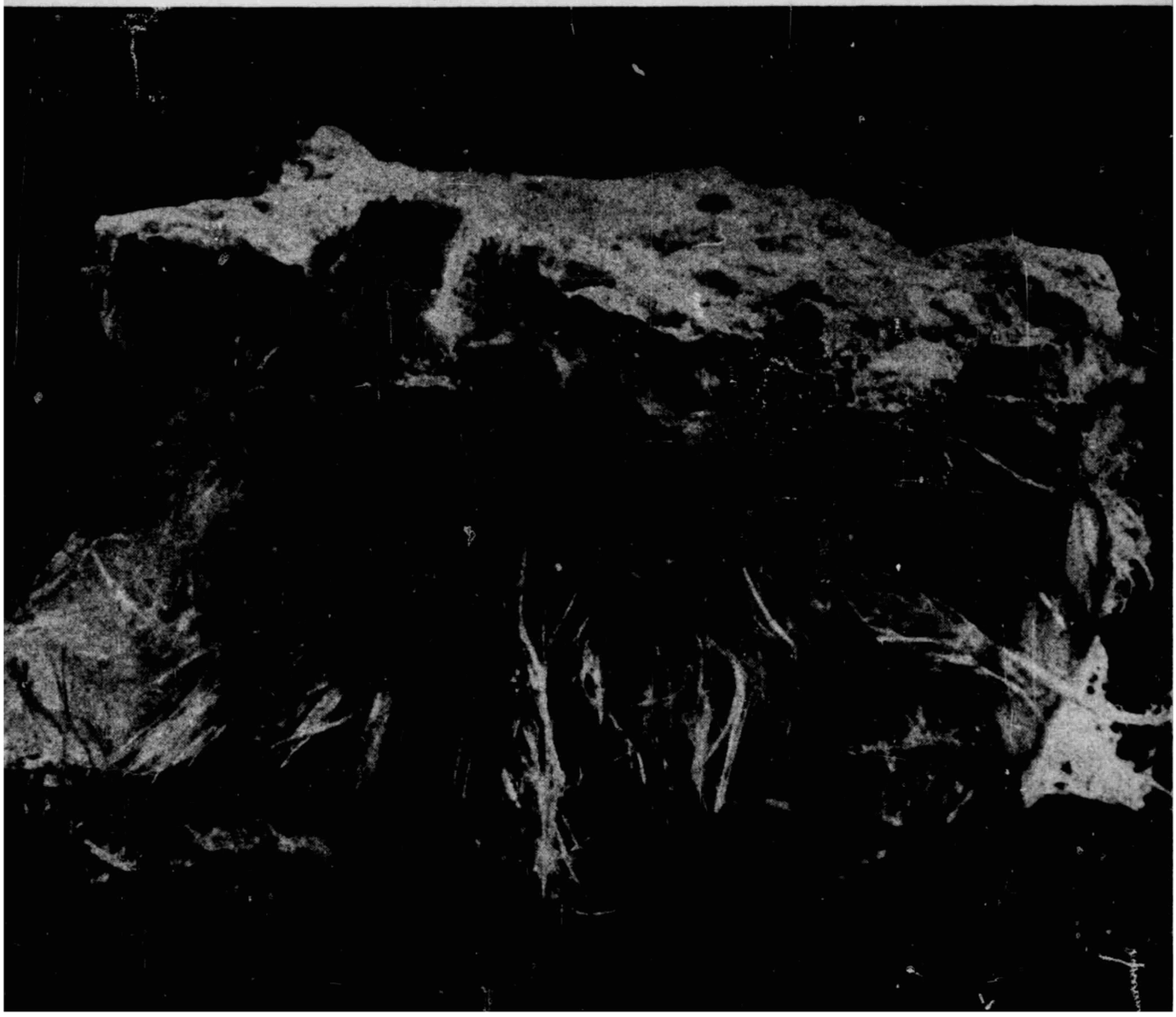
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FIBERS AND WHISKERS AS REINFORCEMENTS

The following article is based on a paper by Joseph P. Wronski, Physics Section Head, Raybestos-Manhattan, Inc., Manheim, Pennsylvania, originally presented at the Asbestos Textile Institute Conference on February 11, 1966.

In recent years, much effort has been expended on the development of materials having strength levels far in excess of those of the finest steels and with densities equal to, or less than, that of steel. The space agencies and manufacturers of aircraft and related equipment are extremely interested in such materials for obvious reasons.

Recognizing that, even with extremely costly processing, the steels and other metals fabricated by rolling, forging, casting and other conventional processes were rapidly approaching a strength ceiling, researchers have been directing increasing efforts to the development of "composites" which, on a strength-weight ratio basis, may far exceed the physical properties of the conventional metals. Such composites consist, in general, of a matrix material such as resin, ceramic or even metal, in which is dispersed a strong, fibrous material which serves as a reinforcement.

Tremendous stimulus to such investigations has resulted from the recent development of strong, inorganic, fiber-like, synthetic materials called "whiskers." Whiskers are inorganic crystals which are grown under controlled temperatures and pressures. The conditions are such that their growth takes place primarily in one direction. They can be grown to lengths of hundreds of times their diameters. Those of our readers who are familiar with the manner in which asbestos crystals were formed will immediately recognize the fact that the *unit* asbestos fiber is, actually, a naturally grown whisker and, for purposes of this discussion, the terms "fibers" and "whiskers" will be used interchangeably. Although glass fibers are not in exactly the same category, they will be mentioned along with the crystalline materials since they are used so extensively as reinforcements in certain composites.

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The use of reinforcements in composites is, historically, very old and includes such applications as the use of straw in mud bricks, animal hair in plaster, asbestos in molded insulations, brake linings and asbestos-cement products, glass fiber in polyester resins and others too numerous to mention. In many past applications, the selection of matrix and reinforcement was made on the basis of materials at hand and their proportioning was determined by "cut and try" methods. Only fairly recently have we begun to apply basic engineering principles to the elucidation of the behavior of fiber-reinforced composites. Much further research remains to be done but, from principles thus far established, we can pretty well pinpoint the properties of fiber and matrix required to produce a composite having reasonably predictable physical properties. The purpose of this discussion is to outline some of these basic principles which apply to the formulation of composites and also to show how asbestos fibers compare with some of the new synthetic fibers as reinforcement materials.

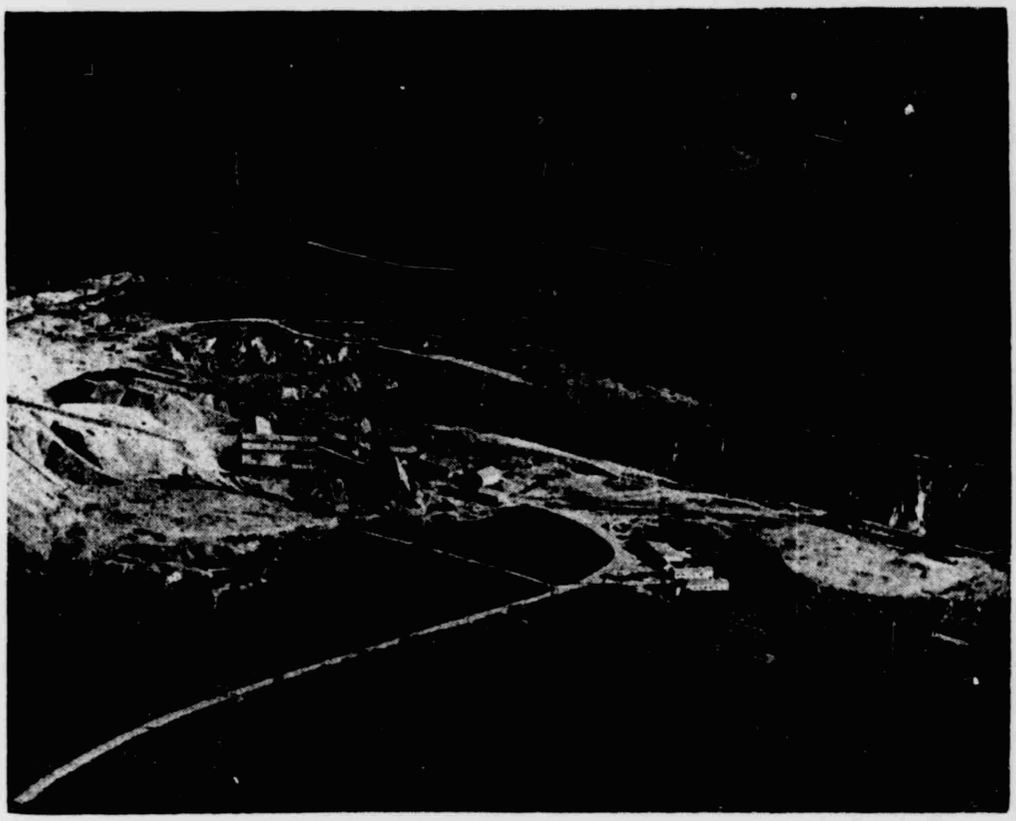
The optimum composite will be one having the highest possible strength-weight ratio combined with ability to survive in its intended environment and a justifiable cost relationship with the material it is intended to supplant.

Since the reinforcement will normally be covered by the matrix, the matrix will be selected to cope with the environmental conditions involved. Compatible with this requirement, it is desirable that the matrix have the highest shear strength-weight ratio attainable within limitations as to cost and ability to attain satisfactory bonding to the reinforcement without damaging the reinforcement. For example, a cast steel matrix with asbestos fiber reinforcement would *not* make a good composite since the asbestos would lose all its desirable physical properties at the pouring temperature of the steel.

Selection of the fiber reinforcement presents the most critical problem in developing a good composite. Here, certain characteristics of the fiber are all-important. These properties and their effects on the properties of the composite will be briefly discussed, not necessarily in the order of their importance.

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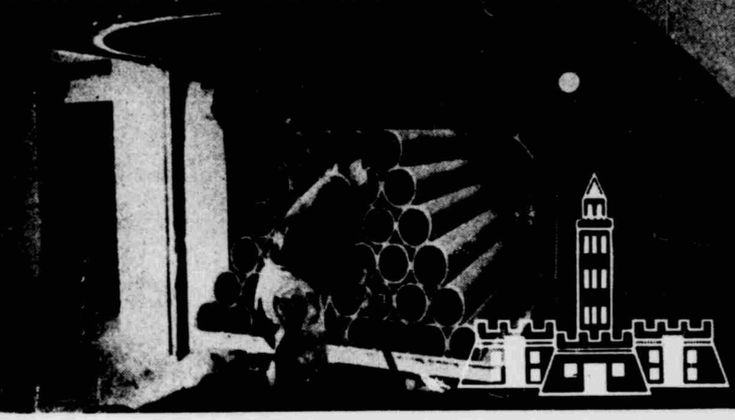
First, the fiber should have high tensile strength combined with light weight. Its strength must be much greater than that of the matrix; that is why it *is* a reinforcement. The strength of the composite will fall somewhere between the strength of the matrix and that of the fiber. Beyond a certain minimum, strength can be increased by adding more fiber. However, if the fiber is heavy, and large amounts are added, the strength of the composite may be the same as that of the finest steel but, if its weight is very close to that of steel, very little will have been gained and the gain may be attained at prohibitive cost. Many of the whiskers produced to date are extremely strong (up to several millions of pounds per square inch) and they are also very light and it is this strength-weight ratio which makes them so attractive as reinforcements.

Second, in addition to their high strength-weight ratio, many of these fibers have another important quality which makes them valuable as reinforcements and that is their high modulus. In simple terms, when any material is stressed by applying a load, say in tension, it will stretch a certain distance. In a simple spring, the greater the load the greater the distance it will stretch or, conversely, the *stiffer* the spring, the more load it will take to stretch it a certain distance. The modulus of a spring, or of a material, is the amount of stress it requires to stretch it by a certain amount. Hence, modulus is a measure of the stiffness of a material.

In a composite, subjected to a tensile load, the material stretches. If the fibers are strongly bonded to the matrix, they will stretch right along with the matrix and the load will be shared by the fibers and the matrix. However, if the matrix has a lower modulus than the fiber — and this is usually the case — the fibers will take over most of the load. Under a given strain (or stretch), the higher the fiber modulus, the greater will be the portion of the load transferred to the fiber. This is the desired condition since the fiber is much stronger than the matrix. The primary function of the matrix is simply to support the fibers and to transfer loads to them. The following table shows the modulus values for asbestos and glass fibers and for some of the new whisker materials along with other important data pertaining to these fibers.

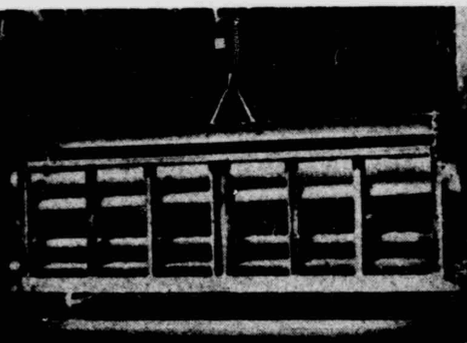
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Table I

Fiber	Modulus (10^6 psi)	Experimental Strength (psi)	Theoretical Strength (psi)	Strength to Weight Ratio (10^6 in.)
Asbestos	23	820,000	1,500,000	9.1
Sapphire	60	2,800,000	6,000,000	19.6
Silicon Carb.	122	1,600,000	12,000,000	13.9
Boron Carb.	65	965,000	6,500,000	10.6
Graphite	142	3,000,000	14,200,000	50.0
Glass	13	550,000	1,500,000	6.1
Iron	29	1,900,000	2,900,000	6.7
Steel	30	600,000	1,000,000	2.1

Figures shown in the table for iron are for iron whiskers. Just for comparison, we have included the properties of a high grade steel, processed to extremely high physical properties. It is interesting to note the superior properties of the fiber or whisker materials over this steel. That is what whiskers are all about.

It will be noted, for example, that silicon carbide whiskers have a modulus about five times and a strength about double that of asbestos. Because of its high modulus, a silicon carbide whisker could take over a greater share of the load in a composite than could an asbestos fiber in the same matrix. Therefore, fewer silicon carbide whiskers than asbestos fibers would be needed to take over the same amount of load. In addition, because of its greater strength, a silicon carbide whisker would support twice the load of an asbestos fiber. However, things are not that much in favor of the silicon carbide when we look at its strength-weight ratio. On a pound-for-pound basis, silicon carbide would support only 50% more load than asbestos instead of twice the load. This situation is even more dramatically illustrated in the case of iron whiskers. Here iron, with over twice the strength of asbestos, is 50% weaker on a pound-for-pound basis.

Data have been compiled to show what fraction of the load will be taken over by fibers of different moduli in composites using a typical resin matrix having a modulus of 500,000 psi. While such data are based on highly idealized conditions such as perfect resin to fiber bonding, perfect alignment of fibers and pure transfer of stress from resin

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to fiber, which can almost certainly not be attained in practice, they do provide an insight into what *relative* properties might be achieved by various fiber-resin composites. Table II shows the proportion of the total load which would, theoretically, be taken over by certain fibers in a resin matrix as the Volume Percent of Fiber in the Matrix is varied.

Table II

Volume Percent of Fiber in Resin Matrix	Percent of Load Carried by Fiber		
	Glass	Asbestos	Graphite
10	74	84	97
20	87	92	99
40	95	97	100

It will be noted from the Table above that asbestos fibers in a composite containing 10% fiber by volume would support 80% of the load imposed on the composite and, at the same concentration in the same resin, glass fibers would support about 70% of the load. Under these conditions, the glass composite would fail before the asbestos composite simply because the resin could not support the greater load imposed on it.

***This artcile will be completed in the next issue of ASBESTOS.**

JOHNSON-MARCH CORPORATION has issued a brochure describing its new and improved *automatic-cleaning bag filter unit*. This unit can utilize either pulsamatic or shaker cleaning action and is especially useful where maximum recovery of valuable dust is desired.

AMPLIGRAPH, a vibration measuring device that records continuously and inexpensively without human attention, is described in a bulletin published by *Vibration Measurement Engineers, Inc.* This recorder is completely portable and simple to operate and continuously records earth borne disturbances created by explosives, impact machinery, construction operations and industrial activity. The ampligraph is a product of *Nitro Nobel* of Sweden.

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Asbestos Paper Drives Your Car

Today's motor cars, equipped with automatic transmissions, get their drive through metal transmission discs which are covered on one side with a super-tough paper containing asbestos fiber. This paper, which is bonded to the metal discs, is wafer thin, but sufficiently strong and tough to last up to 140,000 miles of operation in the continuous oil bath provided in the transmission. The average transmission contains from eight to twelve of the paper-faced discs. While the quantity of paper in each transmission is small, the current output of over six million automatic transmissions annually requires disc paper production running into hundreds of tons.

When you kick your car away from a stoplight and experience that satisfying feeling of smooth, positive power, it is difficult to imagine that the entire drive train depends, for its effectiveness, on paper cushions that are only 40 thousandths of an inch thick and about one-half inch in width. The paper is designed to take this full power punch continuously for the life of the car.

The transmission discs are covered with paper on one side only. Experience has shown that metal-to-metal contact of the discs, due to insufficient friction between discs, resulted in excessive wear due to slippage. The use of paper improves the friction characteristics and reduces slippage and wear when the discs are so arranged that the paper-lined side of one disc contacts the plain metal side of the adjacent disc. The use of the paper also provides a cushioning effect when the discs come into engagement and this contributes to smoothness of shifting when gear changes are being made.

The paper composition consists of Blue Crocidolite Asbestos fiber, Chrysotile Asbestos, cotton or wood fibers and certain inorganic powder fillers, combined to form a paper and subsequently impregnated with phenolic resins and cured to form a final product which, in hardness and density is similar to plastic laminates used for gear blanks, table tops, etc.

The discs, of course, are subject to abrasion and high temperatures caused by a certain amount of "planned slippage" which contributes to the smoothness of the modern drive train. Transmission experts and paper technicians

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This is a customer's idea. Ordering his third Hurricane was practically a rubber stamp routine, he said, because of the excellent record established by his first two units. As most of the more than 100 Hurricanes now in use represent repeat orders, other customers apparently agree with his logic. Nearly 70 of these air attrition mills are processing nonmetallic minerals. One major asbestos producer now uses 21 units! Applications include opening shorter grades of fibre to controlled levels, processing groups 5, 6, 7, as well as floats and tailings, and extracting impurities from usable fibres. If you haven't ordered your first Hurricane yet, may we send you one . . . complete with rubber stamp for reordering? **The Bauer Bros. Co.**, Springfield, Ohio 45501, and Ontario, Canada.

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worked for some years to develop a paper that would resist the heat/friction attack and still provide the desired resiliency. Crocidolite, which comprises about ten percent of the disc paper formulation, provides desirable frictional characteristics and heat resistance and, as the strongest of all mineral fibers, contributes the strength and structural integrity required of the paper in this critical application.

(The above is based on an article which appeared in the July 1967 issue of "Asbestos News," published by North American Asbestos Corporation.)

FRICTION MATERIALS STANDARDS INSTITUTE held its annual meeting on June 19, 1968, in Miami, Florida, and elected the following officers for the ensuing year: President—John H. Kelly of The Bendix Corporation, Vice President—Steven S. Conway, Jr. of Abex Corporation, Treasurer—Harold Hodson of The Bendix Corporation and Secretary—Miss Harriet G. Duschek. The Directors serving with these officers are Frank T. Gatke of Gatke Corporation, Alexander J. Bette of Johns-Manville Corporation, Joseph W. Greenen of Maremont Corporation, William J. Vachout of Carlisle Corporation and James L. McGovern, Jr. of Raybestos-Manhattan, Inc.

FMSI supports Periodic Motor Vehicle Inspection and the removal of the brake drum to inspect the braking contact surfaces and works very closely with Federal Authorities on the establishment of quality brake lining performance standards.

U.S. BUREAU OF MINES plans to test a 704-foot long wind tunnel some time this summer which it expects will help establish safety standards for ventilation rates, dust and contamination limits and explosion prevention. The tunnel will be used as a simulated mine passage for large-scale tests of air flow around equipment and other obstructions. Its 5-foot by 8-foot cross section will accommodate full-size mock-ups of mining equipment. For the testing program, Bureau technicians will mount a reversible mine fan, rated at 250 horsepower, at one end of the tunnel to supply air under

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Automobile Sales

MAY 1968 motor vehicle factory sales from plants in the *United States* totaled 1,103,478 (passenger cars—916,-852, trucks and buses—186,626). The total for May 1967 was 898,286.

Motor vehicle factory sales from plants in *Canada* totaled 130,158 for May 1968 compared to 98,926 in May 1967.

THE 1968 SOUTH AFRICAN BUILDING EXHIBITION will be held August 21-29 at Milner Park, Johannesburg. Manufacturers of building materials, equipment, components and services will exhibit their latest developments and trade and materials associations will provide official representation for sectors of the building industry. The combined stands of many countries will display building techniques and products from outside South Africa.

THE PRODUCERS' COUNCIL will hold its *47th Annual Meeting* in Chicago, Illinois, September 24-27, 1968. The theme of the Meeting will be "The Construction Industry—Where Is It Headed?" Emphasis will be placed on national developments affecting the construction industry and particularly the manufacturer, with several sessions to be focused on the functions and responsibilities of the market manager, product manager and field sales manager.

A SYMPOSIUM ON THERMAL EXPANSION OF SOLIDS, sponsored by the Westinghouse Astronuclear Laboratory and the National Bureau of Standards, will be held at the NBS facilities at Gaithersburg, Maryland, September 18-20, 1968.

IDCNA NATIONAL MEETING—The Insulation Distributor-Contractors National Association will hold its "13th Annual National Meeting" at Marriott Motor Hotel,

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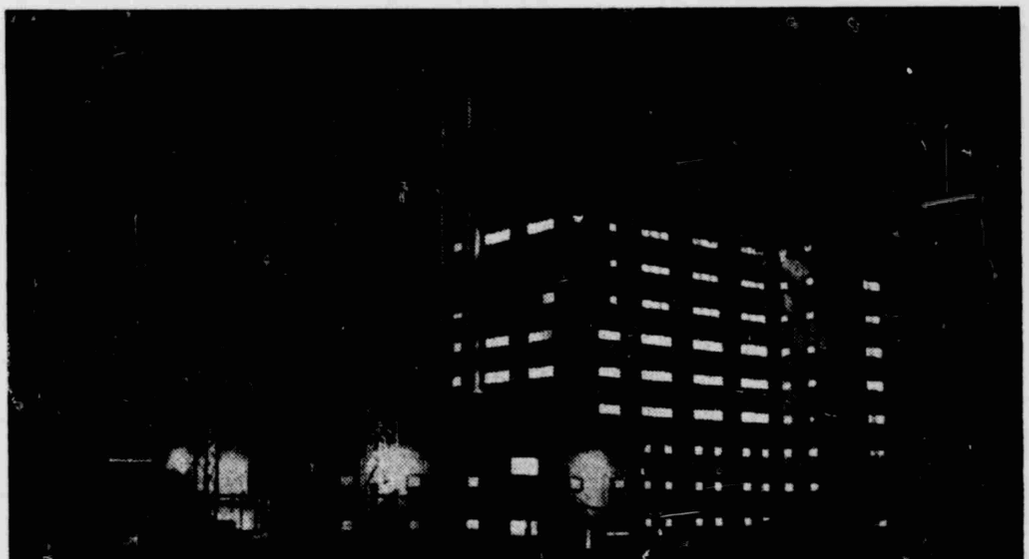
CLARENCE HERBERT CARLOUGH, President and Founder of *Carolina Asbestos Company,* passed away June 17, 1968. He founded Carolina Asbestos in 1930 and operated a textile plant at Davidson, North Carolina. In 1939, an additional plant was established at Marshville, North Carolina. The facilities at Davidson then became largely a carding and spinning mill and the new operation at Marshville was principally a weaving mill. In 1947, these plants were acquired by Unarco Industries, Inc. and Mr. Carlough joined Unarco as Vice President in charge of Textile Operations. In 1950, Mr. Carlough became President of the newly-formed "Carolina Asbestos Company" and the new company purchased the Davidson textile plant from Unarco. Later the Davidson property was sold to H. K. Porter Company, Inc. and Johns-Manville Corporation purchased the Marshville facilities.

Mr. Carlough was the first president of the Asbestos Textile Institute and served in that capacity in 1945-1946.

Mr. Carlough was very well known and respected as a leader in the asbestos textile industry in the United States and will be greatly missed by his many friends and associates.

A MICROFILM LIBRARY, designed to help the nation's construction industry overcome a mounting paperwork burden, has been introduced by *Showcase Corporation,* a Detroit, Michigan, based visual communications firm. Developed after ten years of research, the microfilm library provides for the reduction, storage, and instant retrieval of specific information which might otherwise take hours and even days to find using conventional office methods. The library will be marketed through 239 Showcase Centers located in the United States and Canada. Eight of the centers will be owned and operated by Showcase Corporation and the remaining 231 will be franchised. Many of the initial centers will be located in Hilton Hotels. In addition, a reader-printer machine will be made available that will enable the user to make high-quality prints of the information being viewed. The libraries will be updated every three months and wholly new sets of cartridges will be provided each year.

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Building

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JUNE 1968 contract values for future construction totaled $5,589,481,000, less than 1% higher than the year-ago amount. Construction contracts reflect tightening credit conditions as year-to-year gains in residential building have become smaller. In addition, public building projects are beginning to feel the effects of cutbacks in Federal spending and higher costs of borrowing for state and municipal governments.

Residential building contracts, valued at $2,243,119,000, were up only 4% from a year ago. Apartments continue to account for most of the gain. A 32% increase from last June in the value of contracts for multi-family units was only half as large as the average for the first five months of 1968 and barely enough to offset a small June decline in single family building.

Nonresidential building contracts were valued at $2,029,-887,000, 2% below the year-ago total. Sharp declines were registered in all of the institutional building categories—educational, hospital, religious and public buildings. Almost offsetting these declines was a continued improvement in industrial and office building.

Nonbuilding construction contracts totaled $1,316,475,-000, 2% below last June. A 20% increase in contracts for sewer and water facilities was not enough to offset an 18% drop in highway construction contracts.

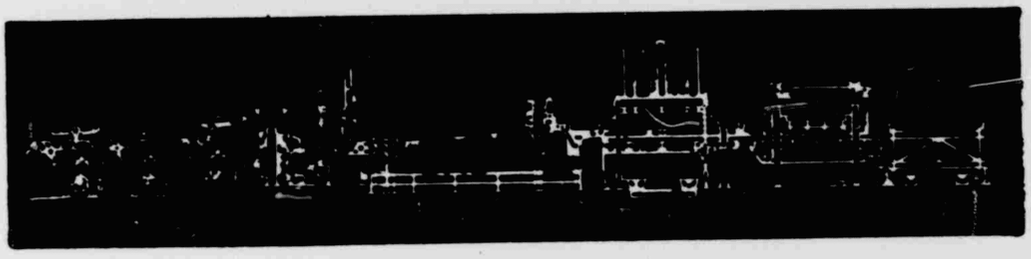
FIRST SIX MONTHS 1968: Residential, $12,120,-919,000, up 22%; Nonresidential, $10,129,402,000, up 2%; Nonbuilding, $6,943,904,000, up 12%—Total Construction, $29,194,225,000, up 12%.

J-M INDUSTRY FORECAST—Construction expenditures in the United States will increase by $4 billion this year to a new high of $78.9 billion, or a gain of 5.3% over 1967, according to a semi-annual industry forecast by *Johns-Manville Corporation*. Expenditures for private residential construction will be up 18.9%, an overall 2.7% decline will occur in the public sector and there will be a 9% decline in expenditures for industrial construction.

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Tel. 45 91 / Telex 024 4874

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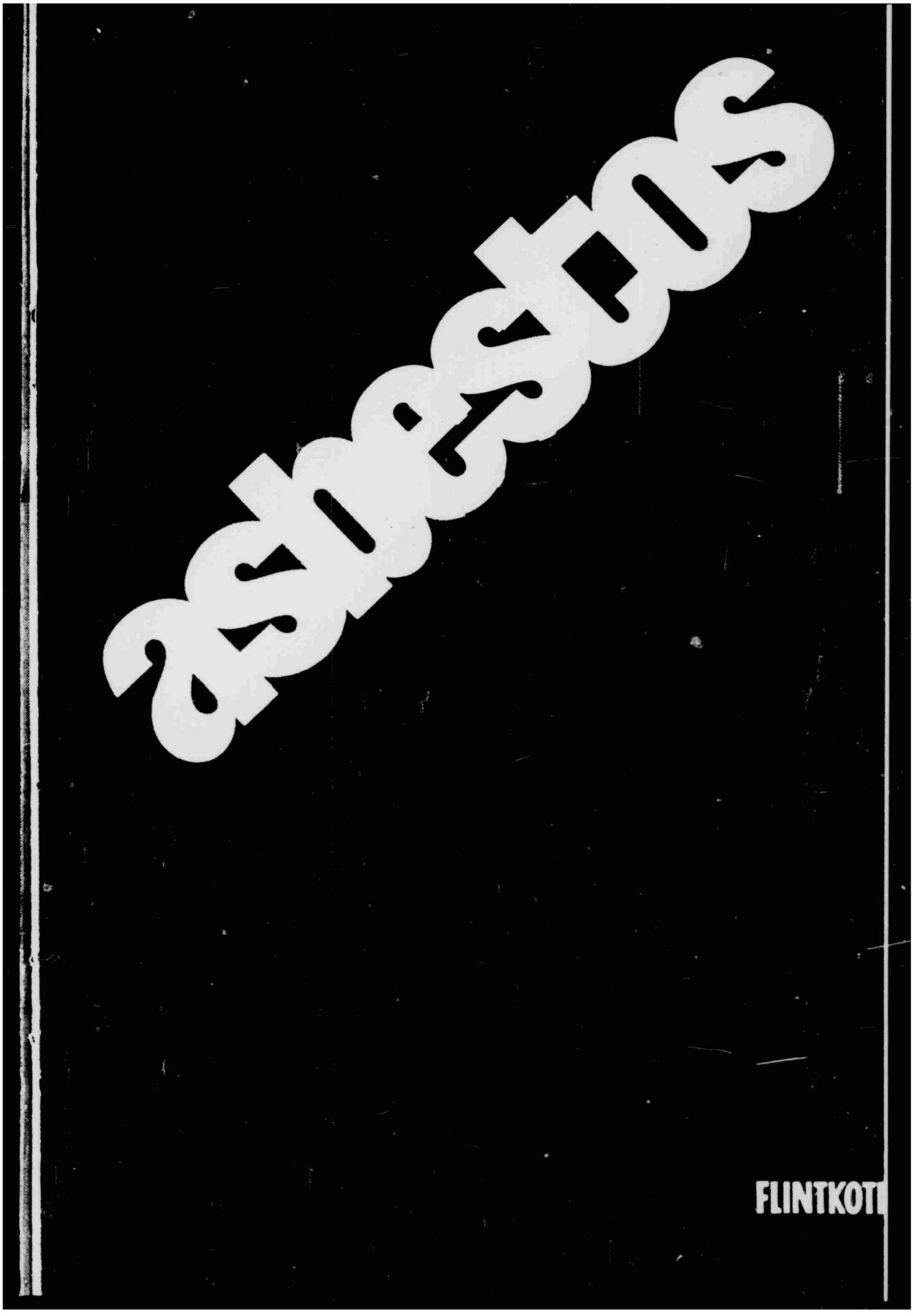
D P WAY CORPORATION has developed the *"ULTRAVAC Industrial Vacuum Loader"* for the removal of both fine and high density industrial debris and spillage. Materials are drawn by a high velocity air stream created by a new type blower which was designed and built specifically for this equipment. Up to 150 feet of lightweight and easily handled suction hose, 6 inches or less in diameter, can eliminate refuse weighing as much as 200 pounds per cubic foot from remote areas. Its maximum maneuverability offers a potential savings in time and money where hand labor is utilized to clean solid refuse. The Loader is less than 8 feet high and can make a complete revolution within a 15 foot circle.

According to the Company, this equipment is capable of handling particle-size asbestos dust present during clean-up operations and also the spillage from beneath conveyors, screens and other processing equipment.

GEOSCIENCE INSTRUMENTS CORPORATION has a new electromagnetic micromill, designated the *Micro-Pulverit,* designed for pulverizing and homogenous mixing of geological specimens for laboratory analysis. The unit utilized electromagnetic energy to vertically oscillate the mortar. These oscillations are transmitted to the pulverizing ball through the material to be pulverized. Initially, coarse grains in the material are selectively triturated. As the overall grain size becomes progressively smaller, the pulverizing ball motion is converted to a tumbling action. A built-in variable resistor enables the impact force of the pulverizing ball to be regulated.

CENTER FOR PROFESSIONAL ADVANCEMENT, Hopatcong, New Jersey, has scheduled the following workshops: *Noise Measurement & Control*—October 21-24 and *Thermophysical Measurements Techniques*—October 23-25.

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asbestos
FLINTKOTE

CANADAIR LIMITED, Canadian subsidiary of General Dynamics Corporation, has acquired a minority interest in ASBESTOS CORPORATION LIMITED. The shares of stock were sold by the former owners of Johnson's Company Limited and Johnson's Asbestos Company whose properties were sold to Asbestos Corporation in 1964.

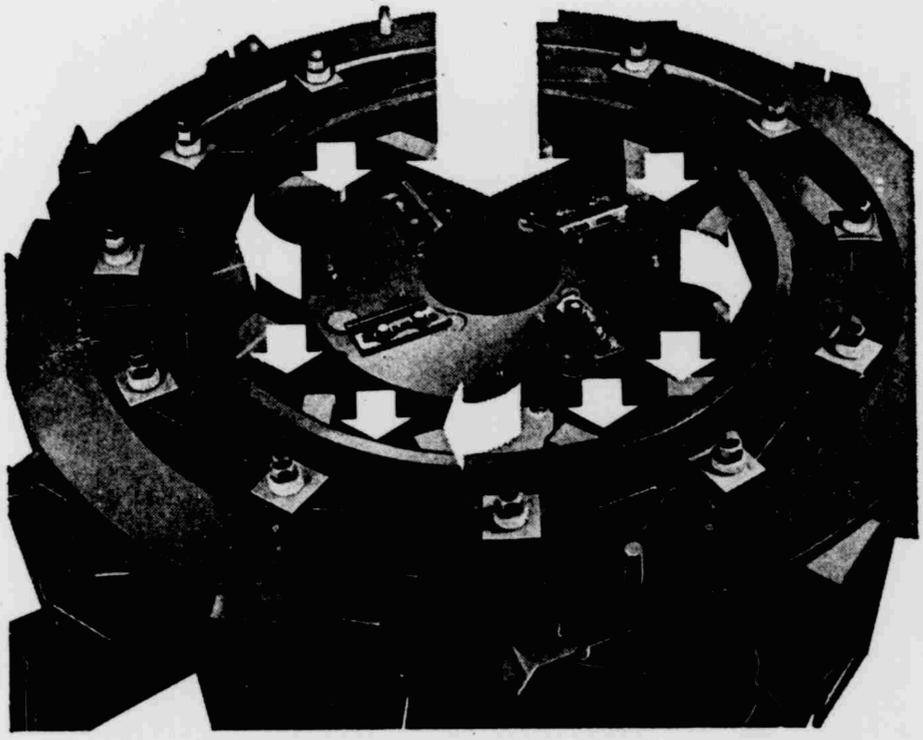
NATIONAL GYPSUM COMPANY will build a multi-million dollar paper mill plant in New Columbia, Pennsylvania. Although a substantial amount will be available to serve customers' requirements, the new mill will produce paper primarily for the manufacture of Gold Bond wallboard which is used extensively in residential and commercial construction. This plant represents the largest single capital investment in a new facility in the history of National Gypsum.

TURNER & NEWALL LIMITED has reached an agreement with CEMENT LIMITED, Dublin, to further integrate asbestos-cement interests in Ireland. T&N recently opened a factory at Ballyclare for the manufacture of asbestos-cement building products. This factory will be registered as *"Turners Asbestos Cement (Northern Ireland) Limited"* and will operate in conjunction with a subsidiary of Cement Limited.

T&N and Cement Limited have equity in "Asbestos Cement Pipes Limited" which has been successfully operating at Drogheda, Ireland, since 1964.

CONEXPO is the new name of the former "Construction Equipment Exposition and Road Show". CONEXPO '69 will be held at the International Amphitheatre in Chicago, Illinois, February 16-22, 1969. It is estimated that 80,000 construction officials from nearly 100 countries will attend. The shows are held every six years.

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Simplicity's D'CENTEGRATOR fibrizes so thoroughly, the longer fibres are not "dirtied". The break-up action is pictured above schematically (our asbestos fibrizers actually have 12 bars). On-the-job performance also indicates a higher recovery rate and lower percent of fines. Both lower initial and maintenance cost make this 60 t.p.h. unit (2" cubical feed) an outstanding producer. Write or call about a test.



Model 24
Asbestos
D'CENTEGRATOR

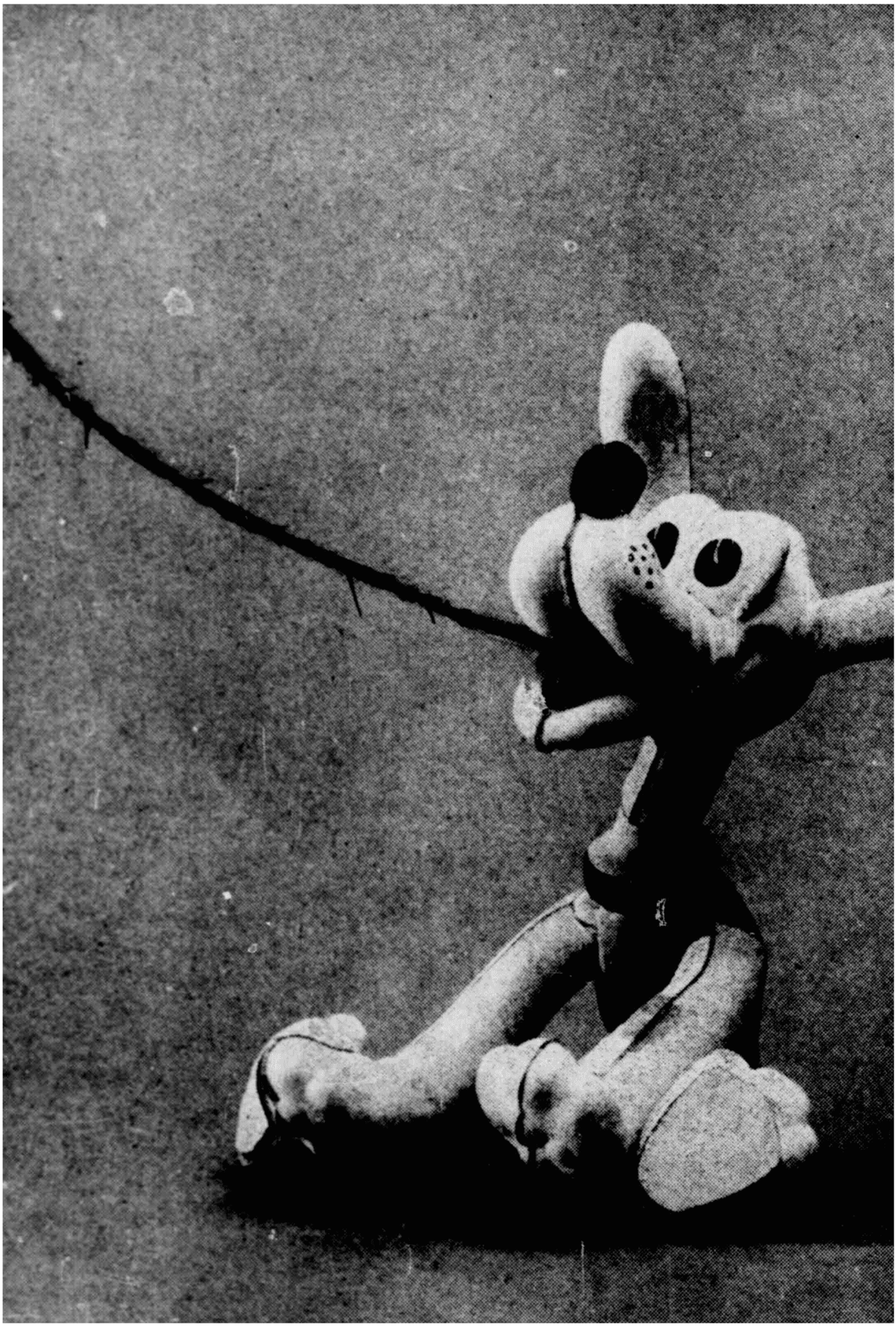
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Telephone: (312) 922-7435
(Members of the Cape Asbestos Group of Companies)

TW2759

MARKET CONDITIONS

General Business.

While corporate earnings reports for the second quarter are generally favorable and, in some cases, surprisingly good, business has shown definite signs of a slowdown during July. Most economists are now looking for third quarter results about equal to those of last year and for a decline in general business during the fourth quarter.

Biggest news during July was that the steel producers and the United Steelworkers union had reached agreement on terms of a three year contract and thus avoided a labor stoppage in this basic industry.

Immediately following this, U.S. Steel announced a price increase on can-making steel and Bethlehem announced an increase of about 4.5% on practically all its products. Smaller producers indicated they, too, would raise prices on some or all of their products. The President has vigorously protested this move and it remains to be seen how much pressure will be brought to bear by the Government to persuade the producers to rescind all or part of the price increases and what results such pressure may produce. Regardless of price considerations there is certain to be a sharp drop in steel production until users work off the substantial inventories they had accumulated in anticipation of a strike. Over the longer term it is also believed the settlement will force the closing of a number of marginal production facilities which will be unable to operate profitably under the increased wage scale and this will lead to a reduction in total industry capacity until more modern, efficient mills can be brought into production.

The political situation remains extremely confusing and the pollsters are having a field day as the relative positions of the most likely candidates keep changing almost daily.

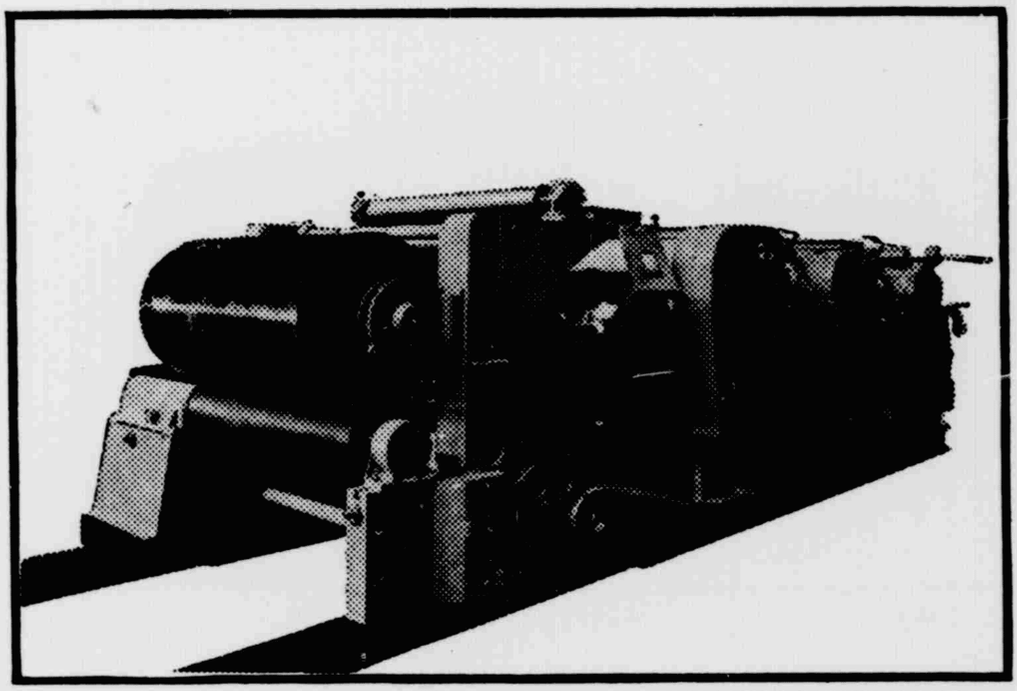
The Paris peace talks continue but no tangible progress is reported publicly. Rumors persist that some things are

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ASP/HAC/19

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HYDERABAD ASBESTOS

CEMENT PRODUCTS LTD.

PLANT MANUFACTURING DIVISION HYDERABAD-18 INDIA

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being accomplished behind the scenes, possibly at higher levels, and we can only hope such is the case.

The stock market suffered rather substantial losses in July indicating that the preceding rise was based more on hopes of speculative gains than on a sound evaluation of future corporate earnings which, at the moment, do not seem to be headed upward for the balance of this year.

SPEED KING MANUFACTURING COMPANY, INC. has announced the availability of the *BeltVeyor Elevating Undercar Feeder* which has one continuous belt and is a single unit for the unloading and elevating of dry granular materials when they are unloaded from a hopper bottom rail car. The unit eliminates the need for a pit under the track and can handle variable capacity to fit individual needs —up to 70 tons per hour of 60 pounds-per-cubic-foot-material. It has an adjustable material inlet guide which serves as an automatic flow regulator. Thus, if the material flows from the rail car faster than the feeder can move it the material runs onto the guides until it reaches its natural angle of repose, at which time it ceases to flow until the feeder can "catch up." The equipment is well balanced and can easily be moved about by one man. Although it can be used in many other applications, the feeder is designed to operate with a BeltVeyor Bucket Elevator or a Tubular Conveyor. According to Speed King, this feeder can handle such products as shredded asbestos, cement and gypsum.

PREDICASTS has recently completed a *"Plastics Additive Report"* which shows that the plastics additives and fillers industry is a large, rapidly growing and potentially profitable area and worthy of further investigation for present or future business opportunities. Additives and fillers used to modify and extend the properties of plastic currently represent a $500 million market. By 1976, consumption should reach $1.2 billion—a 9% average annual growth rate. The 1966 volume was 3.0 billion pounds, which amounts to 24% of plastics consumption for the year.

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Careful quality control ensures that our ASBESTOS SHORTS are free of grit and other minute particles that clog spray equipment.

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"Insud" Cia. Sudamericana de Industria y Comercio S.A.

BRAZIL, Rio de Janeiro
Sao Paulo "Brasimet" Comercio e Industria S.A.

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E. B. Taylor Company

CALIFORNIA, San Francisco
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CANADA, Montreal
Federated Metals Canada, Ltd.

CANADA, Toronto
Federated Metals Canada, Ltd.

COLOMBIA, Barranquilla
Holanda, Colombia, S.A.

COLORADO, Denver
Van Waters & Rogers, Inc.

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Gulf Coast Chemical Corporation

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D. H. Litter & Co., Inc.

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MINNESOTA, Minneapolis
Industrial Chemical & Equipment Co.

MISSOURI, St. Louis
Harry A. Baumstark & Company

NEW YORK, Buffalo
Buffalo Solvents & Chemicals Corp.

NEW YORK, New York
D. H. Litter & Co., Inc.

OHIO, Cleveland
A. C. Mueller Co., Inc.

OREGON, Portland
Van Waters & Rogers, Inc.

PENNSYLVANIA, Conshohocken
Van Horn, Metz & Co., Inc.

UTAH, Salt Lake City
Van Waters & Rogers, Inc.

WASHINGTON, Seattle
Van Waters & Rogers, Inc.



ASARCO

A subsidiary of American Smelting and Refining Company

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RAYBESTOS-MANHATTAN, INC. has issued a new brochure entitled *"The Company That Keeps Things From Happening"* which very completely describes the company's major products and beautifully illustrates how R/M's products and services contribute to industrial life throughout the world. R/M works in four basic materials — asbestos, rubber, specialized plastics and sintered metals — and creates the modern materials known as "composites." Copies of this interesting and informative brochure are available upon request.

THERMOID OIL FIELD PRODUCTS is the title of a new 24-page brochure from *H. K. Porter Company, Inc.* which presents detailed information about Thermoid rubber, friction and textile products specifically engineered and constructed for oil field use. Separate sections cover each product line with illustrations and descriptions of applications and construction. Included in the brochure are sections concerning hose, V-belts, asbestos textiles such as pipe lagging and safety cloth, vinyl tapes, gasket material and friction materials such as brake linings and clutch facings.

LOAD UNIT is the title of a new four-page circular, No. 2393, prepared by *Grant Wilson, Inc.* It includes a Table which indicates the proper way to prepare a load unit. For easy figuring, the percentages of a load unit are based uniformly on ten packages of each item. The brochure illustrates the amount of floor space required for ten cartons of a given product and gives instructions on stacking or storing for efficiency in counting, ordering and warehousing.

CP299:1968 SPRAYED ASBESTOS INSULATION is a new Code of Practice available from the Sales Office of the *British Standards Institution.* The cost is 7 shillings per

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YOUR ENQUIRIES ARE INVITED



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WAYCROSS, Ga., U.S.A. **JOLIETTE, P.Q., Canada**

FLORIG EQUIPMENT COMPANY, INC. has issued a new brochure desribing its *"Sani-Bulk System."* This system combines, in one vehicle, the capability of transporting either dry bulk or general cargo and packaged freight. The special equipment in the vehicle is a permanent vinyl laminated nylon liner and a movable bulkhead. When not in use, the liner is collapsed into the front of the van where it is protected by the bulkhead. Conversion from general cargo to dry bulk takes less than 5 minutes and materials may be bulk loaded directly into the van from protected storage. Separate liners can be provided for incompatible products carried in the same van.

ARMSTRONG BOOKLET—An eight-page illustrated folder on the proper method for *spraying contact adhesives* has been published by Armstrong Cork Company's Industry Products Division. The booklet, entitled "How To Get the Most Out of Spraying Armstrong Contact Adhesives," describes the advantages of spraying over other application methods, preparation before spraying and the correct way to spray.

BULLETIN 516, available from *Stedman Foundry and Machine Company, Inc.*, lists the equipment manufactured by Stedman for crushing, pulverizing, disintegrating, mixing and screening. According to the company, this equipment is designed for rapid, economical and uniform reduction of many materials including asbestos fiber, asbestos pipe covering and asbestos shingle scrap.

CANADIAN GOVERNMENT SPECIFICATIONS BOARD has announced that "Specification 51-GP-3 for Thermal Insulation (85% Magnesia) For Piping, Machinery and Boilers For Marine Use" has been cancelled as of April 19, 1968, since this type of material is no longer available in Canada.

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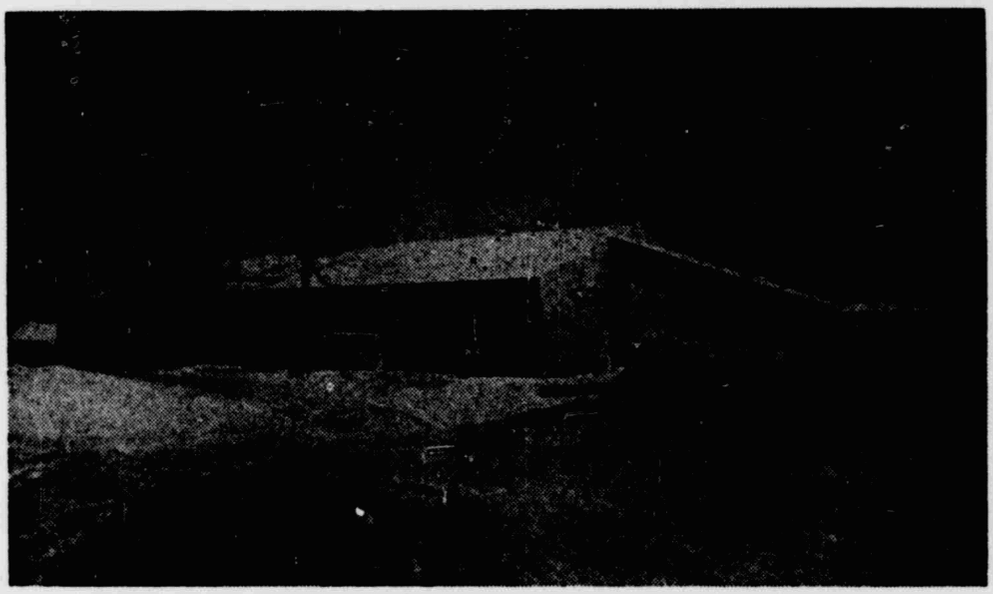
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Producers of Soft, Low Iron, White Chrysotile
Crudes and Filter Fibre

MINES AND MILL IN GILA COUNTY

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NBS CONFERENCE SERIES—The Institute for Applied Technology, National Bureau of Standards, has announced plans to sponsor a series of interdisciplinary conferences entitled *"Man and His Shelter."* The Building Research Division of the Institute will act as host and coordinator of the series. The first of these conferences, "Performance of Buildings—Concept and Measurement," will be held at the Bureau's Gaithersburg, Maryland, site, September 23-25, 1968. It will provide an opportunity to exchange ideas and should help to eliminate the confusion surrounding the term "performance concept."

Tentative topics for subsequent conferences include Modular Coordination, Cost and Evaluative Systems, Fire Research and Safety, Materials—New Ideas and Approaches, User Needs and Building Codes.

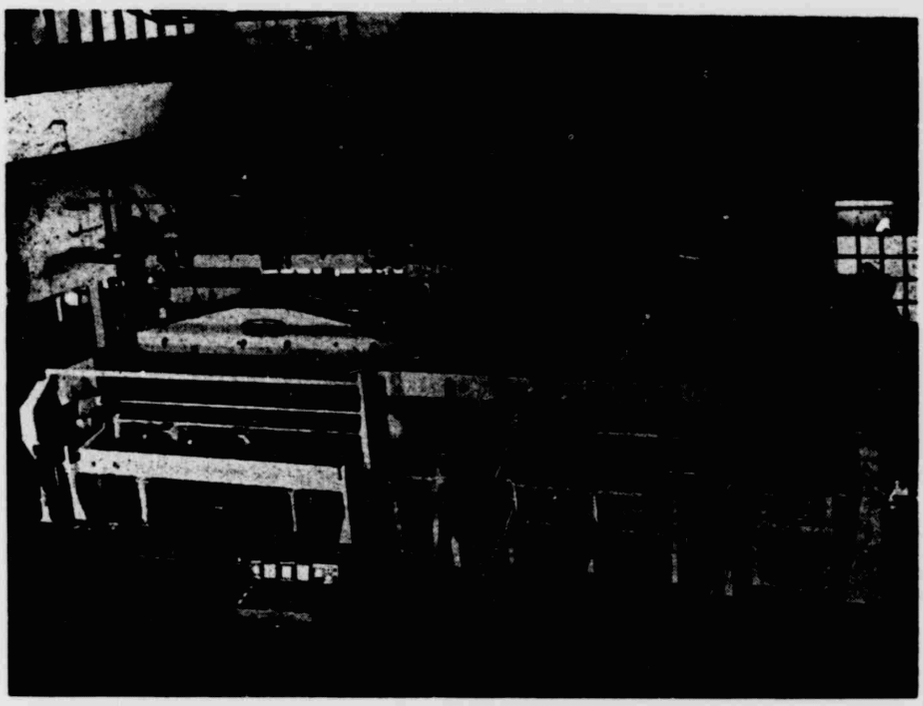
CAST, short for "Clearinghouse Announcements in Science and Technology," is a new document announcement service inaugurated by The Clearinghouse for Federal Scientific and Technical Information of the U. S. National Bureau of Standards. CAST is a method for the scanning of the flow of new technical information in any of 46 separate fields of technology. It will feature the latest comprehensive reporting of publicly available U. S. Government sponsored and other Research & Development reports and translations. Subscriptions are available at $5.00 per year ($6.25 foreign) for the first category and $5.00 per year ($6.25 foreign) for each two additional categories.

NBS CATALOG—"Standard Reference Materials: Catalog and Price List of Standard Materials Issued By the National Bureau of Standards" describes the various NBS Standard Reference Materials which are used to calibrate measurement systems and to provide scientific information that can be referred to a common base. A schedule of prices and quantities is included for each material, as well as directions for ordering. (NBS Misc. Publ. 260; 42 pages; 45c)

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Paris

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Mr. Knut Moerch
c/o A/S Polyvog
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Oslo 1

PORTUGAL

Nogueira Limitada
Apartado 2457
R. dos Douradores, 107
Lisboa 2

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Otto G. Bunzi
Pablo Aranda 18
Madrid

SWEDEN

A. B. Industrimetoder
P. O. Box 5168
Stockholm 5

The British Metal Corp. (Canada) Ltd.
121 Richmond Street West
Toronto, Ontario, Canada

ARGENTINA

Tennant Argentina S.A.I.C.
Avenida Cordoba 333
Buenos Aires

AUSTRALIA

Sydney
The British Metal Corp. (Australia) Pty. Ltd.
Kindersley House
Bligh/O'Connell Streets
Sydney, N.S.W.

Melbourne
The British Metal Corp. (Australia) Pty. Ltd.
Pearl Assurance House
143-151 Queen Street
Melbourne C.I.

AUSTRIA

Allmetall GmbH
Porzellangasse 18
Vienna IX

BRAZIL

Sao Paulo
Tennant Importacao E. Exportacao Ltda.
Caixa Postal 7284
Sao Paulo

Rio de Janeiro
Tennant Importacao E. Exportacao Ltda.
4 Avenida Branco S. 1407/9
Rio de Janeiro

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Casilla 9306
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FORMOSA

International Trade and Machinery Co., Inc.
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Taipei, Taiwan

INDIA

Bombay
The British Metal Corp. (India) Private Ltd.
P. O. Box 1729
Steelcrete House—Dinsha Waccha Road
Bombay

Calcutta
The British Metal Corp. (India) Private Ltd.
United India Life Building
P. O. Box 743
22 Chittaranjan Avenue
Calcutta

ITALY

USVICO
Societa Industriale Commerciale
Via Generale Albricci 8
Milano

JAPAN

Mitsui and Company, Ltd.
Minerals & Industrial Materials Section
General Merchandise Dept.
Tokyo

PAKISTAN

The British Metal Corp. (Pakistan) Ltd.
5 West Wharf Road, P. O. Box 4910
Karachi 2

SWITZERLAND

Chemische Fabrik Schweizerhall
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Basel

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Queen Street Place
London EC-4

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Avenida Francisco de Miranda
Caracas

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F. W. Hempel & Co.
Am. Wall 127
Postfach 1350
Bremen

Gold Bond
ASBESTOS FIBRES

asbestos fibres

For further information, write
National Asbestos Mines Ltd., Thetford Mines, P. Q., Canada. (Subsidiary of National Gypsum Company.)

Asbestos Magazine, 1968, August 1968
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PRODUCTION

Canada—MARCH 1968 asbestos production amounted to 121,173 short tons (Quebec—114,034; Newfoundland, Ontario and British Columbia—7,139). This compares with the March 1967 total of 120,190. (Dominion Bureau of Statistics, Ottawa)

Canada—APRIL 1968 asbestos production amounted to 123,734 short tons (Quebec—115,783; Newfoundland, Ontario and Brtish Columbia—7,951). This compares with the April 1967 total of 97,140. (Dominion Bureau of Statistics, Ottawa)

Statistical Summary of the Mineral Industry, 1961-1966 has been prepared by the Mineral Resources Division of the Institute of Geological Sciences, London, England, and is available at a cost of £1 7s 6d per copy. This publication contains over 400 pages of statistical tables and includes a chapter on *"Asbestos"* which covers data on production, imports and exports by country and product.

1968 Mining Annual Review is now available from The Mining Journal Limited, 15 Wilson Street, Moorgate, London E.C. 2, England, at £1.15.0 ($4.25 in U.S. currency) per copy. This publication is an authoritative record of the continuing development of the mining industry throughout the world by process, product and country. A brief chapter is included on the production, market, usage and outlook for the Asbestos Industry.

Cable Address "Fraruggles" Telephone (201) 379-2186

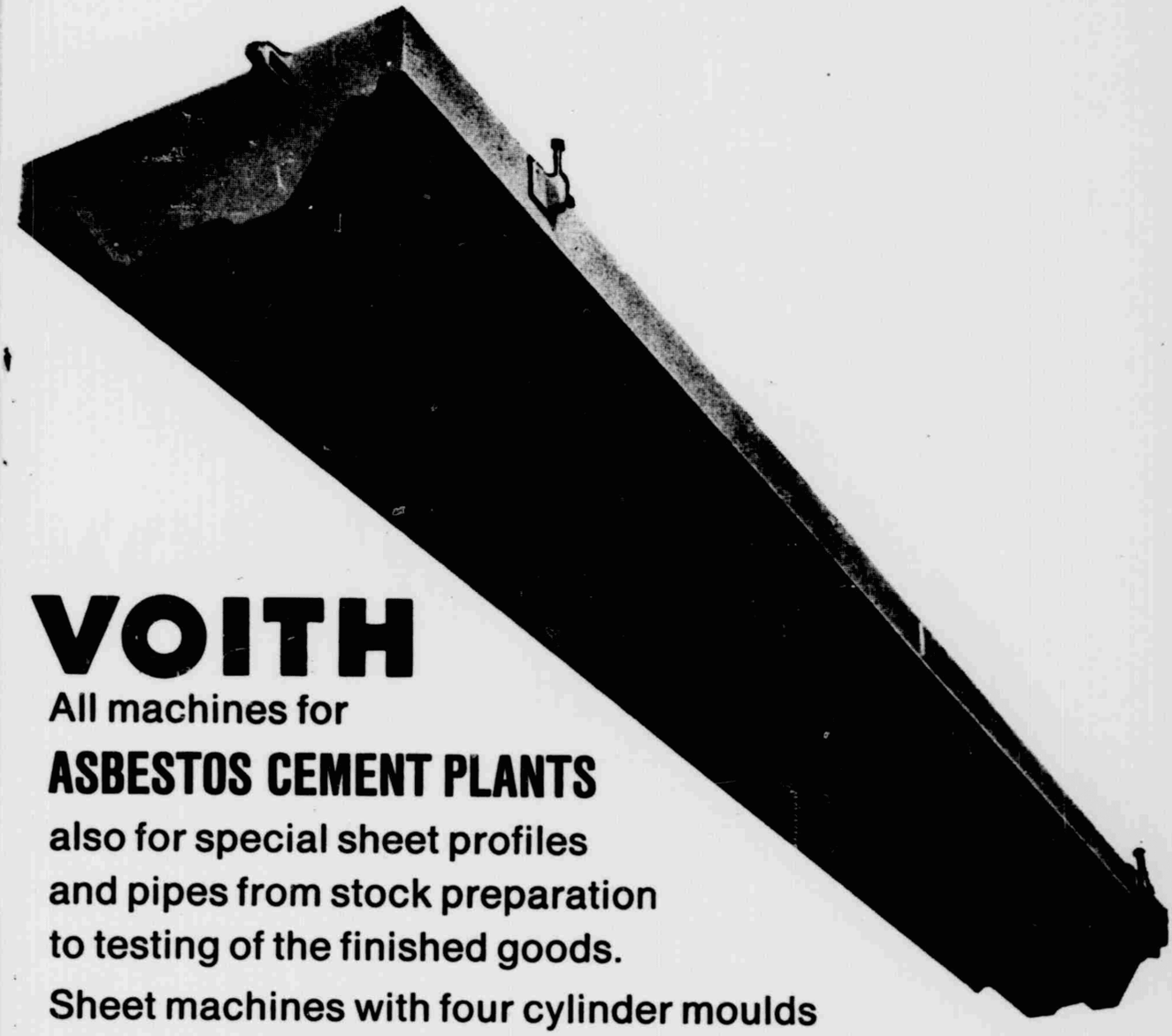
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ASBESTOS WASTE

Frank G. Ruggles Co., Inc.

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Sheet machines with four cylinder moulds and adjacent fully automatic sheet production lines and pre-curing means.

Pipe machines with one or two cylinder moulds for pressure and non-pressure pipes of nom. widths 50 to 1600 mm and maximum pipe lengths of 6 m.

All pipe finishing and testing machines.

Complete electrical installations for semi-automatic or fully automatic operation.

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IMPORTS & EXPORTS

Exports From U.S.A.

(Figures from U.S. Bureau of the Census)

Unmanufactured Asbestos:		APRIL 1968	
Crude & Spinning Fibers	s. tons	..	$ ..
Non-Spinning Fibers	s. tons	929	134,611
Waste & Refuse	s. tons	979	91,028
		1,908	$ 225,639
Manufactured Asbestos Goods:			
A-C Shingles & Clapboard	Lb	1,780,738	$ 170,337
Other A-C Articles	Lb	1,119,068	131,086
Gaskets & Packing	Lb	519,015	540,168
Textiles & Yarns	Lb	292,554	107,414
Mfrs. Other than Friction Materials		..	352,960
Clutch Facings & Linings for auto. use	No	202,601	154,527
Clutch Facings & Linings, Other	No	190,160	70,548
Brake Linings for automative use	Lb	565,570	379,864
Brake Linings, Other	Lb	257,132	182,646
			$ 2,089,550

Swaziland exported R350,818 worth of asbestos to Britain during March 1968.

Minerals Yearbook, 1966—The following sections of Volume I-II of the U.S. Bureau of Mines' Minerals Yearbook, 1966, are available: "Nonmetals," "Review of the Mineral Industries" and "Technologic Trends in the Mineral Industries (Metals and Nonmetals Except Fuels)."

Value of Shipments by Classes of Products, a publication based on the 1966 Survey of Manufactures, has been issued by the U.S. Bureau of the Census. According to this report, the value of shipments for various *asbestos products* is as follows: friction materials—$146,490,000, shingles and clapboard—$27,549,000, vinyl asbestos floor tile—$157,343,000 and textiles and other —$201,519,000.

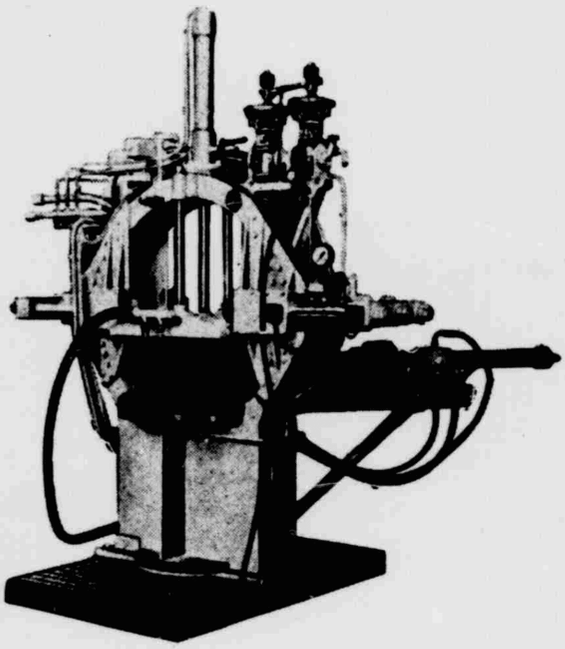
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INDUSTRY NEWS

HAPPY BIRTHDAY

Richard B. Hazard, Vice President, Rubber & Packing Sales, Raybestos-Manhattan, Inc., Passaic, New Jersey, August 17.

Mrs. Joan Holtze, Assistant Secretary & Assistant Treasurer, North American Asbestos Corporation, Chicago, Illinois, August 18.

Albert H. Fay, Vice President-Marketing, National Gypsum Company, Buffalo, New York, August 19.

R. G. Soothill, President & Director, Turner & Newall Limited, London, England, August 19.

Harry Christianson, Vice President & General Manager, Raybestos-Manhattan, Inc., Bridgeport, Connecticut, August 23.

George Robinson, Secretary, Johnson's Company Limited, Thetford Mines, Canada, August 30.

Allan E. Daly, Vice President-Automotive Sales, Scandura, Inc., Charlotte, North Carolina, August 31.

Richard W. Hunt, Vice President, Asbestos Distributors, Inc., Port Chester, New York, August 31.

Adam M. Wyant, Secretary, National Gypsum Company, Buffalo, New York, September 1.

J. P. McCormick, Director, Turners Asbestos Cement Company Limited, Trafford Park, Manchester, England, September 2.

William C. O'Brien, Director of Marketing, Building and Industrial Products Division, GAF Corporation, New York City, September 2.

John B. Swaney, Controller, Asbestos Corporation of America, Garwood, New Jersey, September 4.

R. L. Lanz, General Manager, Extruded Materials Department, Pipe Division, Certain-teed Products Corporation, Ambler, Pennsylvania, September 5.

Frederick K. Sweeney, Vice President, Building & Industrial Products Division, GAF Corporation, New York City, September 5.

Geo. W. Wunder, Director, Hedman Mines Limited, New York City, September 6.

J. L. (Jerry) Mitchell, Textile Consultant, Charlotte, North Carolina, September 7.

F. P. Hodgson, General Superintendent, Clinton Mine, Cassiar Asbestos Corporation Limited, Yukon Territory, Canada, September 8.

F. M. Connell, Chairman of the Board, Cassiar Asbestos Corporation Limited, Toronto, Canada, September 9.

R. W. Little, Plant Manager, British Canadian Mine, Asbestos Corporation Limited, Thetford Mines, Canada, September 10.

W. Harold Connell, Director, Cassiar Asbestos Corporation Limited, Toronto, Canada, September 12.

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W. B. Coetzer, Chairman, Msauli Asbes Beperk, Johannesburg, South Africa, September 13.
James Newton Caws, F.C.A., Director & Secretary, Beldam Asbestos Company Limited, Hounslow, England, September 13.
Robert W. Winson, Manager, Reeves Mine, Canadian Johns-Manville Company Limited, Ontario, Canada, September 13.

To all these gentlemen we extend congratulations and best wishes on the occasion of their birthdays.

Hyderabad Asbestos Cement Products Limited will export R720,000 worth of asbestos-cement sheets to Czechoslovakia through the State Small-Scale Industrial Development Corporation.

L. H. Bell & Associates, Phoenix, Arizona, have prepared a *"Feasibility Study of an Industrial Park on the San Carlos Apache Indian Reservation, Arizona,"* for the Economic Development Administration, U.S. Department of Commerce. This report offers a very complete and comprehensive feasibility study of an *"Asbestos Processing Plant"* and covers the history of Chrysotile Asbestos in Arizona, milling, classification, grading, the market, competition, production methods, operational requirements, ore specifications and values, prices and a conclusion.

Structural Design Concepts has been issued by the Office of Technology Utilization, *National Aeronautics and Space Administration.* Concepts used to design spacecraft which also can help designers and builders of industrial marine and urban structures are explained in this 174-page report. It explains numerous novel configurations, expandable structures, and other developments in aerospace work that are adaptable to meeting other requirements. It describes and compares the potentialities of many different composite materials. A final chapter explains design synthesis and optimization and the use of a computer in designing a structure. (NASA SP-5039; 70c)

GUMMI ASBEST KUNSTSTOFFE

is the asbestos periodical in Europe which covers editorially in each issue the production, processing and application of asbestos. Therefore, it is read by all firms connected with the importing and processing of asbestos in 60 countries and is used for advertising by the asbestos mines all over the world.

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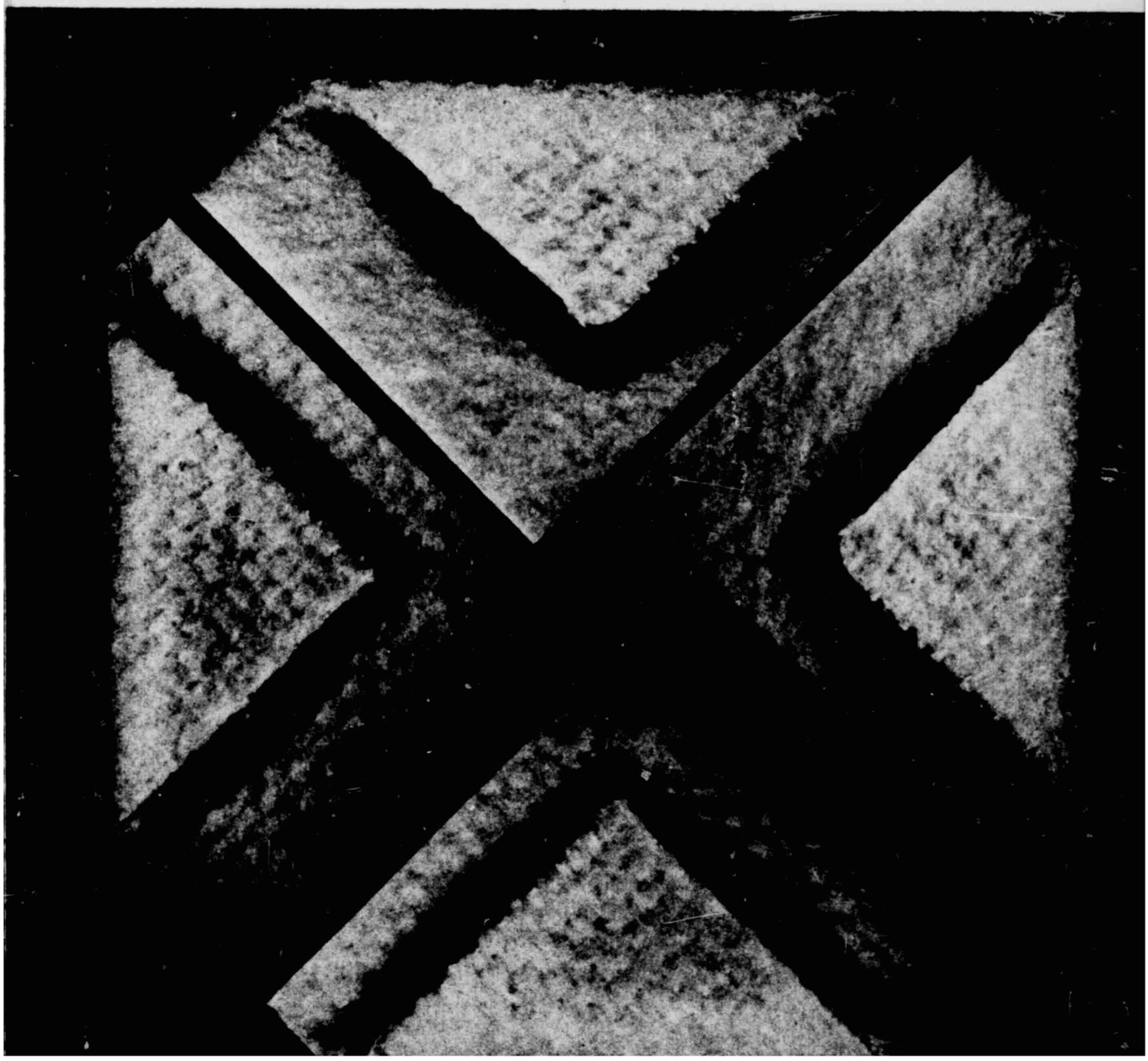
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PERSONNEL NEWS

THE FLINTKOTE COMPANY

W. ROBERT INGRAM—Director of Public Relations and Advertising, WILLIAM E. HAINES—Vice President—Finance, DONALD E. TRIMBLE—Treasurer assuming part of the duties of R. McLEAN CAMPBELL.

GAF CORPORATION

R. POWER FRASER—Vice President (will be responsible for the Industrial Products Division), ERWIN C. GUTZWILLER—Corporate Director of Industrial Engineering, THOMAS WALLACE—District Sales Manager for the Building Products Division succeeding KARL E. MILLER who has retired.

JOHNS-MANVILLE CORPORATION

ROSS E. SAMPSON—Production Engineer for the Asbestos Fibre Division, JAMES M. FLETCHER—Manager of the Advocate Mine at Baie Verte, Newfoundland, M. WARD BURLESON—General Manager of the Industrial Insulations Division (is also a Vice President of J-M Sales Corporation), ERNEST H. PRONSKE—Product Manager Water Pipe.

NATIONAL GYPSUM COMPANY

JOHN P. HAYES—Vice President—Merchandising Operations of the Gold Bond Building Products Division, LEWIS B. CROWELL—Vice President—Manufacturing of the Gold Bond Building Products Division, EUGENE W. ODENWALDT—Senior Vice President—Manufacturing, JOHN B. PROCTOR—Director of Manufacturing—Gypsum, JOSEPH E. DesMARAIS—Director of Corporate Analysis, EDWARD J. KILLIAN—Assistant to the Chairman, JAMES E. LAFFERTY, JR.—Corporate Coordinator of Purchasing.

RAYBESTOS-MANHATTAN, INC.

HERMAN F. ANSPACH—Manager of Engineering Services for the U.S. Asbestos Division, JOHN MacMURRAY—retired as Sales Manager for the Grey-Rock Division, DAVID E. GOW—Sales Manager of the Grey-Rock Division, C. W. SACHS—Assistant Sales Manager of the Grey-Rock Division, THOMAS F. MEISEL—Product Manager for the Grey-Rock Division, BLAINE E. LOWRY—Technical Sales Supervisor of

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ASBESTOS STOCK QUOTATIONS

Close—July 30, 1968

Abex	33	G-Alden (pfd 3)	109½
Advocate	*$3.35	G-Alden (pfd 2.25)	55
Asarco	79¾	Grace	40⅛
Armstrong Cork	77	Gulf & Western	42½
Asbestos Corporation	*$22.75	G&W (pfd 1.75)	132¼
Bendix	37⅞	G&W (pfd 3.50)	165½
Bendix (pfd 3)	68⅝	G&W (pfd 3.87)	75½
Cassiar	*$17.00	G&W (pfd 5.75)	75¼
Certain-teed	25⅞	Johns-Manville	64
Fiberboard	53	National Gypsum	55⅞
Flintkote	29	Patino	*$30.25
F-kote (pfd-A 4.50)	85½	Porter (pfd 5.50)	84½
GAF Corporation	22½	Raybestos	55
GAF (pfd 1.20)	30⅞	Unarco	12⅜
Garlock	22½	Union Carbide	40¾
Glen-Alden	15¾	Uniroyal	58½
G-Alden (pfd 3.15)	121	Uniroyal (pfd 8)	128½

*Canadian currency

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ASBESTOS PRICES

ARIZONA— Per Ton of 2,000 lbs., f.o.b. Globe, Arizona

(As of August 1, 1968) U. S. Dollars

No. 1 Crude	$ ..	$1,410.00
No. 2 Crude	700.00 to	900.00
AAA	..	800.00
Group No. 3 (non-ferrous filtering-plastic)	425.00 to	700.00
Group No. 4 (non-ferrous filtering-plastic)	400.00 to	500.00
Group No. 5 (non-ferrous filtering-plastic)	385.00 to	425.00
Group No. 6 (non-ferrous plastic)	..	250.00
Group No. 7 (white shorts)	65.00 to	90.00

CANADA— Per Ton of 2,000 lbs. f.o.b. Mine

(As of April 1, 1968) Canadian Currency

Crude No. 1	$ ..	$1,410.00
Crude No. 2	..	760.00
Group No. 3 (spinning fiber)	367.00 to	600.00
Group No. 4 (shingle fiber)	201.00 to	341.00
Group No. 5 (paper fiber)	143.00 to	169.00
Group No. 6 (waste, stucco or plaster)	.. to	104.00
Group No. 7 (refuse or shorts)	45.00 to	87.00

CASSIAR— Per Ton of 2,000 lbs., f.o.b. North Vancouver, B.C.

(As of January 1, 1968) Canadian Currency

AAA grade (non-ferrous spinning fiber)	$ 810.00
AA grade (non-ferrous spinning fiber)	643.00
A grade (non-ferrous spinning—Canadian Group 3)	484.00
AC grade (asbestos-cement—Canadian Group 4)	345.00
AK grade (shingle fiber—Canadian Group 4)	241.00
CP grade (shingle fiber—Canadian Group 4)	220.00
AS grade (shingle fiber—Canadian Group 4)	200.00
CT grade (shingle fiber—Canadian Group 4)	195.00
AX grade (shingle fiber—Canadian Group 5)	177.00
CY grade (shingle fiber—Canadian Group 5)	126.00
AY grade (shingle fiber—Canadian Group 5)	126.00

VERMONT— Per Ton of 2,000 lbs., f.o.b. Morrisville, Vermont

(As of August 1, 1968) U. S. Dollars

Group No. 3 (spinning & filtering)	$ 319.00 to	$ 342.00
Group No. 4 (shingle fiber)	186.00 to	296.00
Group No 5 (paper fiber)	132.00 to	156.00
Group No. 6 (waste, stucco or plaster)	..	96.00
Group No. 7 (shorts & floats)	41.50 to	80.00
Group No. 8 (shorts)	..	26.50

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BUILT ON A ROCK

Crude Asbestos is the rock on which our business is built. In the Scandura Factories at Cleckheaton and West Auckland it is used to manufacture everything for which asbestos is best, from yarns and cloths to all types of jointings and packings. Our Research Laboratories keep us at the head of development; Asbestos is *our* subject.

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ASBESTOS PATENTS

Mineral Exploration, Mining, and Processing Patents, 1967, by Oliver S. North, is now obtainable through ASBESTOS magazine, at $25.00 per copy. This fully-indexed volume is of immediate and permanent reference value and covers abstracts of United States, Canadian and British patents issued during 1967 on exploration for and mining of metallic and nonmetallic minerals (excluding solid fuels and petroleum), beneficiation and concentration of metallic and nonmetallic minerals, extraction of metals from ores and refining of metals extracted from ores. The book also includes carefully selected patents issued in Germany, France, Japan and the U.S.S.R.

U.S. Documents—The following reports are available at $3.00 per paper copy and 65c per microfiche from the Clearinghouse, U.S. Department of Commerce, Springfield, Virginia 22151:

AD-488 387—Fibers for High Performance Composites: A Literature Survey, by C. M. Bower, et al;

AD-488 389—The Rheology of Fibrous Materials in Low Viscosity Media: A Literature Survey, by C. W. Bower, et al;

AD-664 781—Survey of Tracing and Sensing Systems for the Detailed Study of Fibrous Materials Under Tensile-Impact Loading, by B. Rosen, et al;

AD-664 567—Science of Aviation Material, by A. E. Leykin, et al;

AD-667 527—Current Developments in Fiber-Reinforced Composites, by J. A. Snide, et al;

AD-667 713—Manufacture of the NRL Filter Unit, Model A, by B. R. Sandoval, et al;

N67-36014—Colloidal Asbestos Fibrils as Reinforcements for Polymeric Structures, by C. A. Rader, et al;

N67-38580—Thermal Insulation Systems: A Survey, by P. E. Glaser, et al;

N68-12874—Procedures and Requirements for the Evaluation of Spacecraft Nonmetallic Materials, by A. F. Ringwood;

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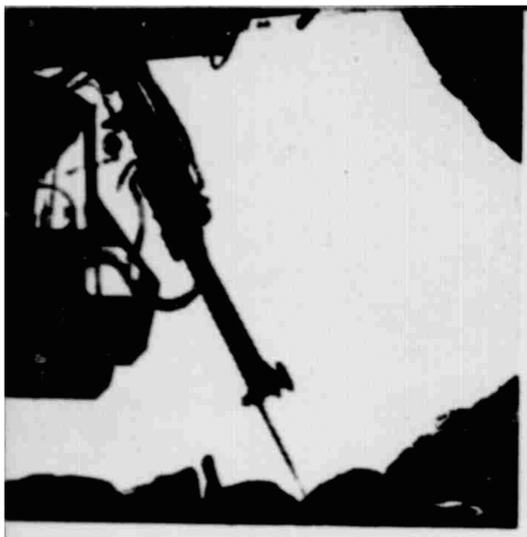
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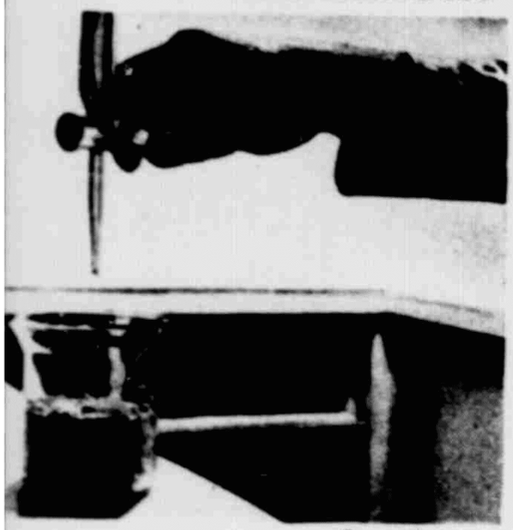
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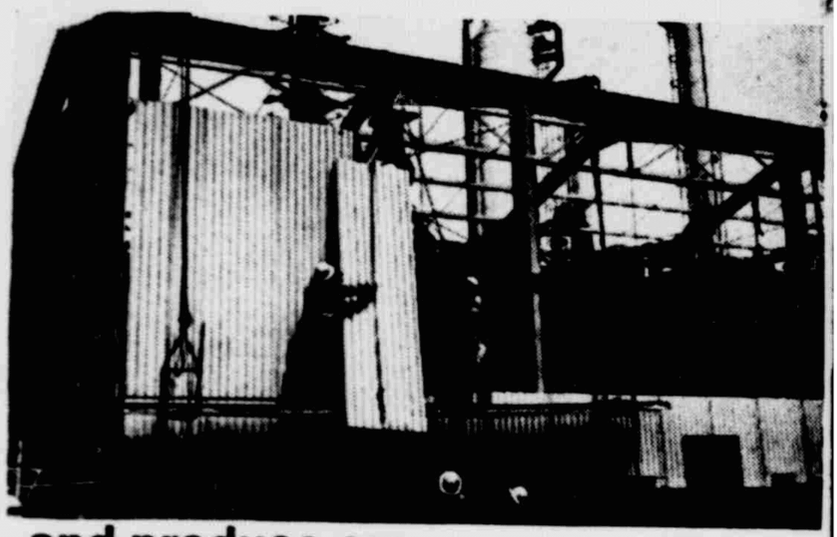
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