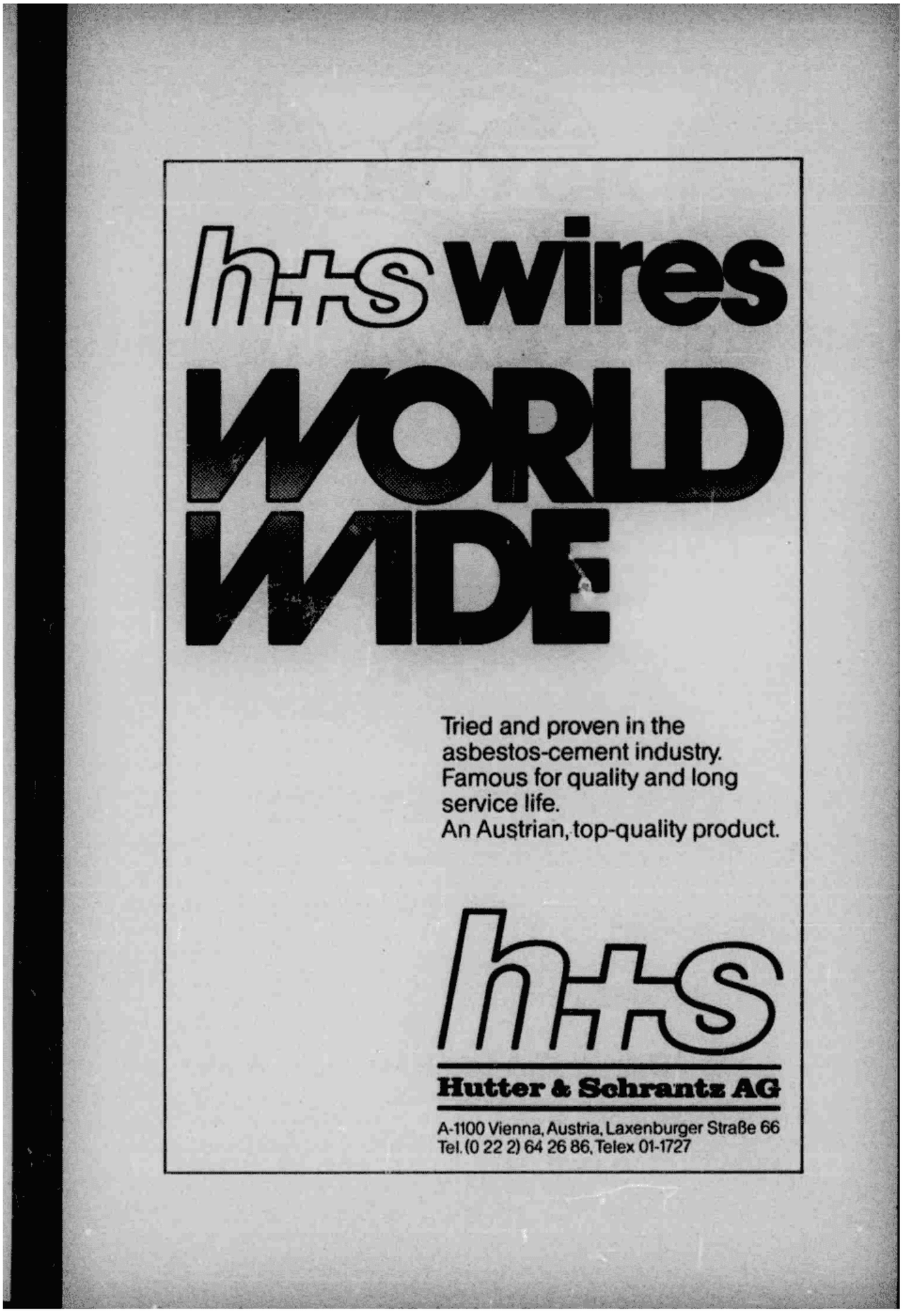


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ASBESTOS

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THE SEARCH FOR ASBESTOS SUBSTITUTES

BY: A. K. GREEN & A. M. PYE

[The authors of this article are associated with the Fulmer Research Institute Ltd., Stoke Poges, Slough, England, and have recently produced a booklet entitled "Asbestos, Characteristics, Applications and Alternatives" which includes an examination of the substitute materials commercially available for the major applications of asbestos and asbestos products. The Fulmer Research Institute is a non-profit research organization specializing in materials technology.]

SUMMARY

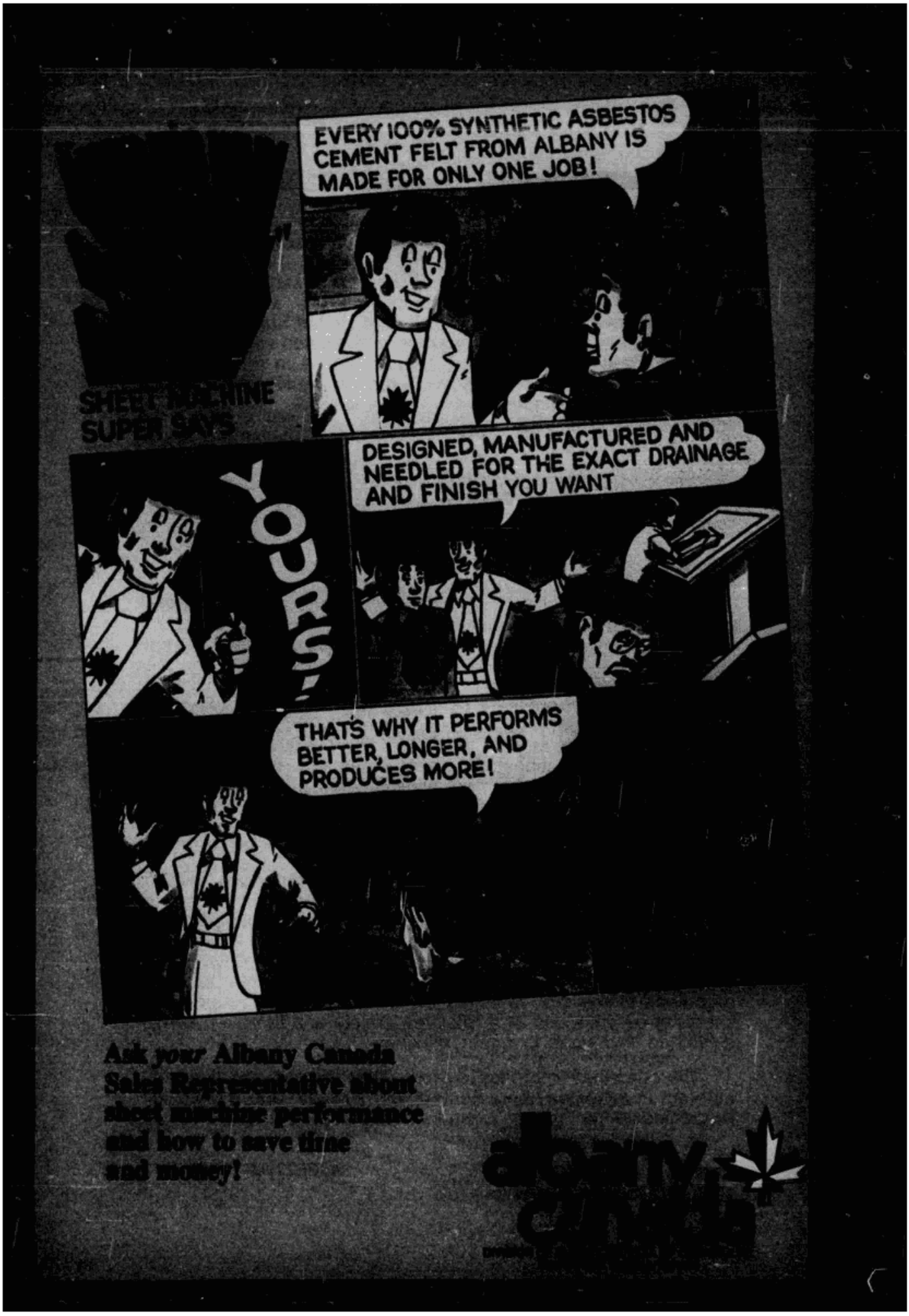
This article examines in some depth the materials available as alternatives to asbestos for two of its major applications—asbestos-cement and friction materials. Asbestos is used in a wide range of applications and the most successful approach to its replacement is to examine each application individually. It is noted that it is not always possible to replace asbestos on technical grounds and where replacement is possible, cost-penalties are frequently involved.

INTRODUCTION

Asbestos is a material which makes a great contribution to human safety through a number of its applications but it can also constitute a health hazard to those who are exposed to its fine, airborne fibers. In several countries around the world great concern at present exists over the use of asbestos products and attempts are underway to minimize the risks of asbestos exposure by examining the safety precautions taken when carrying out potentially dangerous dust-producing operations with asbestos products (machining, delagging, demolition, etc.) and also by exploring the possible use of suitable alternative materials.

A considerable volume of research has been directed in recent years to finding substitutes for asbestos, the major effort being concentrated in areas that use large quantities of the

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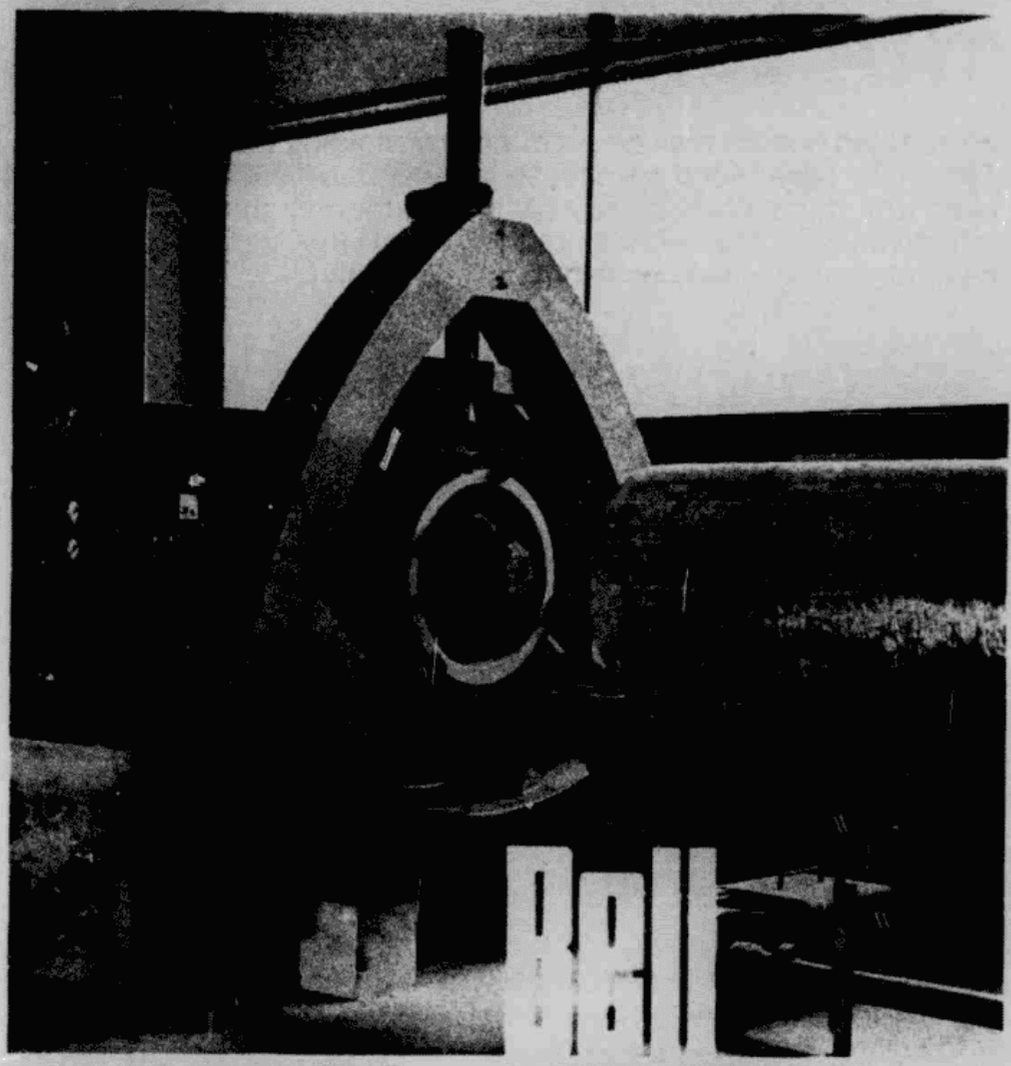
material and in those applications for which asbestos has technical advantages in addition to its low cost. Two prominent examples which will be discussed here are asbestos-cement products and asbestos-based friction materials, which respectively accounted for 38% and 9% of total United States asbestos consumption in 1974. The properties of asbestos which make it useful in these applications will be considered in the following sections and will be compared with the properties of materials which have been suggested as substitutes.

ASBESTOS-CEMENT PRODUCTS

The primary function of the asbestos in asbestos-cement products is to act as a reinforcing fiber. The properties that make it useful in this role are high fiber strength and modulus and a large aspect ratio (ratio of length to diameter). This latter parameter is one of the factors that determines the reinforcement efficiency of fibers in composite systems. The asbestos fibers produce useful tensile and flexural properties in the asbestos cement, enabling it to be used for such purposes as roofing sheets and pressure pipes. In this latter application the high tensile strength of the asbestos fibers is particularly important. For this reason most of the Crocidolite (Blue) asbestos consumed is used in asbestos-cement pipes due to its superior strength, compared to the more widely used Chrysotile asbestos with which it is combined in this application. In 1974, for example, more than 90% of the Crocidolite used in the United States went into piping applications.

The initial stages of asbestos-cement manufacture involve the mixing of water, cement and fibers into a slurry. The fibers mix readily into this slurry. This affinity for water is thought to be a consequence of the porous nature of the fibers and it has been suggested that the individual asbestos fibrils are hollow. Additionally the fibers contribute favorable and controllable drainage properties to the mix, enabling the asbestos-cement pipes and sheets to be produced by a relatively simple and flexible process similar to that used in paper making.

The combination of usefully long fiber lengths and flexibility inherent in asbestos fibers confers wet strength and moldability properties on the "green" boards. Thus complex shapes such as



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corrugated boards may be produced by molding the wet material. The main attractions of asbestos-cement products to the end user are durability, resistance to weathering attack and cost effectiveness. The noncombustibility of the products is significant, but is often of secondary importance.

SUBSTITUTES FOR A-C PRODUCTS

Various currently available materials are used as substitutes for asbestos cement in many of its diverse applications. Cladding panels are frequently manufactured from Glass-Reinforced Plastic (GRP) or various thermoplastics although these materials do not possess the fire resistance of asbestos cement and their combustion can lead to the evolution of toxic fumes. Metals, notably aluminum, are also widely used in this application. GRP or GRP-wound concrete pipes are often suitable for use in corrosive environments and the traditional cast iron sewage pipe performs satisfactorily. Most of these materials are more expensive than asbestos-cement products, although certain thermoplastics may be cost-competitive in specific applications.

In general, however, none of these materials can be fairly considered to be a universal replacement for asbestos cement and the most promising route to achieve this objective at present is the development of glass-reinforced cement technology. Conventional E-glass fiber (which is commonly used in glass-reinforced plastics) cannot be used in conjunction with cement since the severely alkaline conditions produced during the setting of conventional Portland cement degrade the fibers and the resultant composite material rapidly loses its favorable mechanical properties. However, within the last ten years a high-zirconia, alkali-resistant glass fiber has been developed at the Building Research Establishment, Garston, England. This fiber is marketed by Pilkington Brothers Ltd., of St. Helens, England, under the name "Cem-FIL" for cement reinforcement purposes. Glass-reinforced cement usually contains between 3% and 7% of fibers, and typically one would expect a material containing 5% of fibers to have a modulus of rupture similar to that which would be expected from asbestos cement containing 15% of fibers (about 35 MN/m^2). Additionally, the glass-reinforced cement is considerably more impact resistant than asbestos

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cement of comparable strength. The "green" boards have wet strength and can be molded, and large bore pressure pipes can be produced. The final products perform adequately in preventing fire penetration. However, several drawbacks exist in the use of this material.

1) The fiber is approximately four times as expensive as the asbestos used in cement-based products and this, coupled with the less favorable economics of the production process results in a price for glass-reinforced cement some 70% greater than asbestos cement even allowing for the smaller fiber content.

2) The drainage characteristics of a cement-water-glass fiber mix are poor and do not permit the manufacturing process for asbestos cement to be used in an unmodified form. Glass-reinforced cement is usually made by a process referred to as "spray suction." In this process, a special spray head sprays a mixture of chopped glass fiber bundles a few centimeters long with a fine cement slurry onto a porous bed. When spraying is complete, a vacuum is applied to the underside of the bed to remove excess water. A similar procedure is used to make pipes, the spray head being directed onto the inside of a rotating tubular form with the excess water being similarly removed. Consequently, the manufacture of glass-reinforced cement is relatively costly and requires a high capital investment.

However, the manufacturers of glass-reinforced cement are expending considerable effort on attempts to make the material on minimally-modified asbestos cement plants. The impetus for this effort was the result of Japanese legislation about two years ago whereby asbestos was placed in the "dangerous chemical" category of materials. Consequently, severe restrictions apply to any product sold in Japan containing more than 5% asbestos, which includes standard asbestos-cement products. It was found that the standard asbestos cement plant could produce a good quality board from a cement slurry containing both glass and asbestos fibers in suitable proportions, so as to keep the asbestos content below 5%, thus producing glass-reinforced asbestos cement (known as "GRAC"). The research effort is presently concentrated on eliminating the asbestos content completely and this has been achieved by suitable plant modifications. It is likely that this equipment will shortly become available in the United Kingdom, eliminating one of the principal drawbacks to the use of glass-reinforced cement.

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3) Some attack of the glass fiber by the setting cement is necessary to achieve good fiber bonding and this requirement has raised doubts concerning the long-term durability of glass-reinforced cement. The product is too new for really long-term data to be available but manufacturers' findings for a seven-year period indicate that the strength of glass-reinforced cement when wet stored (the worst situation) drops to half its initial value in approximately two years, and then stays constant. An additional safety factor of 3 is recommended, i.e. the quality control initial strength should be at least six times the design working stress. Most existing uses of glass-reinforced cement have been restricted to non-load-bearing components (e.g. cladding) but the more demanding structural applications are gradually being attempted as knowledge of, and confidence in, the material grows. It is likely that the uses for glass-reinforced cement will increase since it allows interesting concepts that are impractical with asbestos cement. A good example is the use of continuous glass fiber roving to filament wind large diameter pipes that are much lighter, due to the thinner wall required, than a steel-reinforced concrete pressure pipe of comparable strength and price.

FRICTION MATERIALS

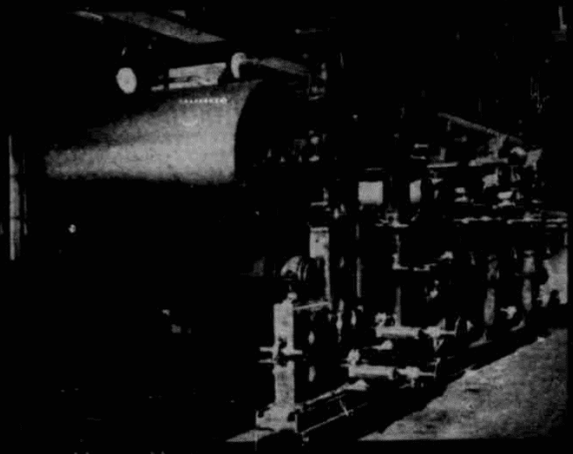
Asbestos-based brake and clutch linings are in widespread use, particularly, but not exclusively, in the automotive field. The asbestos performs a complex function in these applications which is not completely understood. Chrysotile asbestos is used exclusively and stiffens and strengthens the filled phenolic resin matrix. The fibers maintain these properties at the high temperatures generated during, for example, braking and clutch slipping. The friction and wear characteristics of the asbestos fibers and their thermal decomposition product, forsterite, are thought to be responsible for the good braking efficiency and service life properties of these materials. Forsterite is a non-fibrous silicate and is not thought to constitute a health hazard. Investigations have established that the dust produced from the wear of asbestos friction materials does, in fact, contain only 1% to 2% of asbestos fibers. Repeated exposure to this dust is a potential hazard for personnel such as garage mechanics. While this wear debris is not thought to constitute a significant health hazard for the general public, much effort has been concentrated in searching for substitutes for asbestos in this application.

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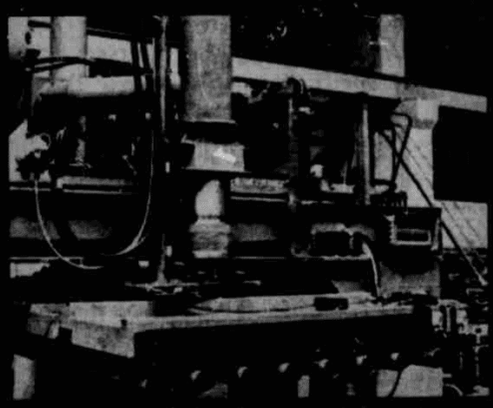
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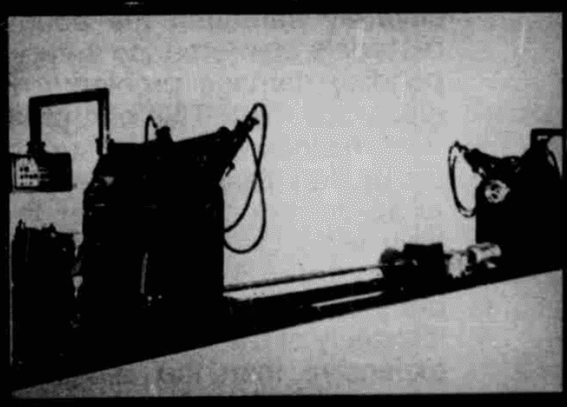
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Various substitute materials have been investigated but they all have drawbacks. Sintered metals, ceramics and metallized bonded products have been available for many years. However, the high thermal conductivity of these materials creates a risk of boiling brake fluid which can cause erratic performance. Carbon fiber/carbon composite brakes have been used successfully on racing cars and aircraft such as the "Concorde." They perform better than asbestos materials under the high service temperatures in these applications but are so expensive that their use can only be justified in specialized circumstances. A considerable volume of work is currently underway on using the existing asbestos-based manufacturing technology and incorporating either steel or glass fibers into the mix to replace the asbestos.

Vehicle trials are underway in the United States with these products and it is estimated that asbestos substitutes are available for about 30% of the friction products market, the exception being in the heavier-duty applications such as disc brake pads where high temperature surface conditions are encountered.

Steel fibers were first used in friction materials in Germany, prior to and during World War II, due to difficulties in obtaining asbestos fiber. It was found the brakes worked well with little loss of efficiency when wet, but the wear debris was abrasive and severely damaged the counterface. Glass fiber-based friction materials also produce a very abrasive wear debris, with corresponding damage problems. Further, at high temperatures the glass can melt. This can produce a sudden, undesirable loss of friction since the sliding surfaces can be effectively lubricated by the molten glass. Both steel and glass fiber-based materials tend to be considerably noisier in vehicle braking applications than their asbestos counterparts. Both glass and steel fibers can be incorporated into friction materials using standard processing, but steel fibers have been found easier to handle. The steel fiber is usually of the fine steel wool type and is about four times more expensive than the asbestos used in friction materials. Conventional E-glass fiber is approximately half the price of the steel wool. Non-asbestos-based materials use proportions of fiber comparable to the conventional product and are hence more expensive.

Thus, although asbestos-based friction materials are technically and economically preferable at present for the majority of applications, it seems probable that these may eventually be replaced by the non-asbestos-based materials as a result of concern over the health hazards involved with asbestos.

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ASBESTOS R & D

The Ontario Research Foundation has provided services to the asbestos industry on a fee or contract basis for the past 12 years. These services include:

- testing and evaluation of asbestos fibers at any stage of milling or processing;
- research and development on asbestos products such as asbestos cement, composites, textiles;
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CONCLUSIONS

It is apparent in the two applications which have been considered that one factor common to both is that substitute materials will be more expensive than the asbestos product it is desired to replace. The two case histories, however, highlight notable discrepancies:

1) The health hazards involved in the handling of asbestos-cement products during machining and demolition operations are greater than those associated with the handling of friction materials, where the dangers are confined to manufacture and the cleaning of brake drums and linings.

2) Research has led to the development of technically acceptable substitutes for asbestos-cement products, whilst inferior products are likely to be accepted as substitutes for friction materials.

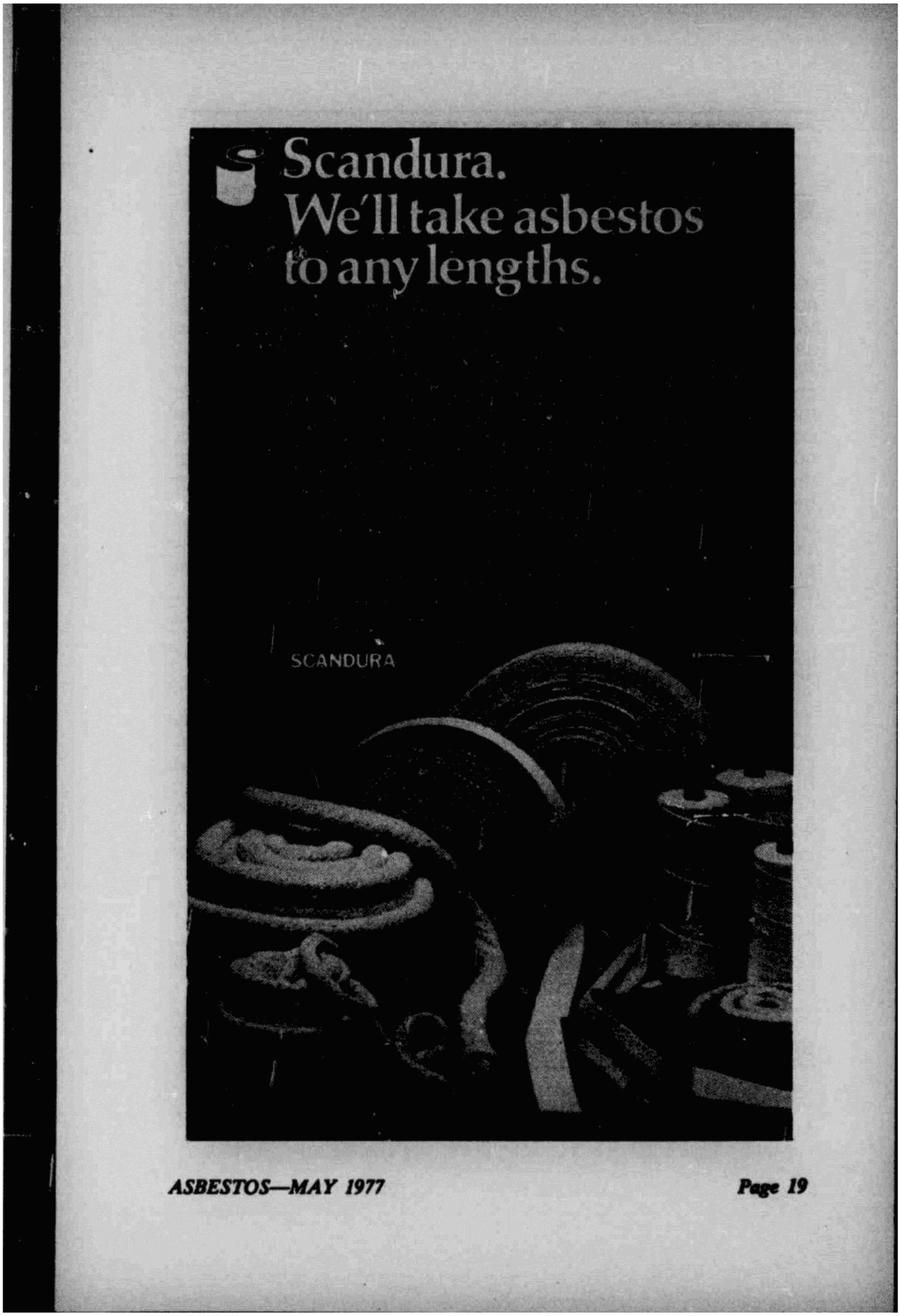
The arguments put forward here therefore mitigate against a total ban upon the use of asbestos products and would suggest that in some cases it would be preferable to ensure the observation of adequate safety precautions during their manufacture and maintenance than to accept inferior products. In addition, the potential health hazards involved with the use of alternative fibrous materials, including glass, should not be overlooked.

COPIES STILL AVAILABLE!

RECOMMENDED WORK PRACTICES—Five manuals published by the Asbestos Information Association/North America include: "Recommended Work Practices for the Fabrication and Use of Asbestos Paper Products," "Shop and Field Fabrication of Asbestos Sheet Products," "Molding and Fabrication of Asbestos Containing Plastic Products," "Fabrication and Use of Asbestos Friction Materials," and "Use and Handling of Asbestos Textile Products." [$1.35 each plus postage; order from AIA/NA or through ASBESTOS Magazine]

NEXT ISSUE—FELTS FOR A/C PRODUCTION

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COMPANIES & PRODUCTS

WALLBOARD PLANT IN VERMONT

The District 6 Environmental Commission has granted a land use permit to *Vermont Industrial Products Inc.* to build a 20,000-square-foot industrial wallboard plant in Morrisville. The $2-million facility will make the product out of tailings from the asbestos mine at Lowell, operated by VIP's parent company, *Vermont Asbestos Group Inc.* Construction is expected to be completed by late summer 1977. . . . It is interesting to note that the worker-owners of VAG purchased 2000 shares in the company just two years ago for $50.00 per share. Each share is now estimated to be worth between $1750 and $3000. Annual dividends of over 100% of the original value of the stock have been issued in the firm's first two years. . . . It has been reported that a group of Vermont investors is being lined up to possibly purchase VAG because of the fear that an out-of-state conglomerate is preparing to gain control through the purchase of the majority of company stock.

TURNER & NEWALL VENTURES

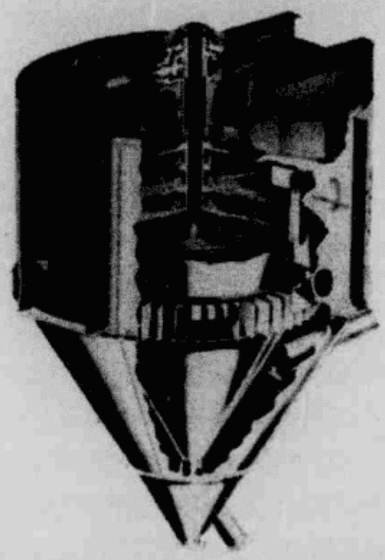
TAC Construction Materials Ltd. is to supply approximately 9000 metric tons of asbestos-cement pipes, joints and associated fittings, valued at over £1.75-million, to the Government of Ras Al-Khaima, one of the United Arab Emirates. The piping will be used to transport water from the mountains on the eastern border and for a new distribution system around the expanding town of Ras Al-Khaima. . . . *Turner Engineering Products (Nigeria) Ltd.* has been formed by T&N for the production of motor vehicle brake linings, disc brake pads and gaskets. The new company will have an office in Lagos and a factory at Ibadan. Turner & Newall has invested £500,000 in the new venture and will hold 60% of the equity. The remaining 40% will be held by Nigerian interests.

PLASTAPAK SEALS IN DUST

Plastapak P.V.C. film is being manufactured and marketed by *Acalor International Ltd.*, Crawley, Sussex, England, as a vinyl

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coating system which prevents the discharge into the atmosphere of asbestos dust. Dust can emanate when asbestos insulation, ceiling boards, mineral cladding or other like materials are damaged due to impact, abrasion or minor repairs. The cocooning and bridging properties of the system ensure a continuous dust and vapor barrier even when applied to rough and broken surfaces, thus preventing fibers or other abrasive particles from flaking and possibly causing a health hazard or product contamination. According to Acalor, Plastapak provides a tough, impervious flexible skin which does not crack or tear when subjected to thermal shock or building movement.

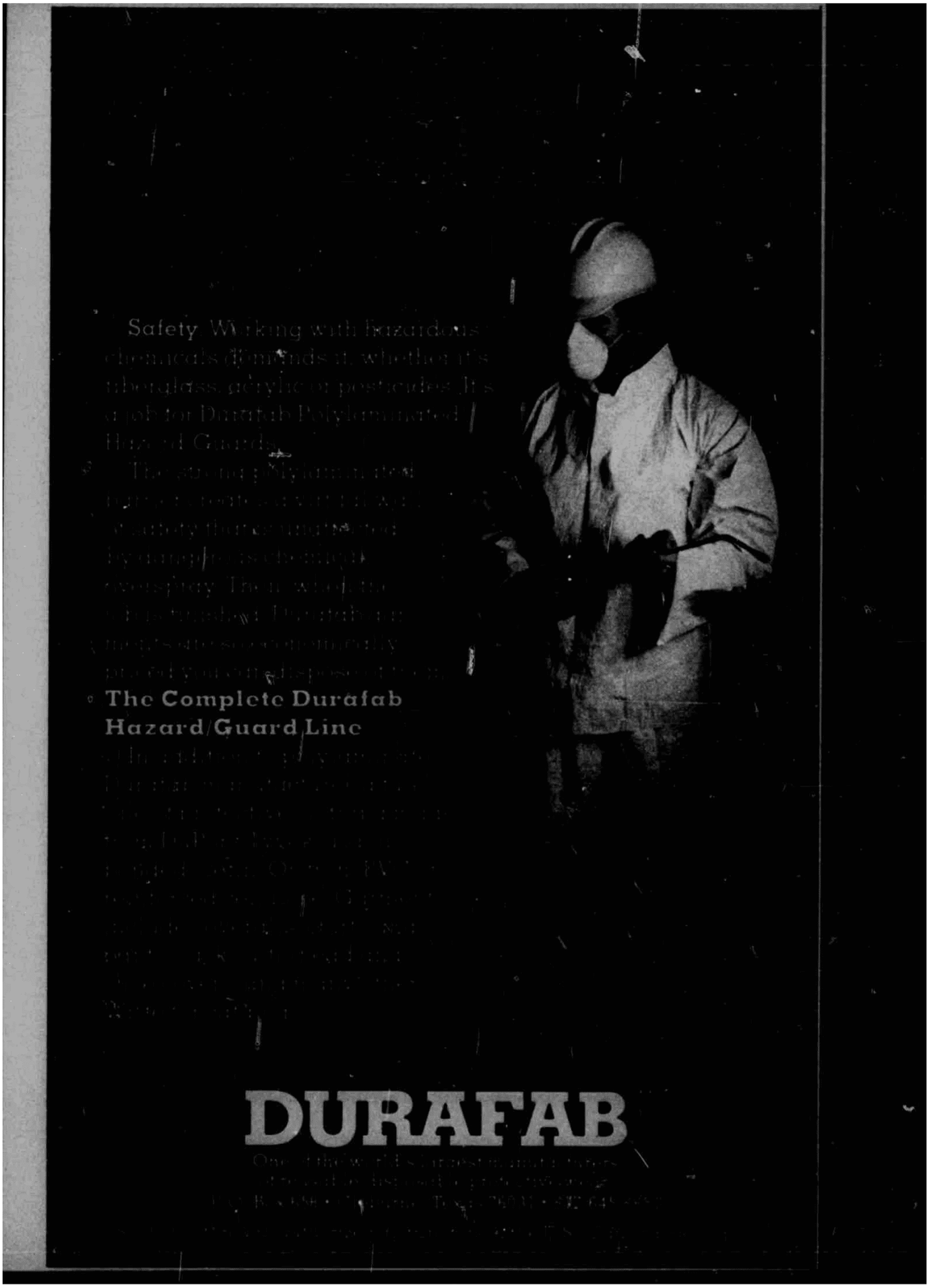
THERMAL INSULATION TESTING

Secretary of Commerce Juanita Kreps has announced preliminary plans for a program which will provide for *accreditation of laboratories* that test a wide range of thermal insulation materials used by industry and the public. The testing is required by thermal insulation standards promulgated by private standards bodies and the Government. The proposal for the program was submitted through the Commerce Department's National Voluntary Laboratory Accreditation Program by three trade associations: Thermal Insulation Manufacturers Association, National Mineral Wool Insulation Association and National Cellulose Insulation Manufacturers Association.

BUSINESS BLURBS

Recent issues of "Middle East Trade Letter" have alerted us to the following new ventures. . . . Bank Rahni Iran is to build a new town west of Tehran, including the construction of 2662 apartments. . . . 7000 apartments are part of the scheme of Lavison Development Company to build a new township in Iran. . . . Al-Rifai Trading Est., Kuwait, has secured a license for the erection of a hotel in Kuwait. . . . An asbestos-cement pipe factory is planned in Tunisia by Societe Tunisienne de Banque, Tunis. . . . Amiantit for Rubber Making Co. Ltd., Damman, in partnership with Ducan Ltd., of India, has been established in Saudi Arabia for the manufacture of rubber products for asbestos-cement pipe.

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The Complete Durafab
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MARKET CONDITIONS

GENERAL BUSINESS

The general business revival continues and seems to be gaining momentum. Government statistics showed a gain of 5.2% in real GNP in the first quarter and new factory orders for durable goods rose 6.8% in March. Both these figures indicate great underlying strength in the economy and are well in excess of predictions. Under the circumstances, and in view of the lukewarm attitude of Congress toward certain parts of the Administration's economic stimulus program, Mr. Carter withdrew his request for a $50 per person tax rebate and also recommended that the business tax incentives be removed from the program.

On April 18 Mr. Carter, in a nationally televised speech, endeavored to convince the public that we have a real energy problem and, on April 20, he presented to Congress and the public his proposals for a comprehensive program designed to cope with the problem. The program is quite complex and detailed discussion or criticism of it, at this point, would be purely academic since Congress will have to determine its final form. Suffice it to say that the main thrust is on conservation, encouraged by a system of tax incentives and penalties which, at first glance, would seem to involve tremendous administrative problems. Surprisingly little stress is placed on ways to increase supplies of energy or to develop alternative sources. Again, however, the Congress will be responsible for enabling legislation which may involve many ideas not even mentioned by Mr. Carter.

Most encouraging is the fact that Mr. Carter has had the courage to "bite the bullet" and that the Congress has indicated it recognizes the need for positive action and will channel its efforts for some months to come into developing an effective and comprehensive energy policy.

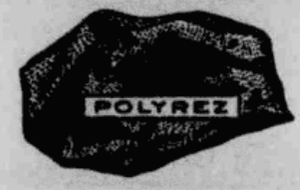
Before addressing the energy situation, Mr. Carter outlined his promised program for dealing with inflation. Unfortunately this turned out to be a "non-program," suggesting nothing which hadn't been proposed many times before and again indicating that our leaders either don't know how to cure inflation or are unwilling to face the political consequences of positive anti-inflationary action. Up to now, no one has come up with any cogent reason as to why we should expect any substantial decrease in the current 6% per annum inflation rate over the next few years.

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HOUSING & CONSTRUCTION

FIRST QUARTER 1977—As reported by the F. W. Dodge Division of McGraw-Hill Information Systems Company, the total value of contracts for new construction during the first three months of 1977 advanced 8% to $24.1-billion (nonresidential building, $7-billion, up 7%; residential building, $11.5-billion, up 38%; and nonbuilding construction, $5.6-billion, down 24%). The seasonally adjusted Dodge Index (1967 = 100) registered 203 in January and 207 in February and March. . . . In commenting on the month of March, G. A. Christie, Dodge Vice President and Chief Economist, said that sharp gains in housing and in commercial and industrial building were the construction industry's main sources of support. He added that "March contracting data confirmed that more is happening in construction markets than just a housing recovery. With the setback of the economy's recovery now behind us, we expect to see further improvement. . . . in the critical area of industrial and commercial building." Mr. Christie further observed that it is possible "we may experience a setback in the previously booming field of electric utility construction. This industry, which has been moving rapidly into nuclear generation, must now reconsider its future in the light of the President's recent energy message."

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THRU THE ENVIRONMENTAL MAZE

JAQUAYS HONORED

Safety Consultant Buck Rogers, of the State Compensation Fund of Arizona, awarded a safety plaque to Jaquays Mining Corporation for its continued good safety program and record during the past insurance period. Along with the award was a dividend check for $8260 presented to D. W. Jaquays, President of the firm and owner of a mining equipment store in Phoenix. Mr. Jaquays was commended for his active participation and strong support of safety activities in the operation of the mill east of Globe and the underground mine 45 miles north of Globe. In making the presentation Mr. Rogers said that "the safety accomplishments achieved in the past as well as the present have reflected very favorably upon all members of the organization and have contributed to holding the line on rapidly climbing insurance rates."

ASBESTOS [illegible] VERMICULITE

The U.S. Occupational Safety and Health Administration has advised its regional administrators and area directors that vermiculite ore contains Chrysotile and Tremolite. Since asbestos fibers may be released during exfoliation processing of vermiculite ore, measurements of possible employee exposure to the fibers should be included in OSHA inspections of vermiculite processing plants, said the Administration.

EPA TOXIC SUBSTANCES PROPOSAL

The U.S. Environmental Protection Agency has proposed rules to implement the required Procedures for Rulemaking under Section 6 of the Toxic Substances Control Act. The basic approach of the proposal is to resolve the questions raised by a given rulemaking in the least procedurally burdensome way. The first step would be an exchange of written comments. When EPA would propose a rule, a detailed explanation of the factors behind the proposal would be given and written comments would be requested. After an examination and digestion of the comments, a legislative hearing would be held before a panel of EPA employees. Finally, an opportunity for cross examination would be provided on unresolved questions of fact material to the rulemaking. In this way, questions would be sifted through suc-

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cessive procedures of increasing formality, with only those questions which could not be resolved by the least burdensome approach being passed on to the more formal stages. Anyone desiring to issue comments on the proposal should do so by July 1, 1977. [Federal Register of 4/21/77; pages 20640-42]

EPA MAY REPAY

In response to petitions from the Environmental Defense Fund, the Consumers Union and the Center for Automotive Safety, EPA is considering a plan to provide financial reimbursement for various interest groups participating in the Agency's rule-making proceedings. EPA said that such participation often provides facts and relevant arguments which would not otherwise have been urged on the Agency.

EPA AWARDS $50-MILLION TO ACADEMIA

EPA awarded $50,166,870 in grants and contracts to 177 colleges and universities throughout the world during fiscal year 1976, an increase of 83% over the previous year. The research funded is expected to help achieve the pollution abatement goals of most EPA programs.

REMARKS BY EPA HEAD

Pollution control spending is creating jobs, and the health effects of pollution are more dangerous than realized, according to the new EPA Administrator, Douglas M. Costle. He said that according to a 1975 report undertaken for EPA and the Council on Environmental Quality, a million people are employed as a result of environmental expenditures. "The unemployment rate in 1977 is estimated to be 0.5% lower than it would be without environmental expenditures required by recent Federal legislation. Available evidence shows that environmental protection laws have had a minimal impact on the gross national product and the consumer price index, and they have not required a disproportionate share of capital spending." Mr. Costle also said it is becoming increasingly clear that the effects of pollution seem to be even more dangerous and widespread than was realized when EPA was created in 1970. "Heart disease and cancer have emerged as the leading causes of death. Increasingly, in indus-

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trialized societies, most of the serious diseases and disabilities are related to our exposure to environmental hazards and to our personal habits."

ATKIN R&D REPORT

A most comprehensive, well-documented report titled "Asbestos—Review of Uses, Health Effects, Measurement and Control," has been written by R. E. N. Bradfield of Atkins Research and Development, a member of the W. S. Atkins Group. Although the report was produced initially as an internal document, Atkins now considers it may be of interest to other individuals or organizations looking for an independent appraisal of the topical but controversial subject of asbestos. Copies are, therefore, available outside the Atkins Group at a cost of £10.00 or US$20.00 per copy. Orders together with remittances should be sent to Mr. Bradfield, Atkins R&D, Woodcote Grove, Ashley Road, Epsom, Surrey KT18 5BW, England.

Essentially the report describes the properties of asbestos fibers and the ways in which they have been exploited within industry and the home. The health effects of occupational exposure to asbestos are discussed and the evidence for, and the risks associated with, non-occupational exposure are reviewed. While current regulations, standards and measurement methods would appear adequate for protection against asbestos, doubts remain over the carcinogenic risks. More epidemiological studies and research, particularly into the relative biological significance of different fiber types and sizes, are needed to evaluate these risks.

Since asbestos-induced diseases are thought to be due to the mechanical/physical (rather than chemical) properties of the fiber, care should be taken when considering asbestos substitutes and other fibrous substances until their long-term health effects are known.

Asbestos is sampled in the workplace by the membrane filter method and the fibers (of length greater than 5 microns and having a length-to-breadth ratio of at least 3:1) are counted under an optical microscope. While this method is probably sufficient for studies relating to asbestosis, it does not provide information on the very fine fibers which may be critical in the development of mesothelioma. Consequently, electron microscopic techniques are recommended for research into mesothelioma and are definitely required when monitoring the nanogram quantities in ambient air.

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To meet clean air standards you not only need a centralized dust collector, you also need a decentralized dust collector.

Clean air standards being what they are, you may not be meeting them even with a central dust collector. And this year, standards are being tightened even further.

So you ought to look at the Nilfisk GA 73 portable industrial vacuum cleaner. It picks up where central systems leave off. And it does that with Nilfisk's exclusive multi-stage filtration system. The oversize main filter resists early dust clogging, and can be shaken and cleaned at all times without exposing the operator.
In addition special Nilfisk exhaust filters can be installed for 99.97% average retention down to 0.3 - 0.5 microns. Heavy gauge air tight container liners insure dust-free disposal of fine dust and chunks of debris. And there are over 50 attachments to choose from.

Yet the GA 73 is light enough for a single person to operate.

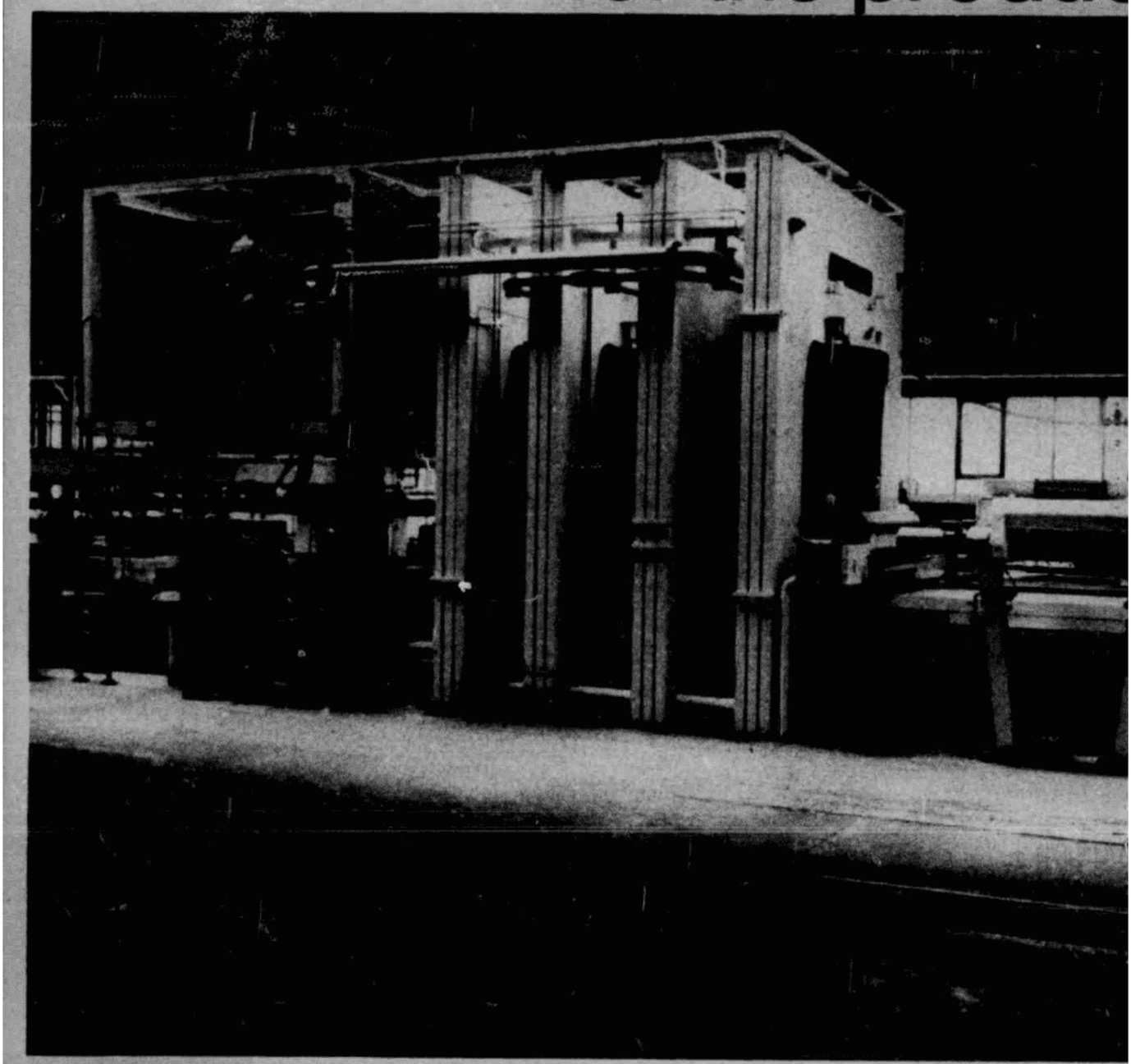
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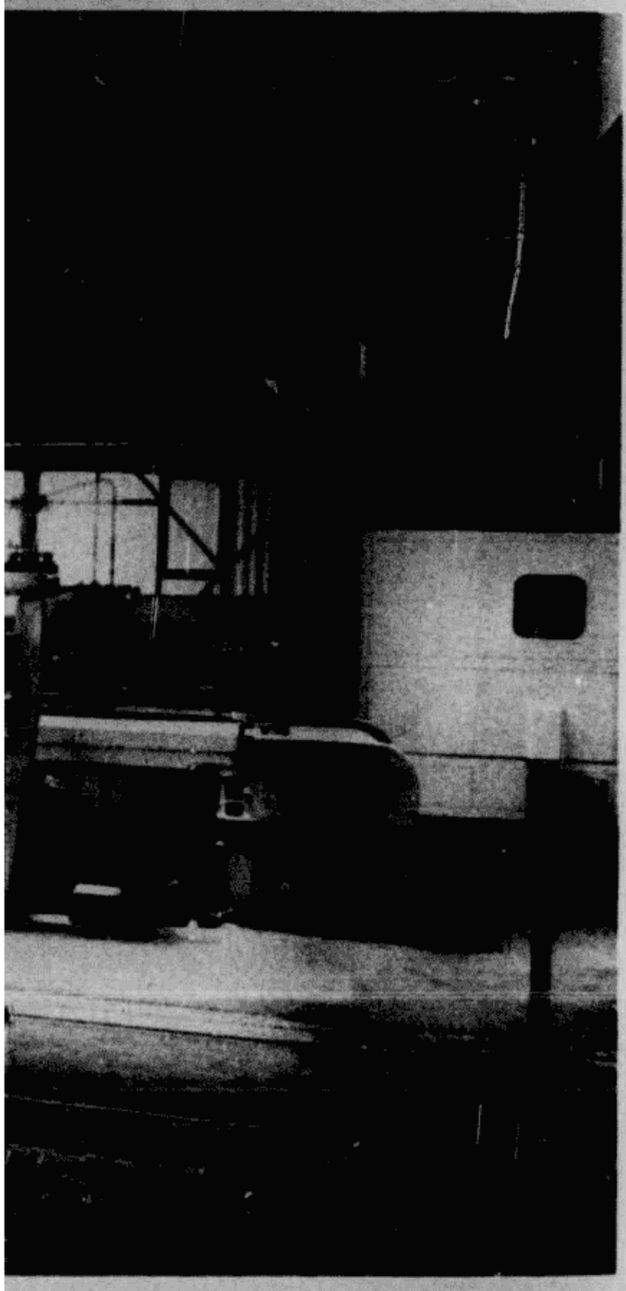
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c production plants for the of:

flat and corrugated asbestos-cement sheets
asbestos-cement pipes

c press lines ction of:



highly compressed asbestos-cement sheets

Fully automatic press lines for: laminating of flat asbestos-cement sheets

Fully automatic press lines for the production of building elements

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12.000 tons short-cycle press and 315 to stamping press for the production of asbestos-cement sheets
size of finished sheets: 1600 x 3600 mm
cycle time: 12 seconds

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PRODUCTION—IMPORTS—EXPORTS

IMPORTS INTO THE UNITED STATES

From: U.S. Bureau of the Census

UNMANUFACTURED ASBESTOS:		JANUARY 1977	
Amosite, Republic of South Africa	s.tons	20	$ 12,276
Crocidolite (Blue), South Africa	s.tons	650	353,283
Chrysotile Crudes, Canada	s.tons	20	12,276
Rhodesia	s.tons	525	450,091
South Africa	s.tons	529	266,400
Chrysotile Spinning Fibers, Canada	s.tons	743	635,424
Chrysotile, Other Canada	s.tons	44,152	9,689,980
Mexico	s.tons	2	349
Other Crudes & Fibers, Canada	s.tons	915	186,845
South Africa	s.tons	608	314,224
		48,164	$11,921,148
MANUFACTURED ASBESTOS PRODUCTS:			
Asbestos yarn, cloth, tape, etc.	Lb	653,461	$ 891,559
A-C pipes, tubes & fittings	Lb	1,278,782	123,544
Other asbestos-cement articles	Lb	896,169	210,426
Other asbestos articles		..	328,035
			$ 1,553,564

EXPORTS FROM THE UNITED STATES

From: U.S. Bureau of the Census

UNMANUFACTURED ASBESTOS:		JANUARY 1977	
Fibers not further processed than beaten, washed or graded to length	s.tons	1,076	$ 498,732
Waste and refuse	s.tons	2,046	383,064
		3,122	$ 881,796
MANUFACTURED ASBESTOS PRODUCTS:			
A-C shingles & clapboard	Lb	16,633	$ 4,884
Other a-c fiber-cement articles	Lb	1,766,249	429,660
Gaskets	Lb	75,639	147,227
Packing	Lb	368,908	1,033,044
Heat or sound insulation		..	230,931
Textiles & yarns	Lb	1,203,086	631,907
Protective clothing		..	109,810
Mfrs. other than friction materials		..	568,227
Clutch facings & linings for auto. use	No	12,227	38,301
Other clutch facings & linings	No	10,557	26,468
Brake linings for automotive use	Lb	867,412	823,034
Other brake linings	Lb	159,403	187,818
			$4,231,311

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EXPORTS FROM CANADA

From: Statistics Canada

JANUARY 1977
Short Tons

UNMANUFACTURED ASBESTOS:	Crude	Milled Gp 3	Milled Gp 4&5	Shorts Gp-6-9
Western Europe	54	1,305	21,456	13,896
Eastern Europe	..	343	3,020	780
Middle East	..	..	3,701	68
Africa	..	..	1,101	360
Asia	..	181	11,201	18,175
Oceania	..	13	3,444	329
So. & Cen. America & Antilles	..	169	2,244	902
United States	..	720	10,782	36,009
	54	2,731	56,949	70,519

The total amount of unmanufactured asbestos exported in *January 1977* was 130,253 short tons, valued at $41,132,000.

MANUFACTURED ASBESTOS PRODUCTS:

Asbestos cloth, dryer felts & sheets	$103,000
Asbestos brake linings & facings	143,000
Asbestos-Cement building materials	547,000
Other basic asbestos products	171,000
	$964,000

CANADIAN FIBER SHIPMENTS

Primary Canadian Producers' shipments of asbestos (including tonnage for own use) amounted to 132,482 short tons in *February 1977* compared with 127,188 tons for the second month of 1976. The cumulative total for the *First Two Months of 1977* was 254,338 tons: 206,795 tons from Quebec plants and 47,543 tons from plants in Newfoundland, Ontario, British Columbia and the Yukon. The total for January-February 1976 was 249,375 tons: 195,166 tons from plants in Quebec and 54,209 tons from plants in the other four Provinces. [Statistics Canada, Ottawa]

CANADIAN PRODUCT IMPORTS

Imports of various asbestos-containing products for the *Year 1976* were valued as follows: vinyl-asbestos floor and wall tiles—$144,000 (150,447 square yards); asbestos cloth, dryer felts and sheets—$2,842,000; asbestos packing—$1,599,000 (1,168,328 pounds); asbestos brake linings—$4,513,000; asbestos clutch facings—$751,000; asbestos-cement shingles and siding—$143,000; asbestos-cement boards and sheets—$337,000; other asbestos building materials—$7,336,000; and other asbestos basic products—$3,009,000. Imports of unmanufactured asbestos totaled 6,616 tons valued at $2,966,000: 5,044 tons from South Africa valued at $2,535,000 and 1,572 tons valued at $430,000 from the United States. [Statistics Canada]

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THE QUEBEC MINING SCENE

(The ensuing items were excerpted from the April 1977 issue of "QAMA Bulletin," published by the Quebec Asbestos Mining Association.)

ASBESTOS HELPS THE ECONOMY

Quoted below are comments issued by QAMA with respect to the economic benefits accruing in Quebec as a result of commercialization and capital inflow from the asbestos industry in the Province. "It is too often ignored that the asbestos mining industry, by virtue of its efficiency and stable prices, markets and their maturity, contributes more to the Quebec Treasury than all the other mining sectors. In fact, Quebec income from asbestos mines alone represents 60% of all income derived from the entire Quebec mining industry. In 1976 asbestos companies will have paid the State, in mining rights, company income taxes and other provincial taxes, over $40-million."

In addition, thanks to full employment policy, the industry provides work to more than 6500 persons who are also taxpayers and who share salaries totalling over $100-million. "Company disbursements for the various social benefit programs—retirement and pension plans, Workmen's Compensation Board, unemployment insurance, etc.—amount to close to $20-million, to which should be added substantial sums which the industry devotes to scientific and medical research for the development of health conditions at work. On the other hand, the performance of these mining activities, concentrated in five Eastern Township localities, directly benefits 55,000 inhabitants of this Quebec region which, essentially, depends on the asbestos industry."

"Furthermore, the asbestos industry, in doing business with some 290 Quebec suppliers spread among the mining communities, the adjoining cities and the major centres like Quebec and Montreal, purchases nearly $85-million worth of goods and services annually in Quebec. In this way, in total, the asbestos companies whose 1976 sales were about $340-million, injected some $300-million into the national economy."

CAREY-CANADIAN PLAN

A $3-million, air purification program has been undertaken by Carey-Canadian Mines Ltd. at East Broughton Station where, already, considerable progress has been made in open pit operations as well as in the mill and related facilities. Since mid-1976 a new central air eduction system has been providing effective and adequate ventilation throughout the mill and by the end of this year all sifters will be recovered. Covering of the conveyors will be completed by the beginning of 1978. Carey-Canadian has been authorized by the Quebec Government to install six dust filtration units which are capable of filtering over 500,000 cubic feet of air per minute. The equipment will be located in the mill, drying and packing sections, pilot plant, laboratory and in dust-filtering cabins for employees. All floors have been insulated and electric cable will be entirely covered to more effectively eliminate dust accumulation. Another recent purchase was a $300,000 drill, complete with a dust filtration

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The environmental consequences of a burning super-tanker would be disastrous. So would the loss of life.

An empty supertanker is even more dangerous. It can simply explode from a small spark in the wrong place.

No wonder painstaking precautions are taken to protect the ships that carry the oil that runs our economy.

Asbestos material is used to isolate fire-causing people and electrical systems from the cargo because asbestos cannot catch fire and holds up even after steel has melted down.

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system. Also, major work is being carried out to double the surface area in the analysis laboratory. Once the work is completed, by September 1977, the laboratory will be equipped with a complete filtration, heating and air conditioning system. Finally, in order to eliminate noise pollution as much as possible a soundproof room was built in the garage shop and silencers have been installed on several parts of equipment used by employees.

LAKE ASBESTOS PROJECTS

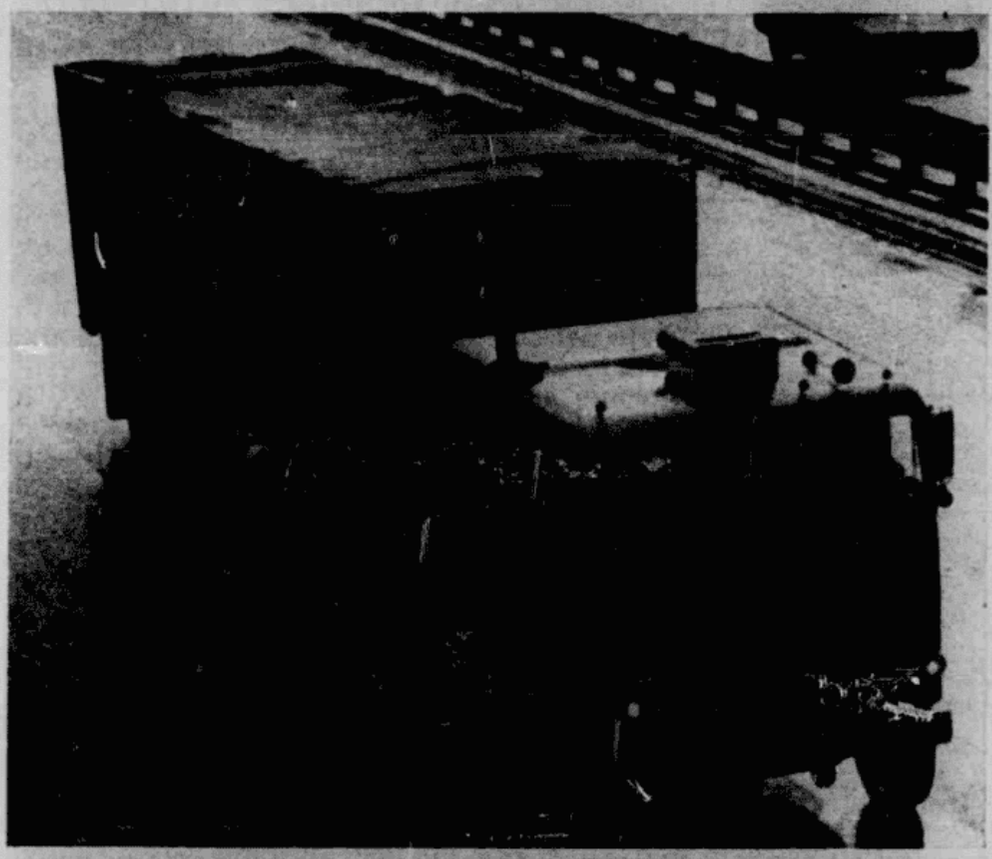
Last year Lake Asbestos of Quebec Ltd. initiated a modernization and air purification program at its National Asbestos Division, Robertsonville. Included in the project, which entails an investment of $3-million by 1980, are the purchase and installation of ten air filtration systems plus a 2190-cubic-foot-per-minute compressor for the mill and drier. The equipment is now in full operation. Hygiene at the plant will be considerably improved due to the three new central suction systems to be put into operation at the mill, dryer and crusher. Other new equipment are a magnetic concentration system, ten air-cushioned separators and two pressure packers. . . . To ensure cleanliness at the mill at Black Lake, LAQ installed three central suction units in the process plant, dryer and crusher. About $250,000 was allocated for this work. According to QAMA, "the use of continually modernized technical equipment is of prime importance in dust control and hygiene in the asbestos industry. Following annual examinations conducted by the Thetford Mines Industrial Clinic and verification by the Pneumology Committee of the Workmen's Compensation Board, not a single incidence of pulmonary disease was discovered among the 359 employees working for Lake Asbestos at Black Lake."

JOHNS-MANVILLE PROGRAM

The decision taken by Johns-Manville to pursue its three-stage investment program is part of a five-year plan to develop its facilities at Asbestos. Essentially the objective is to ensure, over the next quarter century, optimal annual asbestos production at the Jeffrey Mine of 700,000 short tons. Since announcing the $77-million plan in April 1976, J-M has built a new complex for construction and maintenance purposes, bringing together under one roof several different shops in order to maximize service efficiency. The company is also proceeding with construction of new administrative offices and relocation of main storage areas, the mechanical and shovel shops and the effluent purification plant. Also affected will be a residential sector of some 250 dwellings. Work on expanding the mine will be completed by or before 1980. In addition to maintaining production capacity, the program will substantially improve health conditions.

PRICE RANGE—The list of Current Asbestos Prices for Arizona, Quebec, Cassiar and Vermont, as it appeared in April 1977 ASBESTOS on page 30, remains in effect as of this issue.

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LAKE ASBESTOS

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ANNUAL REPORTS—1976

ADVOCATE MINES LTD.

Advocate Mines Ltd. reported excellent earnings performance for 1976 as a result of good fiber production, higher mine ore recovery and sound cost control. Net income was $4.4-million compared with $709,247 in 1975. Earnings per share after an extraordinary item and payment of preference share dividends were 64¢ against 1¢ a year earlier. Following shareholders' approval, all of the outstanding 125,058 4½% Preference Shares of a par value of $100 each were redeemed at year-end out of funds derived from working capital and bank borrowings. This will enable Advocate Mines, based on its projections for the next three years, to pay substantially increased Common Share dividends, subject to Federal Anti-Inflation Guidelines. In December the company arranged $10-million in additional bank financing to augment working capital and complete the redemption of the shares.

Production of asbestos in 1976 at Baie Verte, Newfoundland, amounted to 72,883 tons of A-25 fiber and 11,563 tons of A-35 fiber, or a total of 84,446 tons of fiber valued at $31,790,277. This compared with 69,600 tons in quantity and $21.4-million in value in 1975. Shipments reached 98,124 tons compared with 63,787 tons a year earlier. Waste-to-ore ratio was 4.3:1 in 1976 against 2.9:1 in 1975 and recovery mine ore was 4.06% in 1976 and 2.85% in 1975. At December 31, 1976, ore reserves amounted to 48,672,000 tons and fiber inventory was 7,194.35 tons of A-25 and 1,196 tons of A-35.

A number of projects were undertaken to improve environmental conditions and housekeeping. Emphasis on the improvement of dust control was continued. All projects were carried out in close liaison with environmentalists from the Federal and Provincial Governments and Johns-Manville Corporation. In the primary crusher the design has been completed and the material ordered for a bag collector which will be installed early this year. Engineering and design was begun in 1976 for a bag collector to collect dust from the hot and cold stacks in the secondary crushing and drying building. Considerable progress in suppressing dust on tailings has been accomplished by the addition of water at transfer points on conveyor belts. All dust monitoring stations were maintained at acceptable dust levels. The Government's maximum level is presently set at five fibers per cubic centimeter. Most of the Advocate stations are now under two fibers/cc.

ASBESTOS CORPORATION LTD.

Net income for the year was $20.4-million ($7.19 per share) compared with $14.2-million ($5.01 per share) in 1975. Sales totaled $151.4-million against $84.8-million in 1975 and $108.5-million in 1974.

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— Machinery for asbestos-cement since 1912, therefore take advantage of our experience.

— Complete plants with high capacity for corrugated and flat sheets, flat pressed and coloured sheets.

— Production of special sheets up to 9 mt length.

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— Special plants for preparation of wet and dry Asbestos.

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The 1975 results were adversely affected by the seven-month-long strike at Thetford Mines and a significant loss of tonnage caused by the fire in December 1974 that destroyed the King-Beaver Mill. In 1976 $10-million was spent or committed to improve working conditions at the corporation's plants and adjacent areas and additional environmental improvement expenses of $20-million are currently projected for 1977 and 1978. At the end of 1976 substantial improvements in dust levels were evident in all operations providing encouraging evidence of the success of the environmental improvements program.

Demand for all grades of asbestos fiber remained strong throughout 1976 and at the end of the year inventories of finished fiber in tons were at the lowest level ever. Prices remained firm during the year and a 14% increase was put into effect January 1, 1977.

Asbestos Corporation has the distinct advantage of producing 85% of its asbestos in grades suitable for the asbestos-cement sector. The manufacture of a-c products consumes almost 70% of the world's supply of asbestos by tonnage and a higher precentage by value since a-c production demands the medium-range fibers. Among the 75 countries in which the company sells asbestos, the developing countries offer the greatest potential. Prospects for sales in 1977 are good although there are some indications that the markets for certain grades may weaken slightly. The overall demand for asbestos appears to be firm for several years to come, particularly in the asbestos-cement sector.

Thetford Operations—The Thetford Mines area operated close to capacity throughout the year. A decision was made not to replace the mill at the King-Beaver Mine.Open pit ore at the Normandie Mine will be exhausted during 1977. Accordingly plans are currently being implemented to mine and beneficiate the K-B open pit ore near the K-B Mine site and to transport the ore to the Normandie Mill for processing. The first delivery is expected to take place this month. Non-beneficiated underground ore from the K-B Mine will continue to be processed at the British Canadian plant as it has been since early 1975.

Asbestos Hill/Nordenham Operations—The open pit mine and mill at Putuniq, Ungava, Quebec, produced 223,700 tons of ungraded fiber compared with 276,400 tons in 1975. Low-grade ore had to be treated due to difficulties in the open pit caused by the severe shortage of experienced drillers and some pit wall instability. The underground drifting and diamond drilling program started in 1975 to confirm the extent of underground reserves at Asbestos Hill has been completed and results are being analyzed. Additional detailed exploration may be required before a final decision on the underground operation can be taken. The quality of finished fiber produced by the finishing mill at Nordenham, West Germany, continues to be most satisfactory for the asbestos-cement industry.

Ore Reserves—After taking into account the consumption of ore during the past year, proven ore reserves at year-end were 144.6-million tons: 29.9-million tons at the King-Beaver Mine, 53.9-million at the British Canadian Mine, 29.3-million at Normandie, 17.8-million at

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Asbestos Hill and 13.7-million at other properties. It is also estimated that there are other ore reserves classified as probable in the Thetford area amounting to 120-million tons and further reserves deemed as possible ore in the same area total 90-million tons.

H. K. PORTER COMPANY, INC.

Consolidated net sales for H. K. Porter Company, Inc., totaled $356.2-million in 1976 compared with $267-million in 1975. Net income was $8.9-million or $6.96 per share against $9.3-million or $7.31 per share the prior year. Cash flow amounted to $13.48 per share in 1976 and $11.76 in 1975. In 1976 Porter spent $6.3-million for capital additions which was $1.5-million less than its depreciation for the year.

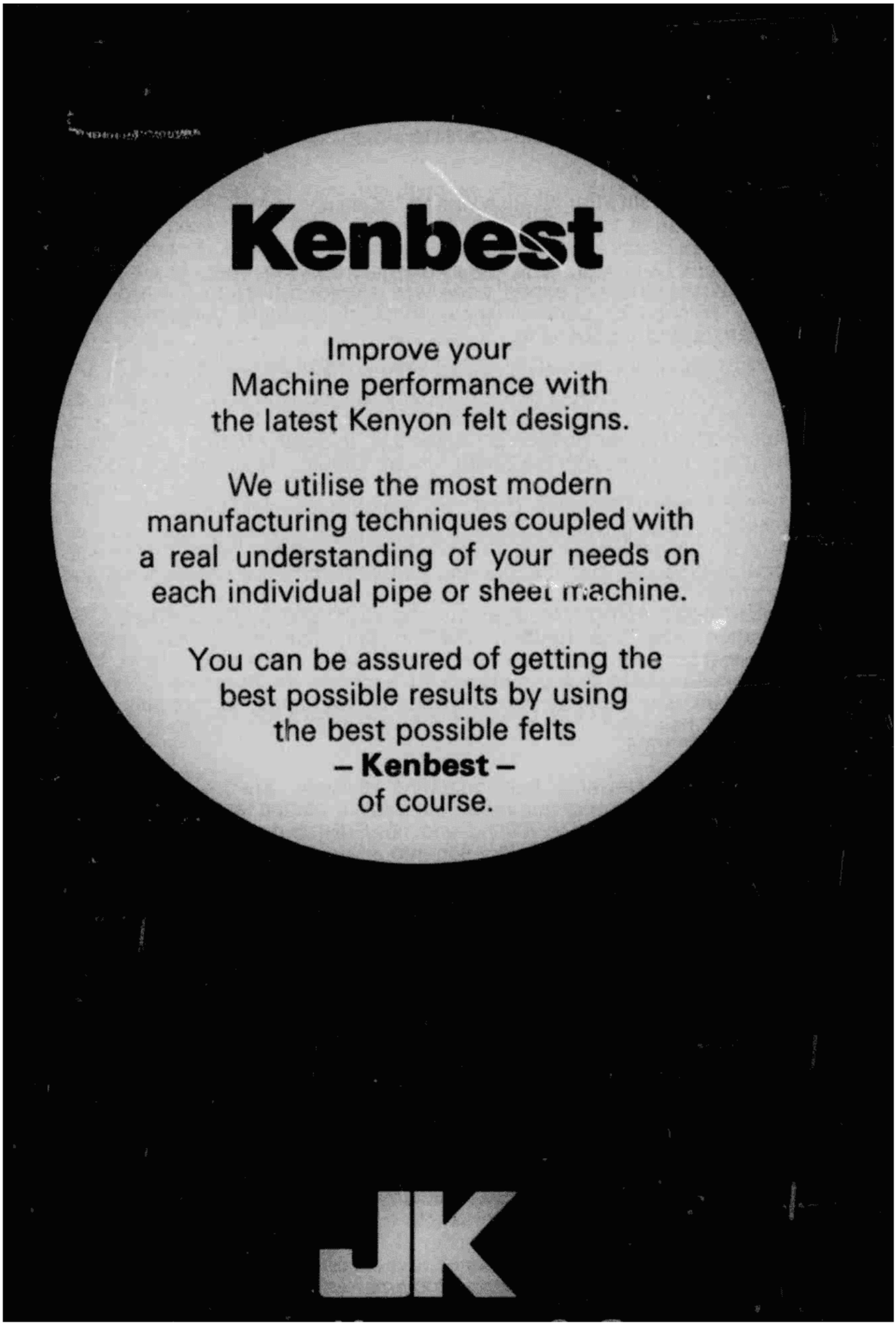
Two major acquisitions were made in 1976. The sales and profits of Fansteel Inc., an 85% owned subsidiary, were included after June 1, and the earnings of Missouri Portland Cement Company, a 54% owned subsidiary, were included on an equity basis after July 1. On February 15, 1977, an agreement was signed between Porter and MPC which provides for a merger of the two companies. The transaction is subject to the satisfaction of certain conditions among which is a favorable vote of MPC shareholders other than Porter. A vote on the merger is expected to take place this month. During 1976 Porter sold the remaining operations of its Refractories Division and closed the plant at Springdale, Arkansas, the New Orleans Works of Connors Steel Company and the Bennettsville Works of Southern Asbestos Company. In February of this year the Friedman Metals Company was sold and Porter is presently liquidating its Canadian company.

Southern Asbestos Company—The installation of new spinning and twisting equipment was completed at the Charlotte Works, representing a multi-million dollar project designed to provide a superior asbestos textile product, reduce costs, improve working conditions and broaden product capabilities. Also completed were the consolidation of the two textile facilities into a single operation at Charlotte and the establishment of a narrow tape department including the installation of twelve high-speed glass looms. A wide shuttleless loom was added to the weaving department to reduce noise levels and improve production capability. Sales remained at depressed levels during most of 1976 although bookings improved in the 4th quarter and the early part of this year. The latest contribution of the Research and Development Department was the introduction of such coated materials as Viton, Hypalon and Silicone.

TURNER & NEWALL LTD.

Major improvements in profitability were reported by Turner & Newall Ltd. Sales rose 29% to £332,511,000, trading profit increased 68%, profit before taxation was up 64% and profit attributable to stockholders

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rose 25%. Profit after taxation was £17.8-million in 1976 compared with £11.3-million in 1975. The taxation charge in 1976 represents 50% of the pre-tax profits. The value of direct exports from the U.K. set another record at £72-million, 32% higher than the previous year. In addition a considerable indirect export trade was achieved through the export of many finished or partly-finished industrial products containing T&N materials and components.

Important among T&N's overseas investments is the acquisition of a 49% interest in a new French company formed with S.A. Francaise du Ferodo and the Institut de Developpement Industriel to acquire the Curty Automotive Gasket Division of Cefilac S.A. In South Africa an agreement has been reached with the South African Mutual Life Assurance Society which is acquiring a minority interest in T&N's local holding company, Turner & Newall Holdings (Pty) Ltd., which is investing £4.6-million in a plastics molding powder plant. The company's building materials interests in Nigeria are being expanded and a firm has been formed with local interests to manufacture and market automotive components and to provide a base for a plastics processing activity. In 1976 T&N sold to Saint-Gobain-Pont-A-Mousson the shares it held in CertainTeed Corporation. The sale realized $34.7-million. T&N is actively seeking reinvestment opportunities in the United States. It has also sold its 33% interest in TEAM S.A., realizing $3.3-million. In Rhodesia T&N has important wholly-owned mining and manufacturing companies from which it has been cut off since the declaration of independence in November 1965.

Turner & Newall's four operating divisions are concerned with plastics and industrial materials, automotive components, construction materials and asbestos mining and fiber distribution. Management is following a policy of diversification into a wide range of plastics, glass fiber, mineral fiber, rubber, cork and other materials. Such non-asbestos products now constitute over 40% of worldwide sales and more than half the sales in European markets. The company states that its belief in the future for asbestos-based products does not impede research into alternatives. Limitations on free world asbestos fiber supplies and the costs implicit in new mining ventures spurs on such research, which has been particularly successful in insulation materials during the past ten or more years.

TBA Industrial Products Ltd.—Sales revenue increased and profits were marginally better than in the previous year. Exports were again an outstanding feature at 46% of total sales revenue. Although demand for asbestos textiles in general was weak for much of the year, output of TBA's range of FORTEX asbestos textiles produced by the wet dispersion process continued to increase. Sealing materials benefited from higher demand in the automotive industry and an increased proportion of sales was exported. Belting products had a difficult year but the subsidiary's position as a major supplier of PVC conveyor belting to the National Coal Board was consolidated and exports of transmission beltings increased. Plant commissioning problems restricted reinforced plastics

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production early in the year resulting in difficulty in meeting strong demand for DURESTOS phenolic molding materials.

Asbestos Fiber Mining & Distribution—Total sales by overseas companies increased 88% to £43.5-million and by U.K. exports rose 63% to £6.9-million. All mines associated with the T&N Group sold their production in 1976 at firm prices. The market for most grades of fiber was strong in the wake of the shortages which arose from the prolonged strike of Eastern Quebec asbestos workers in 1975. The capital expenditure program was maintained at Bell Asbestos Mines Ltd., Thetford Mines, Quebec, principally on extensions and modernization of the mill. The Bell Mine operated profitably after absorbing substantial costs of introducing new milling procedures. Production in 1977 should be at a more consistent level and total production will be sold at satisfactory prices. . . . Havelock Asbestos Mines Ltd., in which the Swazi nation has a 40% shareholding, operated at a high level of efficiency throughout its financial year. Total production was sold at good prices and negotiations are in hand to prolong the life of the mine. . . . Dublin Consolidated Asbestos Mines (Pty) Ltd., Johannesburg, again produced a satisfactory profit although late in the year it encountered some mining difficulties which served to reduce production.

ASBESTOS STOCK QUOTATIONS

April 19, 1977

Abitibi Asbestos	C$.80	G&W (pfd 2.50)	34 3/8
Advocate Mines	C$3.35	G&W (pfd 3.87)	67 1/4
Armstrong Cork	23 7/8	IC Industries	25 7/8
Armst. Cork (pfd 3.75)	53 3/4	IC Ind (pfd 6)	114 1/2
Asarco	21 5/8	IC Ind (pfd 3.50)	44 3/4
Asbestos Corporation	C$23.75	Jim Walter Corporation	32 3/8
Bendix	42	Jim Walter (pfd 1)	11 1/2
Carlisle	17 7/8	Jim Walter (pfd 1.60)	35 1/4
Cassiar Asbestos	C$8.50	Johns-Manville	34 5/8
CertainTeed	28	Kennecott Copper	27 3/8
Charter Conso.	pence 127	Lear Siegler	15
Colt Industries	51 1/4	Lear Siegler (pfd 2.25)	39 3/8
Colt Ind. (pfd 1.60)	27 1/4	Maremont	18
Colt Ind. (pfd 4.25)	73 1/2	McAdam Mining	C$.29
Conwest	C$3.35	National Gypsum	17 1/8
Flintkote	19 1/8	Pathfinder	C$.21
F-kote (pfd-A 4.50)	76 1/8	Porter, H. K. (pfd 5.50)	74
F-kote (pfd-B 2.25)	38	Raybestos-Manhattan	30 5/8
GAF Corporation	11 3/8	Rio Algom	C$27.25
GAF (pfd 1.20)	17	Supradur	Bid 6 1/8 ; Asked 6 5/8
Gulf & Western	13 5/8	Union Carbide	57 1/8
G&W (warrants)	11/16	Woodsreef Minerals	C$.68

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MEN ON THE MOVE

AMERICAN TEXTILE MACHINERY ASSOCIATION

Richard P. Newell, recently-elected President of ATMA, announced the appointment of *Harry W. Buzzerd, Jr.*, as Executive Vice President of the Association. Mr. Buzzerd's association management career began in Washington in 1965. The majority of his duties has been in government, public relations and marketing functions for such organizations as the National Cotton Council, the Outdoor Power Equipment Institute and the National Canners Association.

ASARCO INC.

Max M. El Tawil was promoted to Section Head-Mineral Science, Central Research Department, South Plainfield, New Jersey, it was announced by *Dr. Val Kudryk*, Department Manager. A native of Egypt, Dr. El Tawil joined Asarco in 1973 as a Research Engineer-Mineral Science. Last year he was named Senior Research Engineer.

JIM WALTER CORPORATION

Dr. Robert F. Lanzillotti was named a Director of Jim Walter Corporation. He is Dean of the College of Business Administration, University of Florida, and a former member of the U.S. Price Commission and Consultant to the Federal Trade Commission and the U.S. Department of Justice.

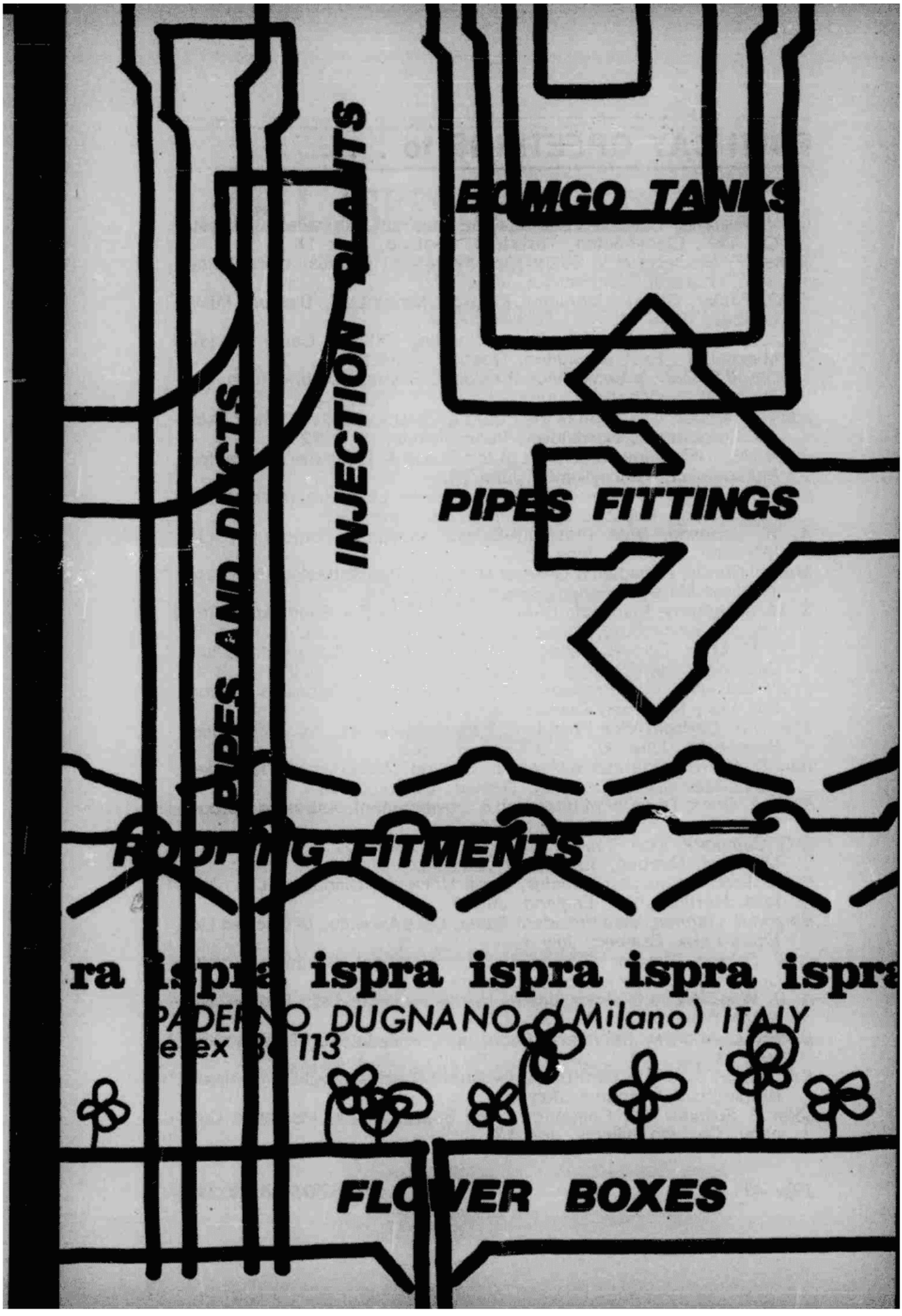
H. K. PORTER COMPANY, INC.

Keith Worthington was appointed Managing Director of H. K. Porter Company (Great Britain) Ltd. His broad experience in industrial and automotive components includes several years in Germany in the molded rubber industry and, most recently, General Manager for K. Metzeler Ltd., United Kingdom.

UNION CARBIDE CORPORATION

Basil T. Hone was named Vice President of Exploration and Resource Development, Metals Division. In addition to continuing as President of the subsidiary, Union Carbide Exploration Corporation, he will head a new department which is a consolidation of domestic and overseas exploration and mine development activities. Mr. Hone joined UCC in 1973 as Director-Mineral Resources for the former Mining and Metals Division.

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BIRTHDAY GREETINGS to . . .

D. H. Pillinger, Chairman & Managing Director, Cresswell's Asbestos Co. Ltd., Cleckheaton, Yorkshire, England, June 16.
James F. Maclachlan, a Senior Vice President, Raybestos-Manhattan, Inc., Trumbull, Connecticut, June 19.
D. O. Poirier, General Manager, Flintkote Mines Ltd., Thetford Mines, Quebec, June 19.
Michael Prus, President & Chief Operating Officer, Carey-Canadian Mines Ltd., East Broughton, Quebec, June 21.
Frederick S. Daly, a Senior Vice President, Raybestos-Manhattan, Inc., Trumbull, Connecticut, June 22.
John W. Weber, Chairman of the Board & Chief Executive Officer, Amatex Corporation, Norristown, Pennsylvania, June 22.
C. Branton Wheatley, Chairman of the Board & Treasurer, Pacor Inc., Philadelphia, Pennsylvania, June 22.
H. A. Guettinger, Technical Manager, Everite Ltd., Braamfontein, Johannesburg, Republic of South Africa, June 23.
A. S. Johnson, Vice President-Sales, Asbestos Corporation Ltd., Montreal, Quebec, June 23.
Marcel Dorais, President & General Manager, Bell Asbestos Mines Ltd., Thetford Mines, Quebec, June 25.
S. M. Dougherty, Managing Director, Cape Asbestos South Africa (Pty) Ltd., Johannesburg, Republic of South Africa, June 25.
J. F. H. Main, Deputy Managing Director, Trist, Draper Ltd., Bristol, England, June 26.
J. W. McCarvill, Vice President-Corporate Planning, Asbestos Corporation Ltd., Montreal, Quebec, June 27.
Robert A. Carlson, Vice President, Special Materials, Inc., Milwaukee, Wisconsin, June 30.
Paul D. Morrell, Operations Manager, Sealing Components Department, Johns-Manville Corporation, Denver, Colorado, July 1.
G. F. A. Brink, Director of Research & Development, Asbestos Corporation Ltd., Montreal, Quebec, July 2.
I. C. Campbell, Vice President & Secretary, Asbestos Corporation Ltd., Montreal, Quebec, July 3.
C. A. Scott, Managing Director, Cape Universal Claddings Ltd., Watford, Hertfordshire, England, July 5.
Roland P. Gagnon, Vice President-Sales, Lake Asbestos of Quebec Ltd., Black Lake, Quebec, July 7.
J. W. Echerd, Director of Research & Development, Southern Asbestos Company, Charlotte, North Carolina, July 9.
A. D. Woodford, a Director, James Hardie Asbestos Ltd., Sydney, New South Wales, Australia, July 9.
Donald L. Andrew, Secretary, Pacor Inc., Philadelphia, Pennsylvania, July 11.
I. L. Taylor, Vice President-Sales, Cement Asbestos Products Company, Birmingham, Alabama, July 12.
John F. Sullivan, Jr., Chairman of the Board, A & M Insulation Company, Chicago, Illinois, July 13.

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VALUABLE LITERATURE

RESPIRATORY PROTECTION/OSHA AND THE SMALL BUSINESS—Authored by W. E. Ruch & B. J. Held; provides information to the small businessman to protect the health of his employees through respiratory protection and to comply with the rules and regulations promulgated by OSHA; discusses OSHA requirements, lung physiology, classification and evaluation of respiratory hazards, basic techniques of particulate sampling, types and limitations of respiratory protective devices and administering a respirator program. [102 pages; $12.50; order from Ann Arbor Science Publishers, Inc., or through ASBESTOS]

PUBLIC HEALTH RISKS OF EXPOSURE TO ASBESTOS—Edited by R. L. Zielhuis, Coronel Laboratory, University of Amsterdam; offers guidelines referring to public health and not to occupational health, plants, animals or materials; concerned with the usage of asbestos and asbestos-containing materials in the EEC, exposure and related diseases, sampling and detection of asbestos, etc. [150 pages; $12.00/£6.75; place orders with Pergamon Press Ltd., Headington Hill Hall, Oxford OX3 OBW, England]

NOYES DATA CORPORATION—Technology Reviews published recently include: Refractory Materials 1976, by G. B. Rothenberg (266 pages; $39.00); Foamed Plastics 1976/Recent Developments, by Y. L. Meltzer (434 pages; $39.00); Cement and Mortar Additives 1976/2nd Edition, by A. J. Franklin (308 pages; $36.00); Reinforced Plastics and Elastomers 1977/Recent Developments, by M. W. Ranney (314 pages; $39.00); Waste Treatment With Polyelectrolytes and Other Flocculants 1977, by S. J. Gutcho (274 pages; $39.00); and How To Remove Pollutants and Toxic Materials from Air and Water/A Practical Guide 1977, by M. Sittig (621 pages; $48.00). [Order from Noyes Data Corporation or through ASBESTOS]

THERMAL FATIGUE OF MATERIALS AND COMPONENTS—A review of the current state-of-the-art of thermal fatigue; focuses on stress and deformation analysis, life prediction techniques, materials behavior and thermal-mechanical testing. [STP 612; 271 pages; $27.00; order from American Society for Testing and Materials or through ASBESTOS]

CHRYSOTILE ASBESTOS TEST MANUAL, 3RD EDITION—Prepared jointly by the Asbestos Textile Institute, Inc., and the Quebec Asbestos Mining Association; provides 34 standard methods for testing the physical and chemical properties of Chrysotile asbestos fiber. [$18.95 to the U.S., Canada and Mexico; $21.95 to all other countries; place orders with ASBESTOS Magazine]

THE ASBESTOS FACTBOOK, 3RD EDITION—Compiled by the staff of ASBESTOS Magazine; written in layman's terms; offers useful information on the origin, locations and uses of asbestos; gives the chemical compositions of the various types of the mineral; contains data concerning testing methods and grades. [28 pages; $1.00 per paper-bound copy; order from ASBESTOS Magazine]

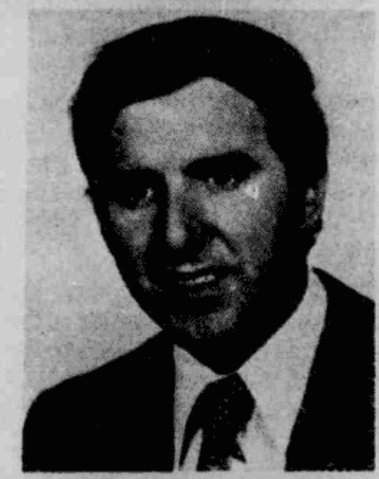
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NEW ASBESTOS PATENTS

U.S. patents may be purchased from The Commissioner of Patents, Washington, D. C. 20231, for 50c each. Photoprints of non-U.S. patents may be purchased from the same source at a cost of 30c per page. Remittances should be in coin, currency or check and the number of the patent, name of the inventor and date of issue should be given.

British 1,457,828—In the dispersion of Chrysotile asbestos in an organic liquid, the asbestos fiber bundles are soaked in a wetting agent that swells the fiber bundles, and the soaked bundles subjected to mild agitation to obtain a stable, highly-opened, gel-like dispersion of reduced friction drag; M. Bridge & I. A. Whittaker; assigned to TBA Industrial Products Ltd., December 8, 1976; 2 pages.

British 1,461,534—Improved insulation for piping or other articles is made by homogenizing a mixture of asbestos, lime, silica and water, placing the mixture in molds and contacting the molded shapes with saturated steam to obtain a hydrated calcium silicate with a lattice of open structure; B. Colturri, January 13, 1977; 3 pages.

British 1,463,720—An improved coupling agent for use in molding compositions comprising primarily Chrysotile asbestos and a thermoplastic polymer consists of 2,6-dimethylol-4-alkylphenols or oligomers or polymers thereof, such as para-alkylphenol; R. G. Azrak, F. H. Ancker & M. D. Bertolucci; assigned to Union Carbide Corporation, February 9, 1977; 26 pages.

British 1,463,883—In the manufacture of vinyl asbestos floor tile having a printed surface covered with a clear, durable wear layer, a sheet formed of a conventional asbestos-base mix is printed by rotogravure or planograph, the printed sheet coated with a cross-linked polymer and the coated surface exposed to ultraviolet light; P. S. Bettoli, A. G. Boranian & B. Terwilliger; assigned to GAF Corporation, February 9, 1977; 18 pages.

British 1,464,367—In the manufacture of electrical insulators of good anti-tracking properties, a mixture of a polyester resin, a cross-linking polymerization catalyst, aluminum trihydrate and asbestos is formed into desired shapes and the shapes are treated to cure the polyester resin; C. Poxon; assigned to H. Clarke & Co. (Manchester) Ltd., February 9, 1977; 5 pages.

Canadian 1,003,989—Relatively thick sheets or shapes may be extruded or injection-molded from (1) a vinyl chloride homopolymer and/or copolymer, (2) asbestos fibers and (3) a complex stabilizer system consisting of dibutyl-tin mercaptide, epoxidized soybean oil or linseed oil and sorbitol or like polyol or an amino compound of polyacetic acid; L. Kacir & M. Narkis; assigned to Center for Industrial Research Ltd. and Palram-Plastics Works, January 18, 1977; 20 pages.

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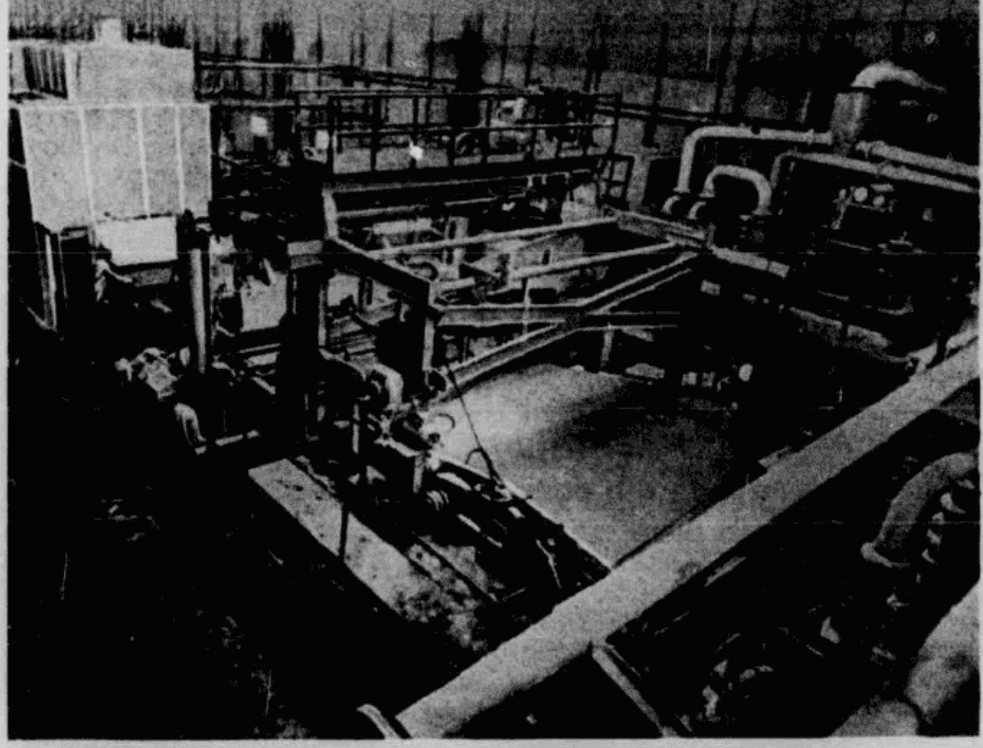
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CALENDAR OF EVENTS

METRIC AWARENESS SEMINARS—A management approach to metric conversion planning; conducted by the American National Metric Counsel; Boston, Massachusetts—*June 1;* New York City—*June 3;* Atlanta, Georgia—*June 6;* Chicago, Illinois—*June 8;* Kansas City, Missouri—*June 10;* San Francisco, California—*June 15;* and Los Angeles, California—*June 17.*

OSHA STANDARDS—New Seminar Series to aid in optimizing responses to OSHA health performance standards with the use of toxic substance monitoring systems; presented by Dr. Daniel P. Boyd and Dr. S. Thomas Dunn; Penn Center Inn, Philadelphia, Pennsylvania, *June 2-3.*

ANTITRUST LAW—18th Annual Institute of the Practising Law Institute; *June 2-3* in New York City; *July 21-22* in Denver, Colorado.

X-RAY SPECTROMETRY—An integrated short course with practical applications; State University of New York, Albany, New York, *June 6-10* and *June 13-17.*

UNIVERSITY OF WISCONSIN—Extension Courses: Industrial Safety and Health, *June 9-10;* Material Selection in the Design Process, *June 9-10;* Environmental Law for Engineers, *June 13-14;* Air Pollution/Monitoring and Control, *June 20-24;* Noise Survey Techniques, *June 27-29;* Environmental Noise Impact Assessment, *June 30-July 1;* and Building Maintenance, *July 11-12.*

GEOTECHNICAL PRACTICE FOR DISPOSAL OF SOLID WASTE MATERIALS—Specialty Conference of the Geotechnical Engineering Division, American Society of Civil Engineers; The University of Michigan, Ann Arbor, Michigan, *June 13-15.*

ULTRASONIC TISSUE CHARACTERIZATION—Conference sponsored by the U.S. National Bureau of Standards; NBS Laboratories, Gaithersburg, Maryland, *June 13-15.*

IMPROVING EMPLOYEE AND PRODUCT SAFETY AND PERFORMANCE—Course presenting current ergonomic practices; University of Michigan, Ann Arbor, Michigan, *June 16-17.*

FUNDAMENTALS OF MINING MANPOWER TRAINING—Short Course at The Pennsylvania State University, University Park, Pennsylvania, *June 16-17.*

4TH INTERNATIONAL CONFERENCE ON FRACTURE—Held under the auspices of the International Congress of Fracture and the Faculty of Engineering, University of Waterloo; Waterloo, Ontario, Canada, *June 19-24.*

QUALITY AUDIT/DEVELOPMENT AND ADMINISTRATION—Education

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and Training Course of the American Society for Quality Control; Holiday Inn-Downtown, Minneapolis, Minnesota, *June 20-22.*

METAL AND NON-METAL MINING—Systematic Overviews presented by Socio- Economic- Technical Advisors: Underground Mining, Marriott Motor Hotel, St. Louis, Missouri, *June 20-22;* Surface Mining, Stouffer's Denver Inn, Denver, Colorado, *June 27-29.*

AIR POLLUTION CONTROL ASSOCIATION—70th Annual Conference and Exhibition; Sheraton Centre Hotel, Toronto, Ontario, Canada, *June 20-24.*

APPLICATION OF COMPUTERS AND OPERATIONS RESEARCH IN THE MINERAL INDUSTRIES—15th International Symposium; Brisbane, Australia, *July 4-8.*

MULTIVARIABLE TECHNOLOGICAL SYSTEMS—Symposium sponsored by the International Federation of Automatic Control; University of New Brunswick, Fredericton, New Brunswick, Canada, *July 4-8.*

UTILIZATION OF MINERAL RESOURCES IN DEVELOPING COUNTRIES—International Conference; Lusaka, Zambia, *August 3-5.*

MINERAL PROCESSING—12th International Congress sponsored by the Ministries of Industry and Commerce and of Mines and Energy; Sao Paulo, Brazil, *August 29-September 3.*

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REMEMBER WHEN?

(April 1927 ASBESTOS)

New Advertiser: The Ric-wiL Co., Cleveland, Ohio

Johns-Manville, Inc., declared initial quarterly dividends on its new stock amounting to 75¢ per share on the common and $1.75 per share on the preferred.

Completion of the new St. Louis plant of Asbestos Shingle, Slate & Sheathing Co. was delayed by a dispute over which labor union should apply the asbestos sheathing to the roof and walls of the building. The problem was resolved by having union structural iron workers apply one half the roof and union roofers apply the other half. Union carpenters applied all the siding.

At a meeting in Kimberley, Union of South Africa, the operators of the Blue asbestos mines formed the South African Blue Asbestos Producers Association. H. S. Milner was elected Secretary and headquarters were to be located at Kuruman.

H. E. Sunbury resigned his position with Multibestos Company, of Walpole, Massachusetts, to become Production and Mill Manager for Asbestos Spinning & Weaving Corporation, Waterford, New York.

(May 1927 ASBESTOS)

New Advertisers: Stone Industrial Equipment Co., Springfield, Ohio
Atlas Asbestos Co., North Wales, Pennsylvania

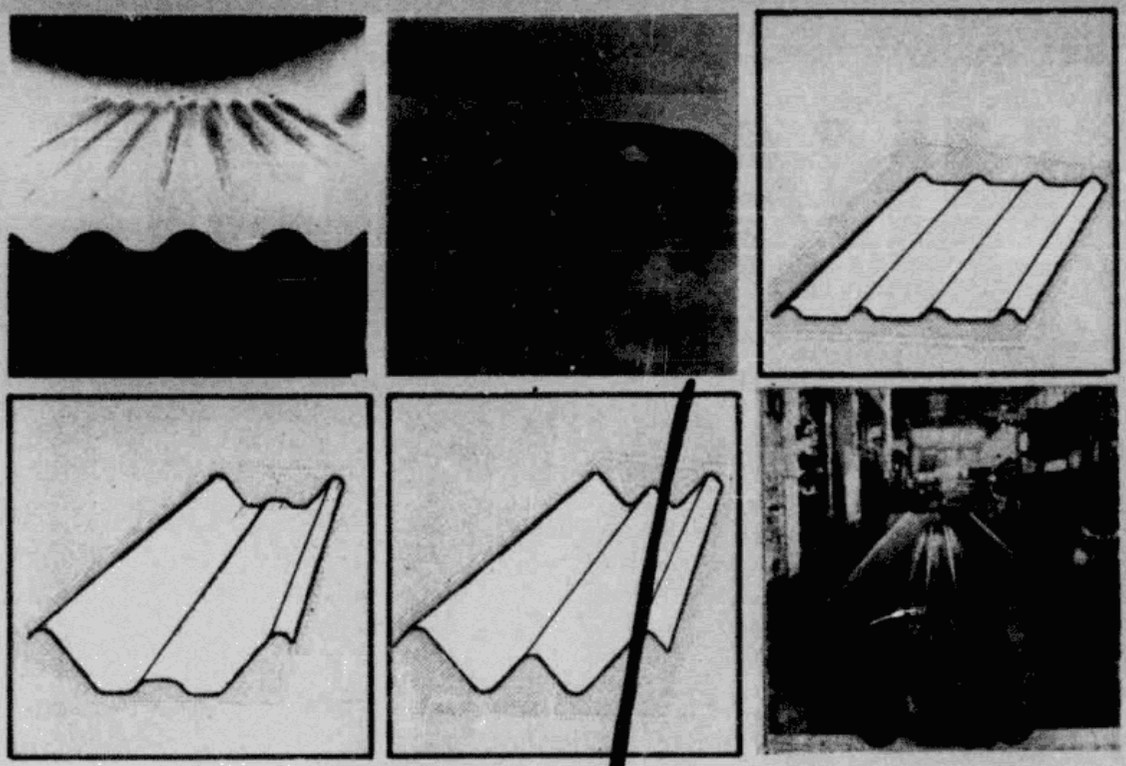
The British Government's Industrial Commission spent three months in the United States investigating business and industrial conditions. The Commission concluded that the success of the U.S. economy could be attributed, among other factors, to mass production, standardization and simplification of designs, friendly relations between capital and labor, the concentration of industry into large companies, cheap electric power, immense natural resources, installment buying and a huge domestic market unhampered by internal tariffs.

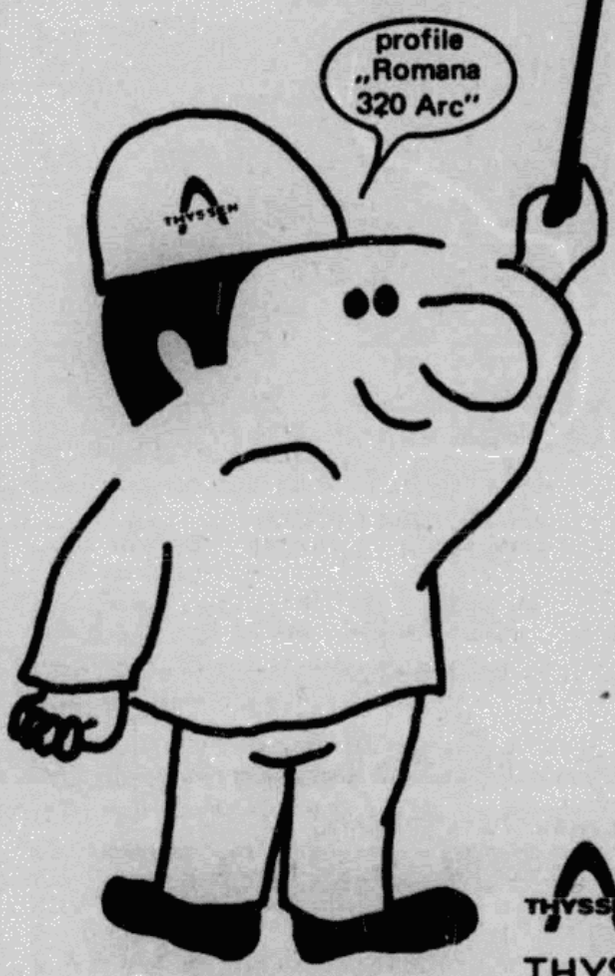
Asbestos Buildings Company, Ambler, Pennsylvania, was reported to have shipped a group of twelve prefabricated houses to be used by key employees of the new St. Louis plant of Asbestos Shingle, Slate & Sheathing Co. Wherever possible, use was made of asbestos sheets, shingles and other asbestos products made by the company. Practically every piece of material for each house was fabricated to exact size before shipment. Materials for each house were packed in a separate boxcar, ready for erection on foundations already in place at the St. Louis site. Asbestos Buildings Co. was far ahead of the times in pre-cutting and pre-assembling parts for such standardized housing units.

John M. High was elected Secretary and a Director of Norristown Magnesia & Asbestos Co. Mr. High was formerly connected with Johns-Manville.

The Superbestos Company, of Chicago, Illinois, underwent a reorganization including an infusion of additional working capital. New officers included H. S. Mikesell, President and Treasurer; F. Elizer, Secretary; and W. J. O'Hara, a Director, replacing Edwin S. Davis, retired.

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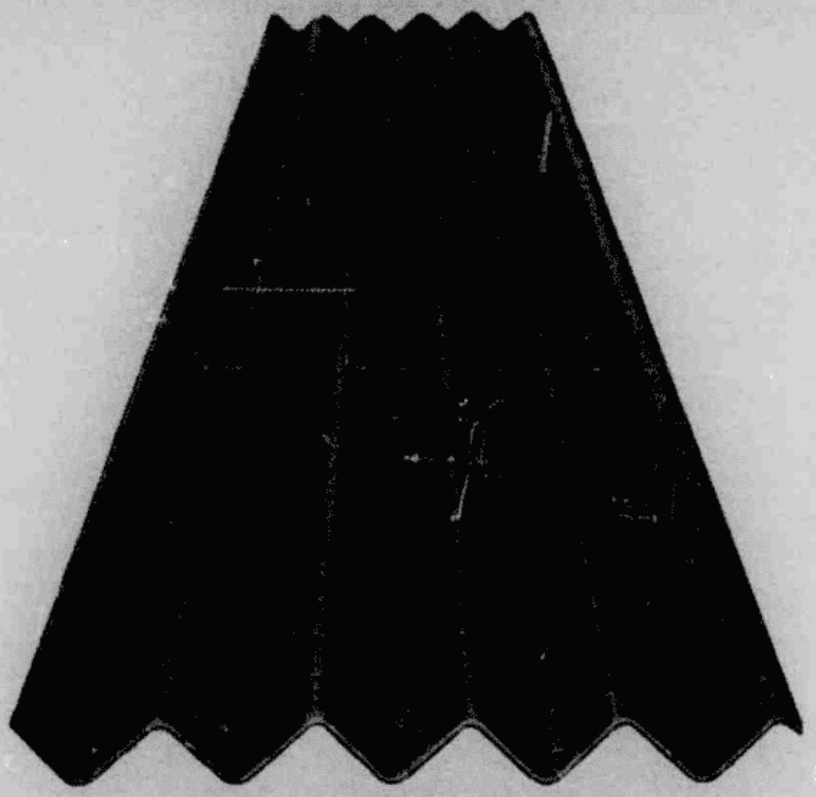
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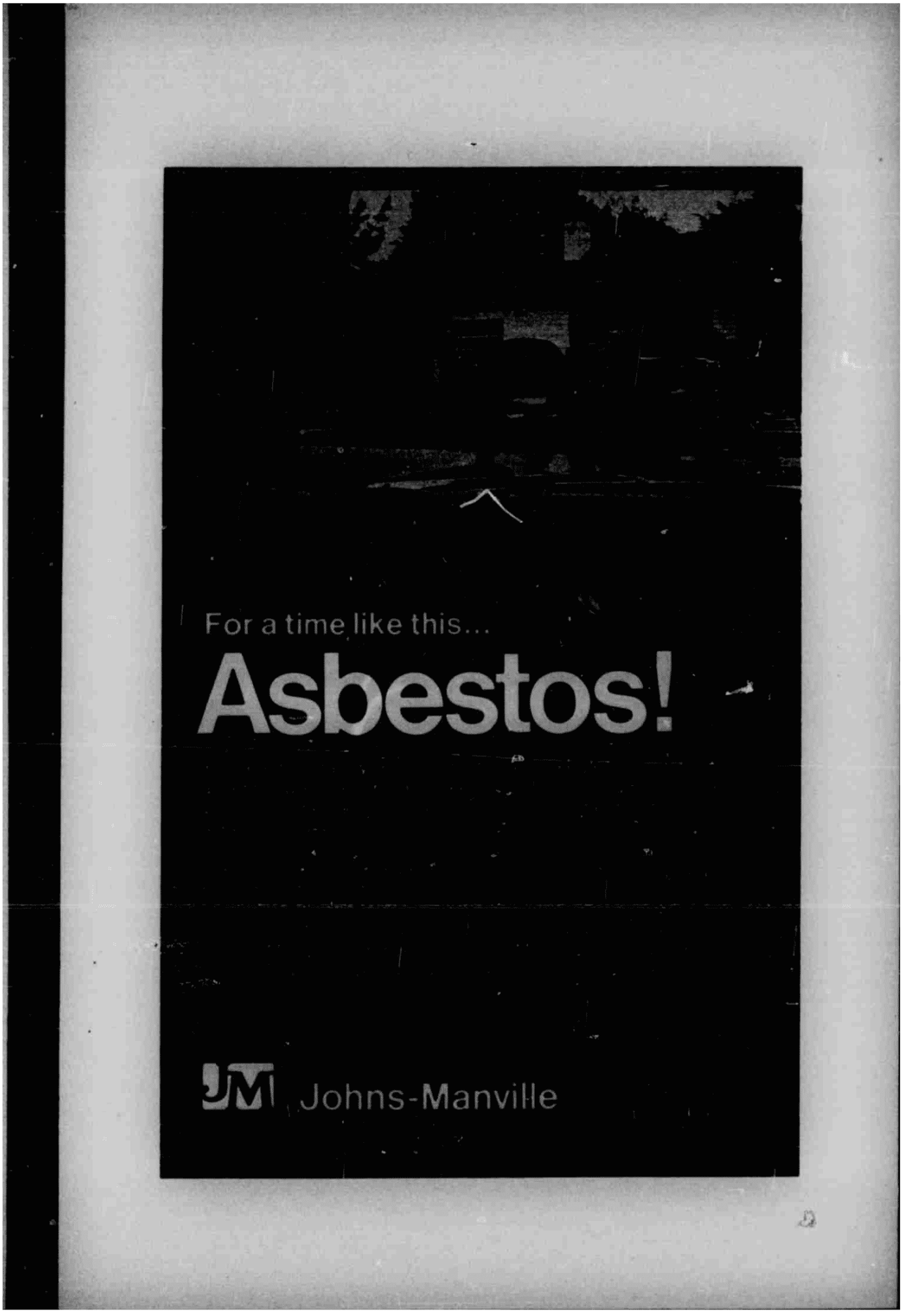
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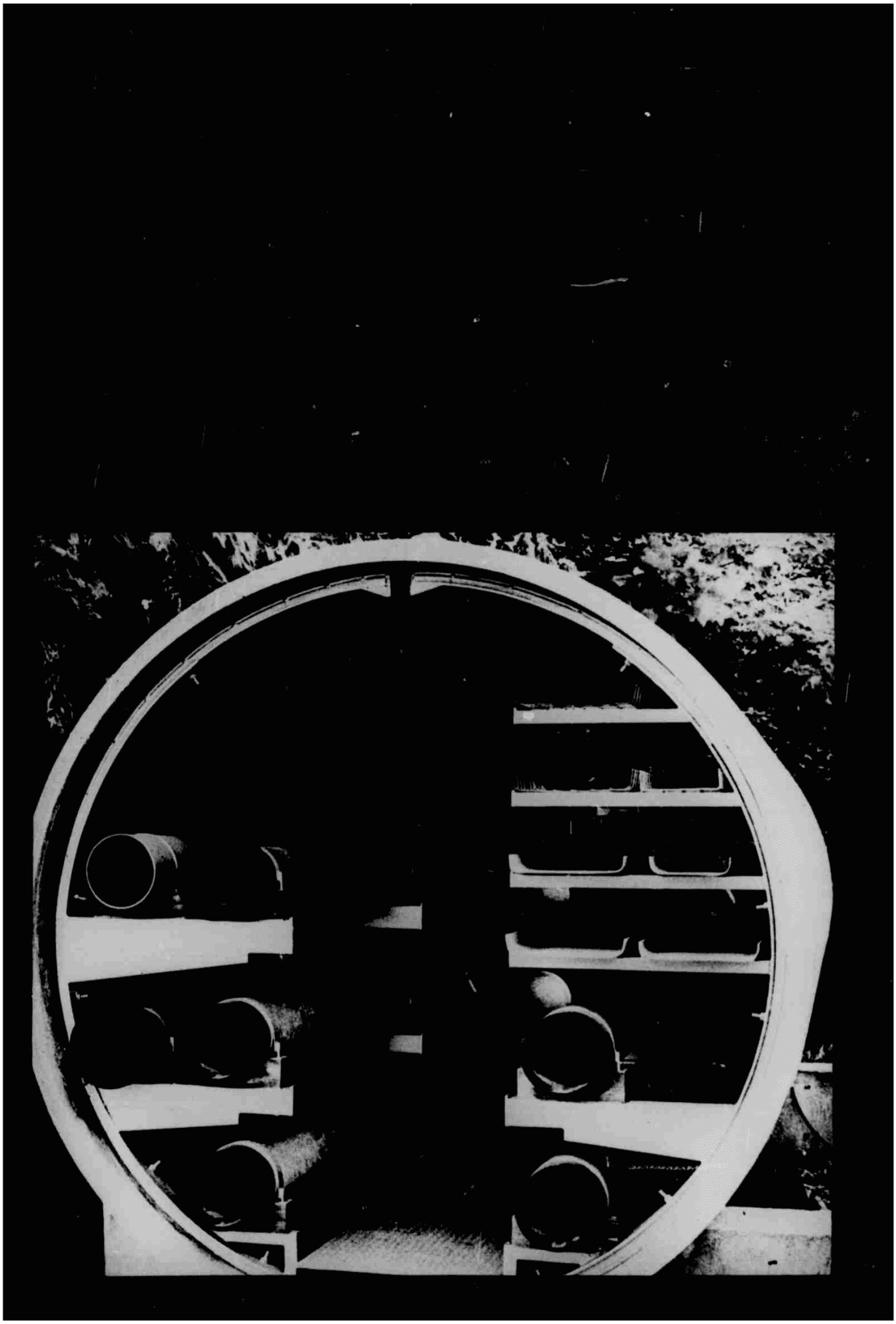
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