubled. These factors allow

a tile of higher strength to be made, and now we are thinking in terms of a thickness of $3/4$ " or less rather than $7/8$ ". Comparative measurements of absorption with the Standing wave apparatus indicate that the absorption value is not significantly diminished, by reducing the thickness to $3/4$ " or $5/8$ ". The breaking point appears to be at $1/2$ " where the absorption values fall off sharply. It must be remembered, however, that these are only comparative figures derived from the Standing wave tester, and full scale tests at an approved sound test laboratory will be necessary to verify these results. For this purpose, about 100 square feet of 2' x 4' tiles is being cast, dried, sanded, and painted.

Tiles of $5/8$ ", $3/4$ ", and $7/8$ " thickness are being tested for resistance to sag, and pilot fire tests are being conducted to estimate the fire resistant properties of the tile. The performance of our tile will be compared to Armstrong Cork Co.'s 2 hour Fire-Guard acoustical tile, which is being successfully marketed.

The economics of the tile, insofar as the raw material cost, look quite favorable. For a $7/8$ " finished tile (excluding paint), the cost is \$0.0365/sq. ft. This allows $1/8$ " for sanding the surface and $1/8$ " for trimming around the perimeter. The raw material costs for $3/4$ " and $5/8$ " tiles would be \$0.0319 and \$0.0274 respectively. The manufacturing, painting, and packaging costs will have to be added; but, at this time, no estimate of these costs has been made. It is visualized that the manufacture of the tile would be very similar to a wallboard operation, except that there would be no paper faces. It is possible, however, that a thin paper on the bottom of the tile would facilitate the forming of the tile. It is being recommended that a pilot plant be built to study the various mixing, drying, sanding, painting, and packaging operations.

7. SOUND TESTING PROGRAM - R&D #276

Objective: Develop partition and floor-ceiling constructions with good resistance to sound transmission.

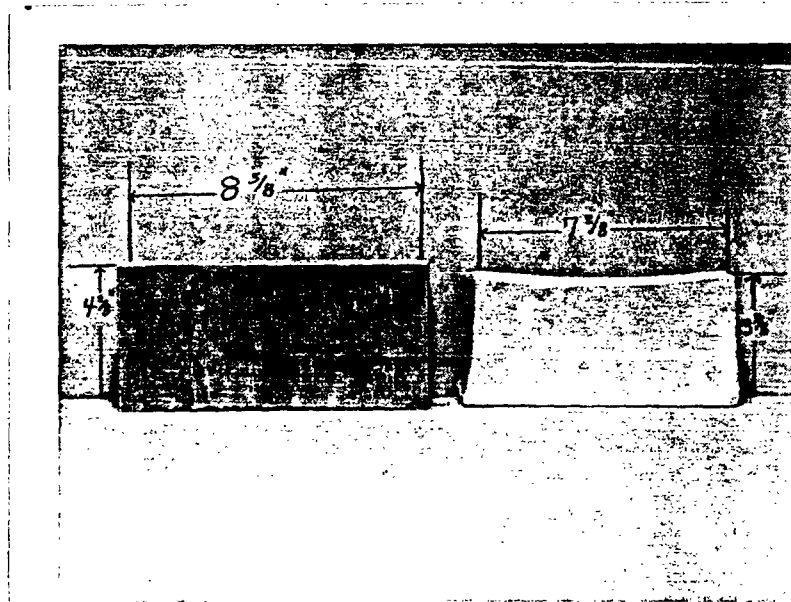
Investigation: Only one partition has been tested thus far. This was a metal stud wall with two layers of $1/2$ " Firestop on each side and glass fiber blanket insulation in the cavity. A rating of 47 STC was obtained for this partition. A series of sound tests will be arranged later in the year. The metal stud partition was tested by itself, because we had just obtained a 2-hour fire rating; and Sales wanted the sound transmission value to go along with the fire rating.

8. DIMENSIONAL CHANGES OF GYPSUM PRODUCTS AT HIGH TEMPERATURES - R&D #277

Objective: To measure the dimensional change which takes place when gypsum is exposed to temperatures of 1000°F. - 2000°F. and gain some knowledge of the effect of these high temperatures.

Investigation: A Gaertner Dilatometer was purchased to enable us to conduct these high temperature studies. The instrument was subsequently found to be unsatisfactory, because an effluent from the gypsum reacted with one of the components of the instrument. The dilatometer was returned for refund, and we are currently in the market for another instrument which will enable us to continue these high temperature studies.

In the meantime, some experimental casts have been placed in the pilot furnace, while fire tests are being made. It has been found that certain siliceous materials enable the casts to retain their integrity during the exposure to high temperature. Even though the cast distorts and shrinks at high temperature, it does not fracture. The picture below shows the shape of a cast before and after exposure to a temperature of 2000° F. The dead burned block was squared off to a uniform size and re-exposed to high temperatures. Subsequent high temperature cycles have not altered the block. One possible use for such a product is as a refractory. Further investigation will be required to gain a complete evaluation of this material.



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

Objective: To investigate the possibility of using asbestos paper in the manufacture of gypsum wallboard.

Investigation: Thus far, several sample boards have been made with asbestos face paper. The bond has not been very

good but, otherwise, the specimens have been reasonably satisfactory. An assembly of regular 1/2" board with asbestos face paper stayed in place for 2 hours 20 minutes, as compared to 40½ minutes for regular 1/2" board. An assembly of 1/2" Firestop with asbestos face paper stayed in place for 3 hours 31 minutes, as compared to 1 hour 57 minutes for regular 1/2" Firestop. This clearly shows that there are certain advantages in fire endurance to be gained by the use of asbestos paper. Another possibility is its use in making a special board for radiant heating installations. Johns-Manville has been informed of our results. The next step is for J-M to produce an asbestos paper which is more suitable to our needs. In addition to the bond, the tensile strength needs to be higher and the porosity increased. We have sent them copies of our wallboard paper specifications.

10. PRE-COATED WALLBOARD - R&D #286

Objective: Apply a coating of Joint System or similar material to the face of the wallboard as an in-process operation. The primary goal is to provide a monolithic surface to receive the decoration.

Investigation: Some preliminary work was done in spraying a souped-up joint system product to the surface of the board. A number of boards were coated and subsequently installed with joints taped and finished and nailheads spotted. An acceptable appearance was obtained when one coat of a latex base paint was used. However, oil paint would not cover satisfactorily in one coat. It was also found that the oil paint decoration over the pre-coated wallboard resulted in a brittle surface which was rather susceptible to cracking. Another problem is that the joint system is short working when applied over the pre-coating because of the absorptive surface of the coating. These discouraging factors, plus the heavy work-load in other areas, have caused postponement of further work on the pre-coating. One other approach may be to apply the pre-coating at the paper mill rather than in the board plant.

11. LIGHTWEIGHT 5/8" FIRESTOP - R&D #289

Objective: Conduct a fire test at Underwriters' Laboratories to reduce the allowable weight of 5/8" Firestop to 2300 lbs/M. or less. The present minimum weight is 2525 lbs.

Investigation: An application for this test has been submitted, and a tentative date of July 26 has been given for pouring the concrete deck. This will be a concrete & bar joist construction identical to either our Design 69 - 2 hrs., or Design 13 - 1½ hrs. A special run of 5/8" Firestop was made at Wilmington in which the weight was reduced to 2300 lbs/M. There appears to be no significant difference in the performance of the lighter weight product.

12. 5/8" FIRESTOP WITH REDUCED GLASS FIBER - R&D #290

Objective: Conduct a fire test at U. L. to enable us to reduce the glass fiber content in 5/8" Firestop. It is felt that the transition to 636 glass fiber makes this a reasonable goal.

Investigation: Underwriters' has advised us that Design 69 - 2 hrs. or Design 13 - 1½ hrs. should be repeated to establish equal performance of the board with reduced glass fiber content. The reduction contemplated is 25% or 2lbs/M. This would represent a savings of \$.52/M. Based on 1964 sales of over 50 million square feet, the projected annual savings is \$26,000. A special run at Wilmington was made, in which the fiber was reduced to 6 lbs/M. The weight of this board was also held to 2300 lbs/M. In our pilot fire tests, this board has performed as well as our regular 5/8" Firestop with the old type glass fiber; so our efforts to reduce the glass fiber to this level appear to be within reason.

It has been decided to attempt to reduce the weight and the glass fiber content in one test - a repeat of our Design 13 - 1½ hour. One reason is that recent success with 1/2" Firestop has induced U. L. to reduce the weight of 5/8" Firestop to 2415 lbs/M. It seems unjustified to conduct a test just to lower the weight another 100 lbs. Also, some recent pilot tests indicate that 2300 lbs. board with 6 lbs. of 636 glass fiber will perform as well as regular weight 5/8" Firestop with 8 lbs. of 799 glass fiber.

An additional incentive is a 2 hour rating for this assembly. It is questionable whether we will get this but, if we should, it will give us a definite competitive advantage for this construction.

13. FIRESTOP TILE BACKER BOARD - R&D #291

Objective: Develop a 5/8" Firestop version of our water resistant tile backer board.

Investigation: The Firestop Tile Backer is only required for partitions where adjoining bathrooms occur between occupancies and there is a fire rating required. Underwriters' has been contacted and has responded that we will need to conduct a full scale test on a wood stud partition and an exploratory test which they would also run. Fort Dodge will manufacture this special 5/8" product under the auspices of the U. L. inspector shortly. Laboratory sample boards of 5/8" Firestop Tile Backer show the same degree of fire protection as regular 5/8" Firestop; so a successful result is anticipated.

14. ONE HOUR PARTITION WITH 1/2" FIRESTOP - R&D #292

Objective: Find a means to pass a one hour fire rating for a wood stud partition faced with 1/2" Firestop.

Investigation: Now that so many ratings have been developed for 1/2" Firestop on floor-ceiling constructions, it is a natural evolution to attempt to gain improved ratings for the same board on partition assemblies. Contractors dislike having two different boards on one job, if it can be avoided. Also, we are certain our competition will be pointing their efforts in this direction. A brainstorming session was held to help generate some ideas for accomplishing this goal. A number of worthwhile suggestions were advanced, and evaluations of several of these ideas are already in progress.

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.