Alvin W. Boese Papers.

Interoffice Correspondence 3M

Subject: December 1967 Monthly Report

January 17, 1968

TO: A. W. BOESE - RETAIL TAPE & GIFT WRAP DIVISION - 220-8W

FROM: B. E. FRANK - RETAIL TAPE & GIFT WRAP DIVISION LAB - 230-B(35)

EQUIPMENT

The work that Herb Walden and you have done on the laboratory card has considerably improved the quality of our test webs. I understand that more changes are contemplated that will further improve both the carding process and also the removal of sample webs from the machine.

BINDERS

Again, this month we have utilized Rhoplex HA-8 as the major binder material for our test webs. By adding pigments, we have produced our first colored webs.

Three (3) new binders were tried -- Ucar 40, Hycar 1572, and Hycar 2600X92.

FIBERS

We have received all the fiber samples currently on order (approximately thirty-five types).

MAKING OF RESIN-BONDED SAMPLE WEBS

Our standard sample web, die-cut for bonding, was increased in size from 4" x 6" to 6" x 8". A series of processes for cutting, weighing, padding, drying, sampling, and testing have been set up and used on all our recent work. All drying has been done, under tension, at room conditions. Testing has been accomplished either on the Scott Tester for "rough" evaluations or on the Instron for precise work.

Three (3) studies have been substantially completed and will be reported separately:

1. Rhoplex HA-8, HA-12, and HA-16 were checked on 100% regular viscose webs (30% solids in each case). Half of each sample web was cured (for cross-linking of the resin) before testing.

2. Thirty percent HA-8 was used on a series of mixtures of regular viscose and high modulus viscose.

3. Comparison of HA-8 (30%) as a binder on 100% regular viscose webs was made with three (3) other binders (mentioned earlier).

Resin migration in the completed samples is still a major problem.

TESTING

Our testing program on the bonded webs has become rather elaborate. Pat Carey and I have coordinated our testing methods so that all data we collect will be directly comparable. Bonded samples are Instron checked for both crosswise and machine direction properties at jaw separations of 0.5" and 2.0". Each starting carded web is also checked at 0.5" jaw separation. This data should give us a complete picture of the effect of both fiber and binder on final material properties.

MISCELLANEOUS

My duties as safety representative for the area were terminated as of January 1, 1968.

Burton E. Franks

BEF:saj

cc: P. H. Carey - 230-B(35)
J. E. Corbin - 220-8W
A. H. Redpath - 220-8W

Interoffice Correspondence 3M COMPANY

Subject: ADDENDUM TO AMES CONTRACT

cc: D. W. McArthur
C. O. McMaster
A. J. Melberg
C. E. Naylor
R. J. Oace
F. A. Steldt
B. W. Weeks
G. P. Netherly

January 22, 1968

TO: A. W. BOESE
W. S. FRIEDLANDER
A. H. REDPATH
J. W. SELDEN

FROM: R. NORTON - NEW PRODUCTS DIVISION 219-1

As set forth in the contract between Mr. Sidney B. Ames and Minnesota Mining & Manufacturing Company, we expect from time to time append to the contract a record of ideas, materials and/or equipment which we believe have reached the marketable stage, and which we wish to have Mr. Ames sell in the toy industry.

When an addendum has been formalized, the subject matter is included within the terms of the Ames Agreement. This has the effect of binding 3M Company to pay Ames a share (one half) of the royalties received from sales by a toy manufacturer of the particular item involved.

The Retail Tape and Gift Wrap Division, several years ago, developed a means of producing preprinted "silk screens" for the hobbyist as the result of work by Mr. C. Bauer. The market evaluation at the time did not appear to be large enough for 3M. Mr. Ames has evaluated the possibility of making a toy hobby-type kit based on the preprinted "silk screen" and feels it can possibly be sold in the toy market. Since this product is already developed, we feel that Mr. Ames should determine the market feasibility by exposure to a toy manufacturer, probably Mattel. Consequently, we propose that the preprinted "silk screens" and accessories as described in Attachment "A" be released to Mr. Ames for sale and that Mr. Steldt be requested to prepare the necessary addendum to the Ames Contract.

If you concur, please so indicate by initialing and dating on the appropriate line below and return one copy to the writer. When we have received the approval of all interested parties, the approvals will be forwarded to Mr. Frank Steldt, who will carry out the legal steps necessary to make a formal attachment to the Ames Contract.

SIGNED: A. Bolsel

DATE: 1/26/48

R. Norton

R. Norton
ais

ATTACHMENT "A"

PREPRINTED "SILK SCREENS"

Mr. C. Bauer developed a process for making preprinted silk screens for the Ribbon Division. They were designed mainly for the hobbyist who wanted to make his own Christmas Cards by screen printing. The project never got beyond some market sampling.

Mr. Ames feels there may be a good potential here with a properly designed kit based on the simplicity of this screen printing approach.

The toy would include with the "silk screens"made to the designs of the toy company, a simple frame, tape, 3M Multi-purpose paint, and possibly art fabric, although paper may be preferred.

Retail Tape and Gift Wrap Division is investigating the present patent position but a design patent on the toy may have to be our minimum position as there is considerable past art in this area.

C/o 1/31

Interoffice Correspondence 3M

Subject: Meeting Notice

cc - R. W. Mueller
Medical Products Operating Committee
Retail Tape & Gift Wrap Operating Committee
Industrial Operating Committee

January 24, 1968

MEETING NOTICE

There will be a meeting of the Tape Division Operating Committees to review final 1967 results of the Tape Group, on Thursday, February 1, at 10:30 A.M., in the Sound Room - 220-1.

R. D. Peters/sjj
R. D. Peters

RDP:sjj

1/25/68

Soln.

A 40 grams Grade A hide glue
80 grams Cold water
soak until glue absorbs water
180 grams Cold water
% solid – 18.2%
150 gr 30% solid HA 8
mixed into glue at 130 °F the combined soln heated to about 120 °F
Above formula was used to saturate 35# ream wt 1.5 den 19/16
Viscose web (Carded

Soln Temp about 125 °F

The web was dipped into the soln between marquesette
and patted dry between towels

Hung room temp 15 min
and cured in oven @ 160 °F for 20 minutes

no finish web wts taken

Web highly compressed and well bonded allthough
it still has a tendency to split (poor center adh.) This is not
as pronounced as HA 8 saturated web (or other Rhoplexes)

The resin sant seems to form films at the interstices
of the fibers and form thicker films than HA 8 soln

This bears further investigation

NB

Technical Awareness Gazette

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VOLUME 6 NO. 2
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OB U2
A. W. Boese 220-8W
Retail Tape & Gift Wrap Division

3M COMPANY

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ITEM A. REFERENCE: D.D.C. DOCUMENT

FIELD RANGE AND RESOLUTION IN HOLOGRAPHY.

D.D.C.
LASER
LIGHT
OPTICS
PHOTOGRAPHY

THE ARTICLE DESCRIBES A MODEL FOR PREDICTING THE EFFECTS OF FINITE HOLOGRAM-EMULSION RESOLVING POWER ON THE RANGE OF FIELD RECORDED IN THE HOLOGRAM AND THE RESOLUTION IN THE RECONSTRUCTED IMAGE. THE OBJECT MUST BE LOCATED WITHIN A PRESCRIBED VOLUME ABOUT THE PHASE REFERENCE POINT TO ATTAIN A CERTAIN REQUIRED RESOLUTION IN THE RECONSTRUCTED IMAGE DETERIORATES. A HOLOGRAM AND ITS RECONSTRUCTION SYNTHESIZED BY NUMERICAL EVALUATION OF THE FRESNEL-KIRCHHOFF INTEGRAL SUPPORTS THIS MODEL. PICTURES TAKEN IN VARIOUS IMAGE PLANES OF A THICK OBJECT ARE SHOWN. THE LIMITED RANGE OF FIELD IS NOT A PROBLEM IN MICROSCOPY BECAUSE OF THE SMALL SIZE OF THE SPECIMEN, SO THAT COMPLETE THREE-DIMENSIONAL RECORDS OF A MICROSCOPE SPECIMEN CAN BE MADE IN A SINGLE MICROHOLOGRAM.

ADXX 649,601 R.VANSTRUM

ITEM B. REFERENCE: D.D.C. DOCUMENT

ANALYSIS OF THE FUTURE.. THE DELPHI METHOD.

D.D.C.
FORECAST
PROBABILITY
SYSTEM

THE DELPHI TECHNIQUE, IN ITS SIMPLEST FORM ELIMINATES COMMITTEE ACITIVITY AMONG THE EXPERTS ALTOGETHER AND REPLACES IT WITH A CAREFULLY DESIGNED PROGRAM OF SEQUENTIAL INDIVIDUAL INTERROGATIONS (USUALLY BEST CONDUCTED BY QUESTIONNAIRES) INTERSPERSED WITH INFORMATION AND OPINION FEEDBACK.

ADXX 649,640 R.VANSTRUM

ITEM C. REFERENCE: D.D.C. DOCUMENT

LASER MATERIALS RESEARCH.

D.D.C.
EXCITATION
GLASS
LASER
LUMINESCENCE
MATERIAL

STUDIES OF NON-RADIATIVE ENERGY TRANSFER IN DOUBLY AND TRIPLY ACTIVATED GLASSES ARE REPORTED. THE UTILIZATION OF THIS ENERGY TRANSFER IN STIMULATED EMISSION PROCESSES IN THESE GLASSES HAS BEEN INVESTIGATED AND HAS YIELDED EXPECTED BENEFITS AS WELL AS SOMEWHAT UNEXPECTED RESULTS. SOME OF THESE EFFECTS ARE.. MUTUAL QUENCHING OF COACTIVATOR LUMINESCENCE PREVENTING THE STIMULATED EMISSION OF EITHER ACTIVATOR SPECIES, CONTROLLABLE SELECTION OF THE LASING SPECIES IN DOUBLY AND TRIPLY ACTIVATED GLASS, INTERNAL OR SELF Q SWITCHING, AND ULTRAVIOLET RADIATION-INDUCED MODULATION OF STIMULATED EMISSION.

ADXX 649,670 R.VANSTRUM

ITEM A. REFERENCE: D.D.C. DOCUMENT

INFRARED STUDY OF THE NATURE OF THE HYDROXYL GROUPS ...

ADSORPTION
D.D.C.
GLASS
HYDROXIDE
INFRARED
POROSITY

THE SLOW DEHYDRATION AND DEHYDROXYLATION OF POROUS VYCOR GLASS WAS FOLLOWED BY INFRARED SPECTROSCOPIC TECHNIQUES. TWO SHARP BANDS AT 3748 AND 3703/CM AND ALSO TWO SHOULDERS NEAR 3850 AND 3650/CM WERE OBSERVED. DEHYDROXYLATION, DEUTERATION, FLUORIDATION AND ADSORPTION EXPERIMENTS SHOWED ALL ABSORPTIONS TO BE DUE TO SURFACE HYDROXYL SPECIES. THE 3748/CM ABSORPTION IS DUE TO FREE SURFACE SILANOL GROUPS. THE 3650/CM SHOULDER IS DUE TO OH VIBRATIONS PERTURBED BY HYDROGEN BONDING. THE 3703/CM BAND HAS A HALF-WIDTH OF 5 TO 14 CM AND CAN ONLY BE OBSERVED AT RELATIVELY LOW SURFACE COVERAGE. IMPREGNATION OF SILICA AND POROUS GLASS WITH BORIC ACID PRODUCED A BAND AT 3703/CM WITH THE SILICA AND ENHANCED THAT FOUND WITH THE GLASS, LEADING TO THE ASSIGNMENT OF THE 3703/CM BAND TO A B-OH SURFACE STRUCTURE. THE NATURE OF THE SPECIES RESPONSIBLE FOR THE 3850/CM SHOULDER IS UNCERTAIN.

ADXX 649,711 R.VANSTRUM

ITEM B. REFERENCE: D.D.C. DOCUMENT

CHARACTERIZATION OF MATERIALS.

ANALYSIS
CHARACTERIZATION
D.D.C.
MATERIAL
PROPERTY
TESTING

THE TERM, CHARACTERIZATION, AS USED IN THIS REPORT MEANS ESSENTIALLY A DESCRIPTION OF THOSE FEATURES OF THE COMPOSITION AND STRUCTURE (INCLUDING DEFECTS) OF A MATERIAL THAT ARE SIGNIFICANT FOR A PARTICULAR PREPARATION, STUDY OF PROPERTIES, OR USE, AND SUFFICE FOR REPRODUCTION OF THE MATERIAL. SUCH WORK ON CHARACTERIZATION IS, AT PRESENT, FRAGMENTED AS A FIELD. WHILE PRACTICALLY EVERY LABORATORY USING MATERIALS MAKES SOME SPECIALIZED MEASUREMENTS WHICH MAY PARTIALLY DEFINE A MATERIAL, RARELY (IF EVER) DO WE GET INDEPENDENTLY AND THOROUGHLY CHARACTERIZED MATERIALS. IN A WORD, MATERIALS CHARACTERIZATION, THE CORNERSTONE OF MATERIALS SCIENCE, IS A NEGLECTED FIELD. THIS COMMITTEE, CHARGED WITH MAKING A DETAILED STUDY OF CHARACTERIZATION IN TERMS OF COMPOSITION, STRUCTURE, DEFECTS, POLYCRYSTALS, AND POLYMERS, HAS DOCUMENTED THE STATE OF THE ART IN OUR ABILITY TO PREPARE A MATERIAL, ANALYZE IT (COMPOSITION, STRUCTURE, AND DEFECTS), AND IN TURN TO CORRELATE THESE TO PROPERTY MEASUREMENTS. THE STUDY ALSO ASSESSES THE SITUATION SURROUNDING SOME OF THE GREATEST NEEDS FOR CHARACTERIZATION. E.G., (A) BETTER TECHNIQUES AND INSTRUMENTS, OR MORE AND BETTER USE OF EXISTING TECHNIQUES AND INSTRUMENTS, (B) ....

ADXX 649,941 R.VANSTRUM

ITEM A. REFERENCE: D.D.C. DOCUMENT

INFRARED COATING STUDIES.

COAT
D.D.C.
INFRARED
OPTICS
VAPOR-COATING

THE WORK WAS CENTERED ON VACUUM COATING MATERIALS FOR THE FAR INFRARED SPECTRUM. FOUR MATERIALS WERE STUDIED IN DETAIL. THESE INCLUDED PB12, TLCL, AND TWO ORGANIC MATERIALS, NEUTRAL RED DYE, AND AUROMINE O DYE. USING THE DATA OBTAINED IN THESE STUDIES, TWO LOW PASS FILTER DESIGNS WERE FORMULATED. THE DESIGNS INCORPORATE SILICON SUBSTRATES WITH EVAPORATED FILMS OF MGO AND TLCL. HIGH TRANSMITTANCE BEYOND 30 MICONS IS OBTAINED.

ADXX 650,222 R.VANSTRUM

ITEM B. REFERENCE: D.D.C. DOCUMENT

DEVELOPMENT OF SOLVENT-RESISTANT SEALANTS.

D.D.C.
EPOXY-RESIN
FLUORO
POLYURETHANE
RESISTANCE
SEALER
SOLVENT

URETHANE TYPE SEALANTS COMPOUNDED FROM CF3 AND C7F15 CONTAINING POLYETHER TRIOLS, TOLUENE DIISOCYANATE AND MOISTURE CURED WERE DEVELOPED WITH GOOD RESISTANCE TO PAINT-STRIPPER SOLVENTS, HIGH MECHANICAL PROPERTIES AND EXCELLENT ADHESION TO ALUMINUM SUBSTRATE. A NUMBER OF FLUORINE-CONTAINING MONO- AND DIGLYCIDYLETHERS, PERFLUORINATED EPOXIDES AND FLUORINE-RICH DIAMINES AND POLYOLS WERE SYNTHESIZED FOR COMPOUNDING INTO URETHANE- AND EPOXY-TYPE SEALANTS. IT IS RECOMMENDED TO CARRY OUT A DETAILED EVALUATION OF THE COMPOUNDS TO SELECT A CANDIDATE FOR FIELD TRIAL.

ADXX 650,315 R.VANSTRUM

ITEM C. REFERENCE: D.D.C. DOCUMENT

THE YEAR 2000.

THE AUTHOR DISCUSSES VARIOUS PREDICTIONS ABOUT CONDITIONS ON EARTH IN THE YEAR 2000.

AIR
COMPUTER
CONTAMINATION
D.D.C.
FORECAST
RESEARCH
WATER

ADXX 650,501 R.VANSTRUM

ITEM A. REFERENCE: D.D.C. DOCUMENT

THE SKILLS OF LEADERSHIP.

D.D.C.
HUMAN
MANAGEMENT
PERSONNEL

THE ULTIMATE CRITERION OF EFFECTIVE LEADERSHIP CAN ONLY BE THE QUALITY OF PERFORMANCE DEMONSTRATED BY AN ORGANIZATION'S PERSONNEL, BOTH INDIVIDUALLY AND AS A UNIT. THIS MEANS THAT A COMMANDER HAS FAILED IF HE DOES NOT IMPROVE, OR AT LEAST MAINTAIN, THE PERFORMANCE CAPABILITIES OF THE ORGANIZATION ENTRUSTED TO HIM. HE HAS FAILED IF HE DOES NOT INFLUENCE HIS PERSONNEL TO PERFORM THE DUTIES ASSIGNED TO THEM. PERFORMANCE REMAINS, OF NECESSITY, BOTH THE AIM AND THE PROOF OF HIS LEADERSHIP. ACCORDINGLY, EACH DELIBERATION OF LEADERSHIP PROBLEMS, EACH LEADERSHIP DECISION, AND EACH LEADERSHIP ACT MUST HAVE AS A FIRST CONSIDERATION ITS EFFECT UPON PERFORMANCE. WHEN VIEWED IN THIS WAY, IT IS CLEAR THAT LEADERSHIP IS THE PROCESS OF INFLUENCING INDIVIDUALS AND ORGANIZATIONS TO OBTAIN DESIRED RESULTS. IT IS ALSO APPARENT THAT THE SKILLS REQUIRED TO EXERCISE SUCH INFLUENCE EFFECTIVELY BECOME HIGHLY IMPORTANT.

ADXX 650,712 R.VANSTRUM

ITEM B. REFERENCE: D.D.C. DOCUMENT

MECHANICS OF COMPOSITE MATERIALS.

COMPOSITE
D.D.C.
FIBER
LAMINATE
MECHANICS
THEORY

THE REPORT COVERS SOME OF THE PRINCIPLES OF THE MECHANICS RELEVANT TO THE DESCRIPTION OF COMPOSITE MATERIALS. THE CONTENTS OF THESE NOTES MAY PROVIDE USEFUL INFORMATION FOR THE UNDERSTANDING OF CURRENT PUBLICATIONS AND REPORTS RELATED TO COMPOSITE MATERIALS. EMPHASIS IS PLACED ON THE USE OF INDICIAL NOTATION AND OPERATIONS. THE RULES GOVERNING THE USE OF THE CONTRACTED NOTATION ARE ALSO OUTLINED. THE GENERALIZED HOOKE'S LAW AND ITS TRANSFORMATION PROPERTIES, MATERIAL SYMMETRIED, AND ENGINEERING CONSTANTS ARE ALSO DISCUSSED. THE PLANE STRAIN AND PLANE STRESS PROBLEMS ARE DISCUSSED IN DETAIL. FINALLY, THE ELASTIC MODULI OF LAMINATED ANISOTROPIC MATERIALS, AND THE STRENGTH OF BOTH UNIDIRECTIONAL AND LAMINATED COMPOSITES ARE COVERED.

ADXX 650,829 R.VANSTRUM

ITEM A. REFERENCE: D.D.C. DOCUMENT

DEVELOPMENT OF A PAVEMENT HEATING SYSTEM TO REMOVE ...

AVIATION
D.D.C.
HEATING
LIGHT
PAVEMENT
SNOW
SYSTEM

THE HEATING REQUIREMENTS FOR SNOW MELTING WERE FOUND TO VARY WIDELY WITH METEOROLOGICAL CONDITIONS. A SATISFACTORY METHOD OF DETERMINING HEATING REQUIREMENTS FOR A LOCATION IS PRESENTED.. THIS METHOD IS BASED ON THE ASHRAE GUIDE AND DATA BOOK. FOR AIRPORT USE, A SYSTEM ADEQUATE FOR 98 PERCENT OF THE SNOWFALL HOURS WAS SELECTED FOR SNOW REMOVAL IN FRONT OF INSET LIGHTS. SOME MINOR SNOW ACCUMULATION MAY OCCUR DURING SEVERE STORMS, BUT SUCH SEVERE CONDITIONS WOULD LIMIT RUNWAY USE FOR REASONS OTHER THAN SNOW ACCUMULATION DURING THIS TIME PERIOD. ELECTRICAL HEATERS AND A SIMPLE HEAT PUMP WERE INSTALLED AT NAFEC FOR EVALUATION. THE HEAT PUMP CONSISTED OF AN INVERTED L-SHAPED SEALED PIPE WHICH CONTAINED LIQUID AMMONIA, IN THE VERTICAL LEG. IT WAS FOUND THAT SIMPLE HAIRPIN, OR W-SHAPED, ELECTRICAL HEATER PATTERNS OPERATED AT 25 TO 50 WATTS PER LINEAL FOOT AT A DEPTH OF 1 INCH WERE SATISFACTORY FOR BOTH ASPHALT AND CONCRETE SURFACES. THE HEAT-PUMP DESIGN, AS USED, WAS NOT ADEQUATE FOR THE PERFORMANCE DESIRED. HOWEVER, A REDESIGN SHOULD INCREASE ITS HEATING CAPACITY. THE COST FOR INSTALLING AN ELECTRICAL HEATER, THE NECESSARY SUPPLY WIRING, AND THE TRANSFORMERS WAS ESTIMATED AT ABOUT $200 EACH FOR A TYPICAL ALL ....

ADXX 650,907 R.VANSTRUM

ITEM B. REFERENCE: D.D.C. DOCUMENT

DEVELOPMENT OF A LOW COST SECONDARY AIRPORT LIGHTING...

AVIATION
COST
D.D.C.
LIGHT
SYSTEM
VISIBILITY

LOW CAPITAL COST OF A LIGHTING SYSTEM FOR VFR NIGHT OPERATIONS AT SECONDARY AIRFIELDS CAN BE ACHIEVED USING A THREE-FOLD DESIGN APPROACH. THIS DESIGN APPROACH EMPLOYS PULSED INCADESCENT LAMPS IN PLACE OF XENON FLASH TUBES, AND SUBSTITUTES FLUORESCENT LIGHTS FOR STEADY BURNING INCANDESCENT SOURCES WHEN FEASIBLE. IN ADDITION, IT SIZES WIND INDICATORS TO THE LEGIBILITY NEEDS OF TYPICAL SECONDARY AIRPORT OPERATIONS. THE MAJOR COMPONENTS OF A LIGHTING SYSTEM DESCRIBED INCLUDE RUNWAY EDGE LIGHTS, STEADY BURNING APPROACH AND THRESHOLD LIGHTS, WIND TEE, ROTATING BEACON, GLIDE SLOPE INDICATOR, AND OBSTRUCTION LIGHTS. A FIELD TEST OF THE PROTOTYPE IS RECOMMENDED TO EVALUATE THE OPERATIONAL USEFULNESS OF THE LOW COST LIGHTING. ALSO RECOMMENDED, IS THE INITIATION OF A NEW WIND INDICATOR DESIGN, BASED ON THE MINIMUM RESOLUTION OF WIND SPEED AND DIRECTION NEEDED FOR SECONDARY AIRPORT OPERATIONS.

ADXX 650,919 R.VANSTRUM

ITEM A. REFERENCE: D.D.C. DOCUMENT

EFFECT OF ADSORBED WATER UPON THE SPREADING OF ORGA...

ADSORPTION CONTACT-ANGLE D.D.C. GLASS ORGANIC SURFACE-TENSION WATER	RESULTS ARE GIVEN OF AN INVESTIGATION OF THE EXTENT TO WHICH WATER ADSORBED ON A SILICATE GLASS SURFACE AFFECTS THE SPREADING AND THE EQUILIBRIUM CONTACT ANGLE OF VARIOUS PURE ORGANIC LIQUIDS. OF SPECIAL INTEREST IS THE EFFECT OF THE TRANSITION OF THE PHYSICALLY ADSORBED WATER FILM FROM A POLYMOLECULAR TO A MONOMOLECULAR FILM. THESE RESULTS CAN BE RELATED TO THE EFFECT OF ADSORBED WATER ON THE SPREADING OR ADHESION OF RESINS TO GLASS AND OTHER HYDROPHILIC SOLIDS AND TO THE PROBLEM OF DEVELOPING BETTER ADHESIVES FOR DENTAL FILLINGS.

ADXX 651,056 R.VANSTRUM

ITEM B. REFERENCE: D.D.C. DOCUMENT

STUDIES OF CERAMIC PROCESSING.

CERAMIC D.D.C. GLASS HIGH-TEMPERATURE PROCESS SINTERING	THE OBJECTIVE OF THE PROGRAM IS TO IMPROVE THE STRUCTURE OF CERAMICS BY PROCESSING. THE OVER-ALL TEMPERATURE RANGE OF INTEREST IS 1800 TO ABOVE 3000 F. IN THE HIGH PORTION OF THE RANGE, 3000 F AND ABOVE, COMPOSITIONS OF PURE ALUMINA PLUS 0 TO 2 PER CENT ADDITIONS OF MGO WERE STUDIED BETWEEN 2822 AND 3180 F, AT 1 TO 7 HOUR SOAKING PERIODS AND IN ATMOSPHERES OF HYDROGEN, HELIUM AND VACCUUM. THE ANALYSIS OF RESULTS IS REPORTED. PETROGRAPHIC, X-RAY, D.C. CONDUCTIVITY, ELECTRON TRANSMISSION AND ELECTRON PROBE METHODS WERE USED AND THE RESULTS ARE REPORTED. THE LOW RANGE, 1800 TO 2600 F, WAS STUDIED USING THE DEVITRIFICATION APPROACH TO THE PREREACTED MATERIALS TECHNIQUE. THE AREA OF CRYSTALLIZATION OF CORDIERITE IN THE MGO.AL2O3.SIO2 SYSTEM WAS EVALUATED AS A SINGLE GLASS SYSTEM. A TWO-GLASS SYSTEM, IN WHICH ONE GLASS DEVITRIFIES CORDIERITE AND THE SECOND SUPPLIES THE BONDING SYSTEM, WAS STUDIED. BONDING GLASS COMPOSITIONS WERE EVALUATED IN THE RO.AL2O3.SIO2 SYSTEM, IN WHICH THE RO MEMBERS ARE ALKALINE EARTH OXIDES. COMPOSITES WERE MADE AT 10, 20 AND 30 PER CENT BONDING GLASS. PROCESSING, STRUCTURES AND PROPERTIES ARE REPORTED.

ADXX 651,061 R.VANSTRUM

ITEM A. REFERENCE: D.D.C. DOCUMENT

WETTING OF HIGH AND LOW ENERGY SURFACES BY LIQUID ...

ADHESIVE
BOND
CONTACT-ANGLE
D.D.C.
ENERGY
EPOXY-RESIN
LIQUID
POLYAMIDE
SURFACE
WETTING

AN INVESTIGATION WAS CONDUCTED TO DETERMINE THE RELATIONSHIP BETWEEN ADHESIVE WETTING AND ADHESION TO CERTAIN ADHERENDS. THE DEGREE OF WETTING WAS DETERMINED BY MEASURING CONTACT ANGLES WITH A CONTACT ANGLE GONIOMETER. THE EFFECTS ON CONTACT ANGLES OF CHANGING THE SURFACE TREATMENT OF THE POLYETHYLENE AND ALUMINUM SPECIMENS WAS STUDIED. NEXT THE ANGLES WERE CHANGED BY VARYING THE ADHEREND ITSELF RATHER THAN JUST THE SURFACE PREPARATION. POLYETHYLENE, ALUMINUM, AND GLASS LAMINATE WERE USED FOR THE PURPOSE. FINALLY, THE LIQUID ADHESIVES THEMSELVES WERE CHANGED IN ORDER TO VARY WETTING AND DETERMINE WHETHER OR NOT A SPECIFIC RELATIONSHIP EXISTS BETWEEN WETTING AND BOND STRENGTH. ADHESIVES USED WERE (1) EASTMAN 910, A CYANOACRYLATE ADHESIVE. (2) EPON 828/VERSAMID 140, A POLYAMIDE-MODIFIED BISPHENOL A TYPE EPOXY. AND (3) KOPOXITE 159/ VERSAMID 140, A POLYAMIDE-MODIFIED RESORCINOL-TYPE EPOXY.

ADXX 651,093 R.VANSTRUM

ITEM B. REFERENCE: D.D.C. DOCUMENT

INVESTIGATION OF BONDING IN OXIDE-FIBER (WHISKER) ...

COMPOSITE
CRYSTAL
D.D.C.
FIBER
METAL
NICKEL
REINFORCED
WETTING

FACTORS AFFECTING THE WETTING AND BONDING OF NICKEL TO SAPPHIRE (ALPHA-AL2O3) WERE INVESTIGATED IN A CONTINUING STUDY. THE EFFECTS ON THE WETTING BEHAVIOR .001 TO 1.0 ATOMIC PERCENT OF ACTIVE METAL ADDITIVES TO THE NICKEL WERE STUDIED IN DETAIL. A SERIES OF 35 SESSILE DROP EXPERIMENTS WERE PERFORMED AND THE RESULTS WERE ANALYZED TO DETERMINE SOME OF THE PARAMETERS WHICH AFFECT THE WETTING. THE CRYSTALLOGRAPHIC ORIENTATION OF THE SAPPHIRE SUBSTRATE AND A 'LOCKING-IN' OF THE CONTACT ANGLE HAD A PROFOUND INFLUENCE ON THE MEASURED CONTACT ANGLE, AND THIS INFLUENCE INCREASED WITH INCREASING TIME AT MELTING.

ADXX 651,190 R.VANSTRUM

ITEM A. REFERENCE: D.D.C. DOCUMENT

CREATIVITY.. YESTERDAY, TODAY, AND TOMORROW.

CREATIVITY
D.D.C.
EDUCATION
HUMAN
INVENTION
PSYCHOLOGY

NINETEENTH CENTURY SCIENCE NEGLECTED CREATIVITY, AND THE LIMITED TWENTIETH CENTURY APPROACH (TO 1950) WAS LARGELY ANECDOTAL. RECENTLY, RESEARCH HAS MULTIPLIED, ALTHOUGH IT HAS INVOLVED LITTLE EXPERIMENTAL HYPOTHESIS TESTING. CREATIVITY COMPRISES MANY DISCRETE ABILITIES WHICH OFTEN DO NOT CORRELATE VERY MUCH WITH EACH OTHER, AND CREATIVITY AND IQ CORRELATE SUBSTANTIALLY ONLY AT LOWER IQ LEVELS. MUCH WORK HAS BEEN DONE IN DEVELOPING EVALUATIVE CRITERIA FOR CREATIVE SCIENTIFIC PRODUCTION, AND ON TEACHING AND LEARNING CREATIVITY. FUTURE BASIC RESEARCH SHOULD CONCERN TRANSFER RECALL, TRANSFORMATIONS, RECLASSIFICATION, ELABORATION, INCUBATION, ENVIRONMENTAL CONDITIONS, AND MOTIVATION. THE SOCIAL CONSEQUENCES OF RELEASING CREATIVE ABILITIES ARE POTENTIALLY ENORMOUS.

ADXX 651,271 R.VANSTRUM

ITEM B. REFERENCE: D.D.C. DOCUMENT

MICROVOIDS IN GLASS-FILAMENT-WOUND STRUCTURES.. THEIR

D.D.C.
DEFECT
POROSITY
REINFORCED-PLAST
SHEAR
TESTING

MEASUREMENT, MINIMIZATION, AND CORRELATION WITH INTERLAMINAR SHEAR STRENGTH. A STATISTICAL POINT-COUNT METHOD ADAPTED FROM PENTROGRAPHIC MODAL ANALYSIS WAS STUDIED AS A QUANTITATIVE MEANS OF MEASURING VOID CONTENT IN FILIMENT WOUND COMPOSITES AND TENTATIVELY APPEARS TO BE A MORE PRECISE, RAPID, AND VERSATILE METHOD THAN OTHER TECHNIQUES PRESENTLY BEING USED, ESPECIALLY AT LOW-VOID-CONTENT LEVELS (GREATER THAN 1 VOL-PER CENT). LOW-VOID-CONTENT (GREATER THAN 1 VOL-PER CENT) FILAMENT-WOUND NOL RINGS WERE FABRICATED BY A CONTINUOUS SINGLE-STRAND-WINDING PROCESS AND RESIN IMPREGNATION AT REDUCED PRESSURE WITH THE VACUUM APPLIED ONLY TO THE RESIN BATH. WORKING OF THE STRAND DURING THE RESIN IMPREGNATION STEP BY VARIOUS CONFIGURATIONS OF GUIDE ROLLS AND STRAND VIBRATING DEVICES EITHER AT ATMOSPHERIC OR REDUCED PRESSURE WAS RELATIVELY INEFFECTIVE IN DECREASING VOID CONTENT AS COMPARED WITH VACUUM RESIN IMPREGNATION ALONE. REGRESSION CORRELATION ANALYSIS STUDIES HAVE SHOWN THAT A LINEAR INVERSE RELATIONSHIP EXISTS BETWEEN THE INTERLAMINAR SHEAR STRENGTH AND THE VOID CONTENT OF NOL RINGS AND THAT VOID CONTENT IS THE PRIMARY FACTOR INFLUENCING INTERLAMINAR SHEAR STRENGTH. THE HIGH DEGREE OF CORRELATION ....

ADXX 651,294 R.VANSTRUM

ITEM A. REFERENCE: D.D.C. DOCUMENT

MICROSTRUCTURE AND ITS INFLUENCE ON STRENGTH.

CERAMIC D.D.C. DEFORMATION GRAIN POLYCRYSTALLINIT POROSITY	A BRIEF REVIEW OF THE EFFECT OF TRADITIONAL MICRO-STRUCTURAL VARIABLES ON THE STRENGTH OF SINGLE-PHASE POLYCRYSTALLINE CERAMICS IS PRESENTED. COMPLICATING FACTORS SUCH AS SURFACE CONDITION, PURITY LEVEL, STRESS CORROSION, OR STATIC FATIGUE, RESIDUAL STRAINS, AN APPARENTLY BENEFICIAL ROLE PLAYED BY RELATIVELY LARGE PORES, AND EVEN DIFFICULTIES IN MEASURING GRAIN SIZE TEND TO OBSCURE 'INTRINSIC' RELATIONSHIPS. NONETHE-LESS, IT HAS BEEN TENTATIVELY ESTABLISHED THAT A MAJOR ROUTE TOWARD IMPROVED MECHANICAL PROPERTIES IS THE DEVELOPMENT OF FABRICATION TECHNIQUES THAT RESULT IN PORE-FREE CERAMICS WITH EVER-DECREASING GRAIN SIZES. RECENT RESULTS ARE SUMMARIZED FOR THE INTERRELATION-SHIPS AMONG PRESSURE-SINTERING PROCESSING IN THE LOW-TO-HIGH PRESSURE REGIMES, RESULTING MICROSTRUCTURES, AND STRENGTHS, PARTICULARLY FOR NEAR SUBMICRON GRAIN SIZE CERAMIC OXIDES. WHILE STRENGTH INCREASES WITH DE-CREASING GRAIN SIZE APPEAR TO BE LIMITED BY STRUCTURAL SUBTLETIES FROM PROCESSING, CONSIDERABLE RELATIVE STRENGTHENING IS POSSIBLE WITH PROCESSING VARIATIONS AND POST-FABRICATION TREATMENTS (THERMAL, THERMOMECH-ANICAL). AN INNOVATION IN THE MECHANISM OF STRENGTH-ENING OF DENSE FINE-GRAINED CERAMICS AS A RESULT ....

ADXX 651,340 R.VANSTRUM

ITEM B. REFERENCE: D.D.C. DOCUMENT

POLYAMIDE-DIPHENOLIC ACID WASH PRIMER.

ACID COAT CORROSION D.D.C. PAINT POLYAMIDE PRIMER SALT-SPRAY	A SOLID POLYAMIDE RESIN CONTAINING DIPHENOLIC ACID WAS FORMULATED INTO ONE AND TWO PACKAGE WASH PRIMERS AND EVALUATED AGAINST THE CONTROL PRETREATMENT PRIMER, MIL-C-15328, FOR SALT SPRAY AND WATER IMMERSION RESISTANCE ON STEEL, ALUMINUM AND MAGNESIUM SUBSTRATES. DIFFER-ENCES IN PERFORMANCE BETWEEN MIL-C-15328 AND THE TWO PACKAGE DIPHENOLIC ACID WASH PRIMER WERE NEGLIGIBLE.. HOWEVER, THE ONE PACKAGE WASH PRIMERS WERE INFERIOR TO THE TWO PACKAGE ONES, PARTICULARLY IN WATER IMMERSION.

ADXX 651,386 R.VANSTRUM

ITEM A. REFERENCE: D.D.C. DOCUMENT

THE PACIFIC OCEAN. CHEMISTRY OF THE PACIFIC OCEAN.

CHEMICAL
D.D.C.
WATER

THE VOLUME REPRESENTS A REVIEW AND RESULTS OF PROCESSING NUMEROUS MATERIALS OBTAINED BY THE SOVIET AND FOREIGN EXPEDITIONS THROUGH 1961 ON THE CHEMISTRY OF WATER AND INTERSTITIAL SOLUTIONS OF THE PACIFIC OCEAN. DATA COLLECTED BY THE SOVIET EXPEDITIONS ON BOARD THE R/V 'VITIAZ', 'OB' AND OTHER VESSELS ARE PREVALENT. THE BOOK IS MEANT FOR INVESTIGATORS AND PRACTICAL WORKERS IN THE FIELD OF MARINE CHEMISTRY, HYDROLOGY, BIOLOGY AND GEOLOGY AS WELL AS SEA FISHERIES.

ADXX 651,498 R.VANSTRUM

ITEM B. REFERENCE: D.D.C. DOCUMENT

THE SHADOW BOX OPTICAL LANDING SYSTEM.

AVIATION
D.D.C.
FRESNEL-LENS
LENS
LIGHT
OPTICS

A SIMPLE RELPACEMENT FOR THE FRESNEL LENS OPTICAL LANDING SYSTEM (FLOLS) WAS DESIGNED AND BUILT AT NRL FOR USE AS A RESEARCH TOOL IN THE EXPERIMENTAL TESTING OF VARIOUS LANDING AIDS. CALLED THE SHADOW BOX OPTICAL LANDING SYSTEM (SBOLS), THE NEW SYSTEM PROJECTS A BEAM PATTERN WITHOUT THE USE OF LENSES AND IS DESIGNED TO PERMIT PARAMETRIC VARIATION FOR EXPERIMENTAL PURPOSES. IN COMPARISON TO THE FLOLS, THE SBOLS IS QUITE INEXPENSIVE, EASY TO TRANSPORT, AND SIMPLE TO MAINTAIN. EXPERIMENTAL EVALUATION OF TWO PROPOSED LANDING SYSTEMS, THE LATERALLY COMPOUNDED FRESNEL LENS OPTICAL LANDING SYSTEM (LCFLOLS) AND THE INTEGRATED FRESNEL RAINBOW OPTICAL LANDING SYSTEM (IFROLS), BOTH OF WHICH INCORPORATE THE FLOLS PRINCIPLE, WAS MADE FEASIBLE BY THE DEVELOPMENT OF THE SBOLS. BECAUSE INITIAL FLIGHTS WITH THE EXPERIMENTAL SBOLS VERIFIED ITS APPARENT OPTICAL SIMILARITIES TO THE FLOLS, INSTALLATION OF SBOLS UNITS ON EVERY RUNWAY AT VARIOUS NAVAL AIR STATIONS IS SUGGESTED. CARRIER PILOTS COULD THEN MAKE TRAINING, PRACTICE, AND EVEN ROUTINE LANDINGS WITH THE PRESENT SHIPBOARD TYPE OF SYSTEM.

ADXX 651,645 R.VANSTRUM

ITEM C. REFERENCE: D.D.C. DOCUMENT

GRAPHITE FIBER REINFORCED COMPOSITES.

COMPOSITE
D.D.C.
EPOXY-RESIN
FIBER
GRAPHITE
REINFORCED-PLAST

SEVERAL TYPES OF GRAPHITE FIBERS WERE USED IN THE FABRICATION AND EVALUATION OF EPOXY RESIN MATRIX COMPOSITES. THE FIBERS COVERED A LARGE MECHANICAL PROPERTY RANGE AND WERE OF VARIOUS CONSTRUCTIONS. FROM THE COMPOSITE DATA OBTAINED, THE POTENTIAL OF GRAPHITE FIBERS AS A COMPOSITE REINFORCING AGENT IS DISCUSSED.

ADXX 651,652 R.VANSTRUM

ITEM A. REFERENCE: D.D.C. DOCUMENT

COMMAND AND CONTROL OF DEEP SUBMERGENCE VEHICLES.

D.D.C.
VEHICLE

THE WIDE VARIETY OF APPLICATIONS FOR DEEP SUBMERGENCE VEHICLES GIVES RISE TO A COMPLEX SET OF COMMAND AND CONTROL REQUIREMENTS. AN OVERVIEW OF THE COMMAND CONTROL REQUIREMENTS IS PRESENTED BY SETTING FORTH A CATALOG OF THE DEEP SUBMERGENCE VEHICLE FAMILY IN TERMS OF TYPE AND MISSION. THE MISSIONS CONSIDERED ARE SEARCH, RESCUE, SALVAGE, AND EXPLORATION, IMPLANTATION, EXPLOITATION. THE LIMITING REQUIREMENTS FOR THE VARIOUS LEVELS OF COMMAND AND CONTROL ARE RELATED TO THIS SPECTRUM OF VEHICLES AND MISSIONS. THE COMMAND/CONTROL SYSTEMS FOR SEVERAL VEHICLES ARE ILLUSTRATED.

ADXX 651,701 R.VANSTRUM

ITEM B. REFERENCE: D.D.C. DOCUMENT

THE DEPTH OF FLASH OPTICAL LANDING SYSTEM.

AVIATION
COLOR
CONFIGURATION
D.D.C.
LIGHT
OPTICS

THE DEPTH OF FLASH OPTICAL LANDING SYSTEM IS AN OPTICAL LANDING AID WHICH PROJECTS A POSITIVE GLIDE-SLOPE INDICATION TO THE APPROACHING PILOT, ENABLING HIM TO ACHIEVE HIGHLY ACCURATE VERTICAL CONTROL OF HIS AIRCRAFT ON THE FINAL LANDING APPROACH. THE SIGNAL GIVES ACCURATE GLIDE PATH INFORMATION TO A RANGE LIMITED ONLY BY THE INTENSITY OF THE LIGHT SOURCE AND ATMOSPHERIC CONDITIONS. CODING OF THE SIGNAL IS BY THE COLOR AND DEPTH OF FLASH OF A PROJECTED LIGHT SOURCE NEAR THE DESIRED POINT OF TOUCHDOWN. COLOR CODING PROVIDES HIGH, LOW, AND ON-GLIDE-SLOPE INFORMATION, WHILE A GRADUALLY INCREASING FLASHING CHARACTERISTIC WARNS THE PILOT OF INCREASING ERROR FROM THE PRESCRIBED GLIDE PATH. ON APPROACHING THE SIGNAL SOURCE, THE PILOT IS GUIDED ONTO THE OPTIMUM PATH BY CORRECTION OF HIS ALTITUDE ERROR IN ACCORDANCE WITH THE SIGNAL RECEIVED. TWO UNIQUE DESIGN PRINCIPLES ARE FEATURED IN THE DEPTH OF FLASH OPTICAL LANDING SYSTEM. FIRST, THE BACKWARD PROJECTOR PRINCIPLE CAUSES THE PILOT TO SEE ONLY THAT COLOR WHICH IS PROJECTED TO HIS EYE. THE LIGHT PROJECTED TO THE AREA DIRECTLY ABOVE THE PRESCRIBED GLIDE PATH IS STEADY GREEN, THAT BELOW IT IS STEADY RED, AND THE 0.2-DEGREE-WIDE GLIDE PATH IS STEADY WHITE. ....

ADXX 651,886 R.VANSTRUM

ITEM A. REFERENCE: D.D.C. DOCUMENT

NEW TEST TECHNIQUE FOR SHEAR MODULUS + OTHER ELASTIC

COMPOSITE
D.D.C.
MODULUS
REINFORCED-PLAST
SHEAR
TESTING

CONSTANTS OF FILAMENTARY COMPOSITES. A NEW TEST TECHNIQUE IS PRESENTED FOR MEASURING THE FIVE PRINCIPAL ELASTIC CONSTANTS OF FILAMENTARY COMPOSITES.. TWO MODULI OF ELASTICITY, TWO POISSON'S RATIOS, AND A SHEAR MODULUS. THE TECHNIQUE EMPLOYS STRAIN ROSETTE-INSTRUMENTED TENSILE SPECIMENS CONTAINING ORIENTED FILAMENTS. TRANSFORMATION EQUATIONS FOR ORTHOTROPIC MATERIALS ARE USED TO DEVELOP PERTINENT EQUATIONS FOR THE ELASTIC CONSTANTS EVALUATION. GIVEN ONE OF THE POISSON'S RATIOS OF A LAMINATE (EXPERIMENTAL OR THEORETICAL VALUE) AND USING MAXWELL'S RECIPROCITY THEOREM, PRINCIPAL ELASTIC PROPERTIES CAN BE OBTAINED FROM DATA CORRESPONDING TO ONE TENSILE TEST. OTHERWISE, TWO TESTS ARE REQUIRED TO OBTAIN THOSE PROPERTIES. THE SHEAR MODULUS, WHICH IS INDEPENDENT OF THE POISSON'S RATIO, CAN BE OBTAINED FROM TENSILE TEST DATA ON A SPECIMEN HAVING FILAMENTS ORIENTED AT ANY ANGLE O, GREATER THAN ALPHA, GREATER THAN 90 DEGREES. THE VALIDITY AND CONSEQUENCES OF USING THEORETICAL VALUES OF POISSON'S RATIO TO COMPUTE PROPERTIES OTHER THAN SHEAR MODULUS ARE DISCUSSED.

ADXX 651,920 R.VANSTRUM

ITEM B. REFERENCE: D.D.C. DOCUMENT

PREFERENTIAL ATTACK ON COUPLING AGENT-TREATED GLASSES.

COMPOSITE
GLASS
MATERIAL
REINFORCED-PLAST
SILANE
SURFACE-CHEMISTR

SOME ERROR IN THE FIGURES FOR THIS PAPER MARS ITS VALUE IN THE SPECIFIC AREA INVESTIGATED. HOWEVER, THE METHOD AND TYPE OF RESULTS MAY BE OF INTEREST. REFERENCES ARE GIVEN JUSTIFYING INTERPRETATION OF ACID-BASE TITRATION OF POWDERED GLASS, IN VARIOUS PH RANGES, AS INDICATING THE NUMBER OF ACTIVE SITES OF CORRESPONDING TYPES, ON THE GLASS SURFACE. THE SAME GLASS SAMPLE, AFTER TREATMENT WITH 'VOLAN' OR SILANE, IS TITRATED AND THE FRACTION OF SITES MASKED BY COUPLING AGENT IS OBTAINED. THE AUTHORS FOUND THAT EVEN WITH A HIGH PERCENTAGE OF SITES COVERED, HYDROLYTIC ATTACK WAS SUBSTANTIALLY OF SIMILAR TYPE AND EXTENT AFTER COUPLING AGENT TREATMENT AS BEFORE.

ADXX 652,408 D.CADWELL

ITEM A. REFERENCE: AMERICAN JOURNAL OF CARDIOLOGY

DESIGN OF A CENTRALIZED ELECTRO-CARDIOGRAPHIC AND ...

APERTURE-CARD
APPLICATION
DOCUMENTATION
HEALTH
HEART
INFORMATION
STORAGE
SYSTEM

A CENTRALIZED SYSTEM FOR RECORDING STANDARD 12-LEAD ELECTROCARDIOGRAMS AND VECTORCARDIOGRAMS IS DESCRIBED. MULTIPLE SIMULTANEOUS SIGNALS ARE OBTAINED FROM THE PATIENT BY MEANS OF BUFFER AMPLIFIERS WHICH MINIMIZE THE EFFECT OF DIFFERENCES IN SKIN RESISTANCE AT THE ELECTRODES ON RESISTANCE NETWORKS. RIGHT-LEG DRIVING IS EMPLOYED TO REDUCE COMMON-MODE VOLTAGE. SIX SIMULTANEOUS CHANNELS OF DATA ARE TRANSMITTED BY DIRECT WIRE OR BY ONE OR THREE SIMULTANEOUS CHANNELS OVER STANDARD TELEPHONE LINES TO A CENTRAL RECORDING CONSOLE. MULTIPLE LEADS ARE SIMULTANEOUSLY MONITORED AND RECORDED FROM A SLAVE OSCILLOSCOPE ONTO 35 MM. FILM PREMOUNTED ON STANDARD COMPUTER PUNCH CARDS (CAMERA CARDS). THE FILM IS AUTOMATICALLY DEVELOPED IN 45 SECONDS. STANDARD-SIZED PRINTS OF THE ELECTROCARDIOGRAM ARE MADE WITH STANDARD MICROFILM PRINTERS FOR RETURN TO THE PATIENT AREA. THE ELECTROCARDIOGRAM MAY BE VIEWED IMMEDIATELY OVER CLOSED-CIRCUIT TELEVISION BY USE OF THE CAMERA CARD. THE USE OF 35 MM. FILM ON PUNCH CARDS ALLOWS MORE EFFICIENT AND ECONOMIC HANDLING. STORAGE AND RETRIEVAL OF ELECTROCARDIOGRAPHIC AND VECTORCARDIOGRAPHIC INTERPRETIVE DATA ARE FACILITATED. SIMULTANEOUS OUTPUT TO MAGNETIC TAPE OR ON-...

AJCO 019:0818 (60067). L.KRUGER

ITEM B. REFERENCE: AMERICAN CINEMATOGRAPHER

FILM AT THE CANADIAN WORLD'S FAIR.

EQUIPMENT
OPTICS
PHOTOGRAPHY

THIRTEEN ARTICLES ON PHOTOGRAPHY AND DISPLAY OF SLIDES AND MOTION PICTURES EMPLOYING THE LATEST TECHNIQUES OF PICTURE PRESENTATIONS. READING IS A MUST FOR ALL CONCERNED WITH PHOTOGRAPHY IN GENERAL.

AMEC 048:0001 (80067). H.BRUECKNER

ITEM C. REFERENCE: AMERICAN CINEMATOGRAPHER

NEW TECHNICOLOR 1000 SUPER 8 OPTICAL SOUND CARTRIDGE

EQUIPMENT
OPTICS
PHOTOGRAPHY
PROJECTION

PROJECTOR. DETAIL DESCRIPTION OF THIS SMALL (14 1/4 INCHES LONG, 11 INCHES WIDE, 8 1/4 INCHES HIGH) LIGHT (WEIGHS 19 LBS.) PORTABLE CLASS ROOM PROJECTOR WHICH MAKES THE PROJECTION OF SOUND MOVIES SIMPLE AND EASY.

AMEC 048:0648 (90067). H.BRUECKNER

ITEM A. REFERENCE: ANGLE ORTHODONTIST

EPIDEMIOLOGICAL STUDIES OF MALALIGNMENT.. APPLICABILITY OF STATISTICAL TESTS TO MALOCCLUSION.

DENTISTRY
STATISTICS

343 USN ACADEMY MIDSHIPMEN HAVING NO RECORD OF ORTHODONTIA, HAD ORAL CASTS MADE AND STUDIED. VARIOUS MEASUREMENTS SUCH AS TOOTH DIAMETER, ARCH BREADTH, LENGTH AND ARCH HEIGHT INDEX, WERE FOUND TO BE DISTRIBUTED NORMALLY, IN THE STATISTICAL SENSE, AS WOULD CERTAINLY BE EXPECTED. THIS SEEMS INTENDED TO LAY THE GROUNDWORK FOR EPIDEMIOLOGICAL STUDIES OF LARGER SAMPLES, SUCH AS A REPRESENTATIVE SAMPLE OF U. S. ADOLESCENTS, TO DETERMINE THE PREVALENCE OF VARIOUS TYPES OF MALOCCLUSION, AND, IN FACT, TO DEFINE IN DIGITAL TERMS WHAT 'MALOCCLUSION' MEANS.

ANOR 035:0326 (00065). D.CADWELL

ITEM B. REFERENCE: BULLETIN OF THE AMERICAN CERAMIC SOCIETY

DENSIFICATION AND WEAR RESISTANCE OF CERAMIC SYSTEMS...

BORON
CARBON
CERAMIC
CUTTING
HIGH-TEMPERATURE
TANTALUM
TITANIUM
TOOL

ESTABLISHED MECHANICAL PROPERTIES OF BINARY SYSTEMS OF TIB2 PLUS TAC, TIC, WC, TAN, TIN, ZRN, SI3N4 AND ZRB2. TAC WAS THE MOST EFFECTIVE. FOR TIB2-TAC SYSTEMS GET A (TI,TA)B2 SOLID SOLUTION UP TO ABOUT 25 WT PER CENT TAC AND THEN A (TA,TI)(C,N) TYPE SOLID SOLUTION - AT HIGHER TAC CONCENTRATIONS. A TOOL 80 WT PER CENT TIB2-20 TAC CUTS AS WELL AS CONVENTIONAL ALUMINA TOOL. A TOOL OF 50 TIB2-50TAC CAN BE EXPECTED TO CUT BETTER.

BACS 046:0643 (70067). P.HOWELL

ITEM C. REFERENCE: BULLETIN OF THE AMERICAN CERAMIC SOCIETY

SILICON OXYNITRIDE REFRACTORIES.

CERAMIC
HIGH-TEMPERATURE
NITROGEN
OXYGEN
PHYSICAL-PROPERT
SILICON

GIVES PROPERTIES OF SI2ON2.
SPECIFIC HEAT 0.25 BTU/LB DEGREES F AT 600 F.
THERMAL CONDUCTIVITY 40 BTU IN./HR. FT SQD., DEGREES F.
THERMAL EXPANSION 70-2600 F 2.4 X 10(TO THE -6TH POWER) / DEGREES F.
M.O.R. 30,500 PSI.
M OF ELAST. 27.8 X 10(TO THE 6TH POWER) PSI.
KNOOP HARDNESS 1580 KG/MM SQD.
ELECT RESISTIVITY 3 X 10(TO THE 11TH POWER) OHM-CM.
HAS OXIDATION RESISTANCE SUPERIOR TO SIC OR SI3N4. NO DATA ON PREPARATION.

BACS 046:0667 (70067). P.HOWELL

ITEM A. REFERENCE: BULLETIN OF THE AMERICAN CERAMIC SOCIETY

CHARACTERIZATION OF SURFACE TOPOGRAPHY WITH THE SCAN...

CERAMIC
CHARACTERIZATION
ELECTRON-MICROSC
METAL
SCANNING
SURFACE

THE SCANNING ELECTRON MICROSCOPE IS A VERY VERSITILE INSTRUMENT FOR OBSERVING SURFACES DOWN TO 150 ANG. RESOLUTION. SHOWS EXAMPLES OF OBSERVATIONS ON CERAMICS AND GLASSES. TEXTURE (SURFACE FINISH) AND PHASE ANALYSIS CAN BE CARRIED OUT. MACHINE HAS EXCEPTIONAL DEPTH OF FOCUS.

BACS 046:0750 (80067). P.HOWELL

ITEM B. REFERENCE: BIOCHEMISTRY

THE PHOSPHOPROTEIN OF THE DENTIN MATRIX.

DENTISTRY
PHOSPHORIC
PHOSPHORUS
PROTEIN
SALT

DENTAL COLLAGEN DIFFERS FROM SOFT-TISSUE COLLAGEN IN BEING MUCH LESS DEFORMABLE, AND INSOLUBLE TO ALL BUT DEGRADATIVE TREATMENT. PART OR ALL OF THIS MAY BE DUE TO ADDITIONAL CROSSLINKING BETWEEN COLLAGEN MOLECULES CONSEQUENT FROM DEHYDRATION, PART FROM A UNIQUE FIBRILLAR WEAVE. CHEMICALLY, DENTIN COLLAGEN IS IDENTICAL IN AMINO ACID AND CARBOHYDRATE COMPONENTS, BUT CONTAINS 0.3 PER CENT PHOSPHORUS AS COVALENTLY-BONDED PHOSPHATE. COMPACT BONE MATRIX COLLAGEN CONTAINS MUCH LESS, AND SOFT TISSUE COLLAGEN ALMOST NO PHOSPHATE. A TECHNIQUE WAS DEVELOPED FOR DEGRADING DECALCIFIED DENTIN THAT PERMITTED CONCENTRATION OF PHOSPHATE IN ONE CHROMATOGRAPHIC FRACTION, WHICH WAS ANALYZED. THE CONCLUSIONS WERE THAT ONE DENTIN COLLAGEN MOLECULE OUT OF FOUR HAS AN ORGANOPHOSPHATE GROUP TIED TO A HYDROXYLYSINE UNIT OF THE COLLAGEN BACKBONE. IT PROBABLY DOES NOT CONTRIBUTE TO CROSSLINKING, BUT RATHER PROVIDES SITES FOR NUCLEATING EPITACTIC MINERALIZATION.

BICH 006:2409 (80067). D.CADWELL

ITEM C. REFERENCE: A NON PERIODICAL BOOK

NEW-PRODUCT DECISIONS.. AN ANALYTIC APPROACH.

ADMINISTRATION
BOOK
DEVELOPMENT
ECONOMICS
FORECAST
MANAGEMENT
MARKET
NEW-IDEA
NEW-PRODUCT
PRODUCT
PROJECT-EVALUATI
RESEARCH

THIS BOOK CONSIDERS THE TOPICS..

1. PRODUCT POLICY.
2. NEW PRODUCT SEARCH AND PRELIMINARY EVALUATION.
3. ECONOMIC ANALYSIS.
4. THE DECISION TO MARKET, TEST MARKET OR DROP A PRODUCT.
5. TEST MARKETS AND ANALYSIS OF SALES.

THE FIRST THREE TOPICS ARE EXTREMELY APPLICABLE TO R+D DECISION MAKING. THIS SHOULD BE PART OF THE READING OF PEOPLE INTERESTED AND ENGAGED IN PROJECT EVALUATION AND MANAGEMENT.

BOOK 000:0039 R.SWANSON

ITEM A. REFERENCE: BRITISH PATENT

	A PROCESS FOR APPLYING A COATING ON A POLYMERIC MATER-
ADHESION	IAL.
COAT	IBM CLAIMS IMPROVEMENT OF ADHESION BETWEEN A POLYMERIC
I.B.M.-CO	SUBSTRATE AND A PLATED COATING BY ACTIVATION OF SUB-
MAGNETIC-PRODUCT	STRATE WITH A DIALKYL SULFOXIDE SOLVENT AND REACTIVE
MAGNETIC-RECORDI	SPECIES OF ALKALI METAL, ALKALI EARTH METAL OR HYDRIDES
PATENT	AND AMIDES OF THESE METALS, FOLLOWED BY COATING. AD-
PEEL-ADHESION	HESION VALUES GREATER THAN 700 GRAMS PER 1/2 INCH WIDTH
PLATING	ON A TAPE PEEL TEST GENERALLY RESULT WHEN SUBSTRATES
POLYMER	SUCH AS TEFLON, POLYESTERS, POLYIMIDES ARE TREATED AND
SUBSTRATE	THEN ELECTROLESSLY PLATED WITH VARIOUS METALS. PATENT
	CLAIMS INCLUDE MANUFACTURE OF MAGNETIC RECORDING MEDIUM
	BY SUCH TECHNIQUES.
	BRXX 1,078,048 (80067). D.SHIELS

ITEM B. REFERENCE: CERAMIC BULLETIN

	MECHANICAL PROPERTIES OF CERAMICS.. AN INTRODUCTORY
BIBLIOGRAPHY	SURVEY. GIVES A VERY COMPLETE AND GOOD REVIEW OF THE
CERAMIC	BASIC MECHANISMS OF DEFORMATION AND FRACTURE OF CERAMIC
DETERMINATION	MATERIALS. INCLUDES ILLUSTRATIVE VALUE FOR CERTAIN KEY
MECHANICS	SYSTEMS AS WELL AS 319 REFERENCES TO THE LITERATURE OF
PHYSICAL-PROPERT	THE SUBJECT. AN IMPORTANT REVIEW ARTICLE BY A GOOD
PROPERTY	MAN IN THE FIELD.
REVIEW	
THEORY	CEBU 046:0756 (80067). P.HOWELL

ITEM C. REFERENCE: CERAMIC BULLETIN

	DIFFUSE REFLECTANCE CHARACTERISTICS OF MONOCLINIC ZRO2
DETERMINATION	AS A FUNCTION OF PURITY.
OPTICS	MEASURED DIFFUSE REFLECTION SPECTRA OF 14 DIFFERENT
PROPERTY	COMMERCIAL ZIRCONIA SAMPLES. TI IMPURITIES GIVE A BLUE
REFLECTION	LUMINESCENCE AND STRONG ABSORPTION IN THE UV IRON
SOLID-STATE	'POSIONS' THE TI EMISSION AND INTRODUCES A STRONG AB-
SPECTRUM	SORPTION IN THE U. V.
ULTRAVIOLET	
ZIRCONIUM-OXIDE	CEBU 046:0837 (90067). P.HOWELL

ITEM A. REFERENCE: CEREAL CHEMISTRY

'HETEROGENOUS REACTION OF GRANULAR STARCH WITH HYD-...

CHLORINE
CROSSLINKING
DECOMPOSITION
DEHYDRATION
DETERMINATION
GAS
HYDROGEN
MICROSCOPY
STARCH

'A HETEROGENEOUS REACTION BETWEEN ANHYDROUS GRANULAR STARCH AND HYDROGEN CHLORIDE GAS TAKES PLACE AT 70 DEGREES C. THE REACTION IS CHARACTERIZED BY AN INDUCTION PERIOD OF 2 TO 17 HOURS DEPENDING ON THE STARCH USED AND THE HCL PRESSURE, AFTER WHICH THERE IS A EVOLUTION OF WATER. THE COLOR OF THE STARCH DARKENS DURING THE INDUCTION PERIOD AND TURNS BLACK SOON THEREAFTER. SOME DEGRADATION OCCURS DURING THIS PERIOD. MICROSCOPIC AND HYDRATION STUDIES ON THE PRODUCTS INDICATE THAT DISORGANIZATION, WITH ATTENDANT COLD-WATER SOLUBILITY, INCREASES TO A MAXIMUM DURING THE INDUCTION PERIOD. A SUDDEN RELAXATION OF THE GRANULE SEEMS TO OCCUR AT THE END OF THE INDUCTION PERIOD, ALLOWING DEHYDRATION TO BEGIN. THE SUBSEQUENT PRODUCTS BECOME INSOLUBLE AGAIN, APPARENTLY THROUGH SOME SORT OF CORSSLINKING, AND THE COLOR BECOMES COMPLETELY AND PERMANENTLY BLACK. MOTION-PICTURE STUDIES OF THE HYDRATION BEHAVIOR OF THE INDUCTION PERIOD PRODUCTS REVEALED SOME OF THE GRANULAR ASPECTS OF THE REACTION'.

CECH 044:0105 (30067). J.HENDRICKS

ITEM B. REFERENCE: CEREAL CHEMISTRY

HETEROGENEOUS REACTION OF GRANULAR STARCH WITH HYD-...

CHARACTERIZATION
CHLORINE
DECOMPOSITION
DEHYDRATION
HYDROGEN
KINETICS
PARTICULATE
QUANTITATIVE
STARCH

'QUANTITATIVE STUDIES WERE MADE ON THE REACTION OF DRY, GRANULAR STARCH WITH ANHYDROUS HYDROGEN CHLORIDE GAS. THE WEIGHT, CHEMICAL ANALYSIS, AND COLD-WATER SOLUBILITY OF THE PRODUCTS WERE DETERMINED AS A FUNCTION OF TIME OF REACTION. THE WATER EXTRACTS WERE EXAMINED ON THE SAME BASIS. THE REACTION IS EASILY FOLLOWED BY PRESSURE MEASUREMENTS IN A SIMPLE WARBURG-TYPE APPARATUS WHICH CLEARLY INDICATES BOTH THE RATE AND THE INDUCTION PERIOD, AS THERE IS A SUDDEN CHANGE IN RATE AT THE END OF THE LATTER. DIFFERENT STARCHES, SUCH AS RICE, CORN, WHEAT, AND POTATO HAD DIFFERENT RATES AND INDUCTION PERIODS, INDICATING THAT GRANULE SIZE AND STRUCTURE PLAY A MAJOR ROLE IN THE KINETICS. IT APPEARS POSSIBLE TO CHARACTERIZE STARCHES TO A CERTAIN EXTENT, WITH THIS REACTION. THE REACTION APPEARS TO BE ONE OF DIFFUSION INTO AND DISORGANIZATION OF THE GRANULE BY THE HCL DURING THE INDUCTION PERIOD, FOLLOWED BY A DEHYDRATION REACTION. THE RESULT IS A BLACK, INERT, WATER-INSOLUBLE, GRANULAR PRODUCT THAT APPEARS TO BE CROSSLINKED'.

CECH 044:0118 (30067). J.HENDRICKS

ITEM A. REFERENCE: CHEMISTRY & INDUSTRY (LONDON)

A CONVENIENT PROCEDURE FOR THE CLEAVAGE OF PHENOLIC ETHERS.

BREAKAGE
ETHER
HYDROLYSIS
PHENOL
PYRIDINE
SYNTHESIS

THIS MODIFICATION OF THE PYRIDINE HYDROCHLORIDE METHOD OF ETHER CLEAVAGE ALLOWS USE OF AQ. HCl AND PYRIDINE. PYRIDINE AND EXCESS HCl ARE MIXED AND DISTILLED UNTIL THE POT TEMPERATURE REACHES 210 DEGREES. ADDITION OF PHENOLIC ETHER AT THIS POINT GIVES RESULTS EQUAL TO THOSE OBTAINED USING THE ORIGINAL PROCEDURE.

CHIN 026:1138 (70167). T.SAVEREIDE

ITEM B. REFERENCE: CHEMISTRY & INDUSTRY (LONDON)

MACROCYCLIC POLYMERS.. A NEW CLASS OF THERMALLY STABLE POLYMERS.

AROMATIC
CYCLIC
DIAMINE
HEAT-STABILITY
MACRO
NITRILE
POLYMER
TENSILE

POLYMERS WERE PREPARED FROM AROMATIC NITRILES. SPECIFICALLY, PYMELLITONITRILE (1,2,4,5-TETRACYANOBENZENE) AND M-PHENYLENE DIAMINE WERE CONDENSED USING A SODIUM METHOXYETHANOLATE CATALYST TO FORM A POLYMER OF THE TYPE..
(STRUCTURE).
THE POLYMER HAD 10 PER CENT WEIGHT LOSS IN AIR AT 540 DEGREES C AND IN ARGON, 600 DEGREES C. TENSILE STRENGTHS WERE AS HIGH AS 13,000 PSI.

CHIN 029:1254 (72267). W.GOETHEL

ITEM C. REFERENCE: CHEMISTRY

BARNACLE CEMENT FOR FILLING TEETH.

ADHESIVE
ANIMAL
BIOLOGY
DENTISTRY
MARINE

THE REASON THAT BARNACLES CAN CLING SO TIGHTLY TO PRACTICALLY ANYTHING IS, ACCORDING TO ROGER KELLER OF UNIVERSITY OF AKRON'S BIOLOGY DEPARTMENT, THAT THEY MANUFACTURE AN EXTRAORDINARILY STRONG ADHESIVE. KELLER HAS AN INVESTIGATION UNDERWAY TO TRY TO PRY FROM SOME BARNACLES THE SECRET SYNTHESIS PROCESS THAT ENABLES THEM TO DRAG A FEW MICRONS OF STEEL ALONG WHEN PRIED OFF A SHIP HULL, OR TO ATTACH THEMSELVES TO EXTRACTED-TOOTH SAMPLES IMMERSED IN KELLER'S SEA TEST FACILITY.

CHRY 040:0007 (90067). R.LARSON

ITEM A. REFERENCE: CHIMIE ET INDUSTRIE, GENIE CHIMIQUE

MOUSSE HYDROPHILE DE POLYURETHANE.

BETA FOAM HYDROPHILIC LACTONE POLYURETHANE	TO IMPROVE HYDROPHILIC BEHAVIOUR OF POLYURETHANE FOAM FOR INDUSTRIAL AND DOMESTIC USES, SEVERAL PROCESSES ARE KNOWN. MESSRS. A. ARCHIPOFF AND J. SAMBETH, FROM THE BATTELLE INSTITUTE IN GENEVA, PROPOSE GRAFTING A CYCLIC MOLECULE (BETA-PROPIOLACTONE) ONTO THE REACTIVE GROUPS OF THE FOAM. AFTER REACTION AND OPENING OF THE RING, BETA PROPIOLACTONE FORMS A CERTAIN NUMBER OF POLAR GROUPS ON THE SURFACE, THUS GIVING PERMANENT HYDROPHILIC PROPERTIES TO THE FOAM.

CIGC 009:1341 (50067). S.RENE

ITEM B. REFERENCE: DESIGN NEWS

STRUCTURAL USES OF COMPOSITES.

ANALYSIS COMPOSITE FORCE GLASS-FIBER MODULUS REINFORCED-PLAST	THE AUTHOR IS DESCRIBING REINFORCED PLASTICS WITH FIBERGLASS BEING THE ONE MOST MENTIONED. A DISCUSSION BRIEFLY OF STRESS ANALYSIS IS GIVEN WITH A NOTE THAT THE ORIGINAL ARTICLE CONTAINED 6 PAGES.

DIGN 022:0078 (70567). W.SCHRENKER

ITEM C. REFERENCE: EUROPA CHEMIE

UNIVERSAL-MATTHEY CONSTRUCTS CATALYST-PLANT IN CALAIS.

CATALYST ECONOMICS FABRICATION PLANT	THE 'UNIVERSAL-MATTHEY PRODUCTS (FRANCE) SA', PARIS, WHICH HAS SOLD UNTIL NOW CATALYSTS, ESPECIALLY FOR THE PETROLEUM INDUSTRY, IS GOING TO ERECT A NEW PLANT FOR THE PRODUCTION OF CATALYSTS, IN ORDER TO STABILIZE ITS POSITION IN THE EUROPEAN MARKET. THE BRITISH PARENT COMPANY 'UNIVERSAL MATTHEY PRODUCTS LTD.', A JOINT ESTABLISHMENT OF THE AMERICAN 'UNIVERSAL OIL PRODUCTS COMPANY' AND THE BRITISH 'JOHNSON, MATTHEY AND CO., LTD.', LONDON, PRODUCES PLATINUM-CATALYSTS IN GREAT BRITAIN. BESIDES THE PLANNED PLANT IN CALAIS, THE PRODUCTION OF CATALYSTS SHALL BE DONE BY THE GERMAN SUBSIDIARY 'UNIVERSAL MATTHEY (GERMANY) AG., COLOGNE. SINCE 1965, THERE ALSO EXISTS IN ROME A SALES COMPANY OF THE BRITISH UNIVERSAL MATTHEY, UNDER THE FIRM-NAME 'UNIVERSAL MATTHEY PRODUCTS SPA'.

EUCH 017:0010 (90067). K.SCHROEDER

ITEM A. REFERENCE: GELATINE AND GLUE RESEARCH ASSOCIATION ABSTRACTS

GGRA ABSTRACTS.

	THESE ABSTRACTS ARE OF RECENT PUBLICATIONS DEALING WITH
BIOLOGY	GELATIN OR COLLAGEN IN CLASSIFIED AREAS UNDER MANUFACT-
CHEMISTRY	URE, BY PRODUCTS, USES AND SUBSTITUTES, PROTEINS, BIO-
ENGLAND	LOGICAL CHEMISTRY, PHYSICS, CHEMISTRY, LABORATORY
EQUIPMENT	EQUIPMENT AND PROCEDURES AND MISCELLANEOUS.
GELATIN	
PHYSICS	
PROTEIN	GGRA 018:0001 (80067). J.KENDALL

ITEM B. REFERENCE: GRINDING AND FINISHING

THE THEORY OF GRINDING.

ABRASIVE	GENERAL DISCUSSION OF ABRASIVE GRINDING. DISCUSSES
GRINDING	CHIP FORMATION, ABRASIVE WEAR, GRINDING MECHANICS, AND
THEORY	RESIDUAL EFFECTS IN THE WORKPIECE. WORK BASED ON
WHEEL	GRINDING WHEEL ACTION.

GRFI 013:0020 (90067). P.HOWELL

ITEM C. REFERENCE: WEST GERMAN PATENT

PROCESS FOR THE PRODUCTION OF PRIMED FLOOR OR WALL ...

COAT	THE ENGLISH FIRM DUNLOP RUBBER COMPANY HAS FILED AN
FLOOR	APPLICATION FOR A PATENT FOR A COATING FOR THE FLOOR
GERMANY	OR FOR WALLS, WHICH IS TO BE MANUFACTURED AS FOLLOWS..
PATENT	1 POLYMER ETHER OR THIO-ETHER, 1 POLYISOCYANATE OR
POLYURETHANE	POLYISOTHIOCYANATE, 1 CURING AGENT BY MEANS OF 2 NCX-
	GROUPS AND 1 INERT FILLER WILL BE MIXED AND POURED OR
	PAINTED ON THE GROUND. THE POLYURETHANE SHALL HAVE A
	VISCOSITY OF 35 TO 250 POISE. THE FILLER SHALL HAVE A
	PARTICLE SIZE BETWEEN 1.676 AND 0.124MM. THE FILLER
	WILL BE USED IN A QUANTITY BETWEEN 50 AND 90 PER CENT
	IN WEIGHT.

GWXX 1,241,549 (60167). K.SCHROEDER

ITEM A. REFERENCE: WEST GERMAN PATENT

APPLICATION OF AQUEOUS DISPERSIONS OF PLASTIC OR ...

COAT
ELECTRIC
INSULATION
THERMOPLASTIC

FOR THE MANUFACTURING OF ELECTRIC INSULATING COATINGS ON MAGNETIC ELECTRIC SHEETS, THE APPLICATION OF AQUEOUS PLASTIC DISPERSIONS IS RECOMMANDED. ONE SUGGESTS TO TAKE FOR EXAMPLE POLYACRYLATE OR POLYVINYLESTER OR POLYVINYLETHER OR NATURAL LATEX TOGETHER WITH SMALL QUANTITIES (1 TO 5 PER CENT IN WEIGHT) OF PHOSPHORIC ACID OR AN ACID PHOSPHORUS. ADDITIONALLY, THE DISPERSION SHOULD CONTAIN FINE SPREAD INORGANIC SUBSTRATES LIKE TALCUM, MUSCOVITE, SILICON OXIDE, ALUMINA OR MAGNESIUM OXIDE IN THE PARTICLE SIZE OF 0.1 TO 5/MU. ALSO, FINE SPREAD ORGANIC SUBSTRATES CAN BE DIFFUSED IN THE DISPERSION, LIKE POLYETHYLENE, POLYPROPYLENE, CHLORIC CAOUTCHOUC OR CELLULOSE IN THE PARTICLE SIZE OF 20 TO 50/MU.

GWXX 1,246,071 K.SCHROEDER

ITEM B. REFERENCE: WEST GERMAN PATENT

PROCEDURE FOR THE COATING OF ELECTRIC COMPONENTS ...

COATING
ELECTRIC
INSULATION
MOLDING
PROCESS-DEVELOPM
RESIN

THE FIRM BAER IS A MANUFACTURER OF AUTOMATIC MIXING AND MEASURING INSTALLATIONS FOR THE DRIPPLING PROCESS FOR CAST RESINS. BESIDES OTHER THINGS, BAER SELLS IN AMERICAN LICENSE 'TRIPLEMATIC' EQUIPMENTS. THE NEW PATENT APPLICATION WORKS AFTER A NEW PROCEDURE. AT FIRST, UNFILLED CAST RESIN MUST BE BROUGHT ON THE ELECTRIC PART WHICH HAS TO BE INSULATED, IN THE DRIPPLING PROCESS OR AFTER DIVING PROCEDURES. DURING THE CASTING UNDER ROTATION, FILLER PARTICLES MUST BE PUT ON THE STILL ADHESIVE RESIN.

GWXX 1,246,837 K.SCHROEDER

ITEM C. REFERENCE: HARVARD BUSINESS REVIEW

RETURN ON INVESTMENT FOR NEW-PRODUCT POLICY.

ADMINISTRATION
DEVELOPMENT
ECONOMICS
FORECAST
MANAGEMENT
NEW-IDEA
NEW-PRODUCT
PRODUCT
PROJECT-EVALUATI
RESEARCH

MR. SCHEUBLE INCLUDES THE FOLLOWING IN HIS ARTICLE..
1. PHILOSOPHY OF PROJECT EVALUATION.
2. PROGRAM LIFE CYCLE.
3. CORPORATE INCOME GROWTH.
4. PRODUCT SPECIFICATION FORM.
5. A NOMOGRAPH SHORTCUT TO RETURN ON INVESTMENT.

THIS SHOULD BE READ BY ANYONE INTERESTED IN PROJECT EVALUATION. MUCH SHOULD BE APPLICABLE TO 3M.

HABR 042:0110 (-1264). R.SWANSON

ITEM A. REFERENCE: HARVARD BUSINESS REVIEW

	HOW TO MAKE R+D MORE PRODUCTIVE THROUGH A PROGRAM APP-
ADMINISTRATION	RAISAL STAFF.
DEVELOPMENT	MR. COOK IS THE MANAGER OF PROJECT ANALYSIS, GENERAL
ECONOMICS	ELECTRIC, SCHENECTADY, NEW YORK. IN THIS ARTICLE HE
FORECAST	POINTS OUT THE FOLLOWING..
MANAGEMENT	1. WHY HAVE A PROJECT EVALUATION STAFF.
NEW-IDEA	2. HOW IT HAS WORKED AT GENERAL ELECTRIC.
NEW-PRODUCT	3. WHAT LESSONS HAVE BEEN LEARNED.
PRODUCT	THIS PUTS VERY WELL A MECHANISM FOR ACCOMPLISHING FOR-
PROJECT-EVALUATI	WARD LOOKING NEW PROJECT PLANNING. I BELIEVE MUCH OF
RESEARCH	THE THINKING HAS VALUE FOR 3M.

HABR 044:0145 (70867). R.SWANSON

ITEM B. REFERENCE: INDUSTRIAL RESEARCH

BIOMEDICINE	'ELECTRIC' BLOOD VESSELS.
BLOOD	CLOTTING OF BLOOD IN ARTIFICIAL BLOOD VESSELS HAS BEEN
COAGULATION	A PROBLEM. DR. W. V. SHARP, A RESEARCH PHYSICIAN IN
POLYURETHANE	AKRON AND MESSRS. D. L. GARDNER AND G. J. ANDRESEN OF
SYNTHETIC	GOODYEAR HAVE DEVELOPED A 'NEW SYNTHETIC MATERIAL THAT
TUBING	SIMULATES THE BIOELECTRIC ENVIRONMENT OF THE HUMAN
	VASCULAR SYSTEM. THE MATERIAL IS A NEW DIAMINE-CURED
	POLYURETHANE HAVING A STATIC POTENTIAL OF UP TO 150
	MILLIVOLTS NEGATIVE. BY ADDING CARBON BLACK, THE NEG-
	ATIVE POTENTIAL WAS BOOSTED TO NEARLY 300 MILLIVOLTS.'
	THE NEW MATERIAL HAS BEEN TESTED IN DOGS OF 15 GRAFTS.
	ALL REMAINED FREE OF THROMBOSIS FOR UP TO 72 HOURS.
	SEVERAL GOING FOR TEN DAYS.

IRES 009:0030 (70067). J.HENDRICKS

ITEM C. REFERENCE: INDUSTRIAL RESEARCH

	°TUNABLE C. W. LASERS ON THE HORIZON'.
ARGON	PROFESSOR STEVEN E. HARRIS, ELECTRICAL ENGINEERING DE-
HEAT	PARTMENT, STANFORD UNIVERSITY, HAS PRODUCED MONOCHRO-
LASER	MATIC LIGHT THAT CAN BE TUNED. THE COLOR IN THE CRY-
	STAL CAN BE CHANGED FROM I. R. TO A DEEP GREEN-BLUE BY
	VARYING ITS TEMPERATURE. A CRYSTAL OF LITHIUM NIOBATE
	IS BOMBARDED BY CONTINUOUS ARGON GAS LASER LIGHT WHILE
	HEATED TO 370 DEGREES C. IN AN OPEN-ENDED FURNACE.
	I MIGHT ADD THAT I TALKED WITH PROFESSOR SCHAWLOW IN
	PHYSICS AT STANFORD U AND HE, TOO, IS DOING WORK WITH
	TUNABLE LASERS.

IRES 009:0033 (70067). J.HENDRICKS

ITEM A. REFERENCE: INDUSTRIAL RESEARCH

MAGNETICS 'HOT' SUPERCONDUCTOR.

BELL-TELEPHONE-L
CHANGE
EDUCATION
ORGANIZATION
SUPERCONDUCTIVIT
TEMPERATURE

ROOM TEMPERATURE SUPERCONDUCTORS ARE HIGHLY DESIRABLE BUT EXTREMELY DIFFICULT TO OBTAIN. DR. B. T. MATTHIAS OF THE U OF CALIFORNIA, SAN DIEGO, AND DR. T. H. GEBALLE OF BELL TELEPHONE LABORATORIES, WERE PART OF A GROUP WHO RECENTLY REACHED 20 DEGREES K AS THE UPPER LIMIT OF SUPERCONDUCTORS.

REFERENCE IS MADE TO DR. W. A. LITTLE, STANFORD UNIV., PHYSICS, WHO HAS PROPOSED A MODEL OF A ROOM TEMPERATURE SUPERCONDUCTOR, 'AN ORGANIC MOLECULE WITH A SPINE ALONG WHICH ELECTRONS MIGHT MOVE WITHOUT FRICTION AT AMBIENT TEMPERATURES'.

I TALKED TO PROFESSOR CONNELL IN CHEMISTRY AT STANFORD UNIVERSITY WHO IS INTERESTED IN RAISING THE CRITICAL TEMPERATURE OF SUPERCONDUCTORS BY WORKING WITH ALLOYS OF METAL AND ORGANIC COMPOUNDS.

IRES 009:0034 (70067). J.HENDRICKS

ITEM B. REFERENCE: INDUSTRIAL RESEARCH

NEW POLYMER FAMILY RESISTANT TO 550 C.

BORON
ELASTOMER
HEAT
RESISTANCE
SILICON

OLIN MATHIESON CHEMICAL CORPORATION HAS ANNOUNCED A NEW FAMILY OF SILICON-BORON POLYMERS HAVING A SHORT-TERM RESISTANCE OF 550 C, AND LONG-TERM RESISTANCE IN THE RANGE OF 260-430 C. THE POLYMERS ARE CALLED 'DEXSIL' AND RETAIN ELASTOMERIC PROPERTIES TO -57 C.

IT IS INTERESTING TO NOTE THAT DR. FRANK HONN AND ANOTHER GENTLEMEN, BOTH FROM OLIN, HAVE BEEN CALLING ON 3M LABORATORIES THE PAST FEW DAYS TO TELL ABOUT THIS NEW FAMILY OF POLYMERS.

IRES 009:0047 (70067). J.HENDRICKS

ITEM C. REFERENCE: JOURNAL OF THE AMERICAN CERAMIC SOCIETY

HOT HARDNESS OF SELECTRED, BORIDES, OXIDES AND CAR...

ALUMINUM-OXIDE
BORON
CARBON
CURING
HAFNIUM
HIGH-TEMPERATURE
NIOBIUM
OXYGEN
TANTALUM
TITANIUM
TUNGSTEN
ZIRCONIUM

DETERMINED HOT HARDNESS OF TIB2, W2B5, ZRB2, HFB2, ZRO2, AL2O3, NBC, TIC, TAC1-X, HFC1+X (TA0.8HF2)C2+X, W2C AND (W0.65 CR0.14 RE0.14 TA0.07)2 AT TEMPERATURES UP TO 1900 DEGREES C USING AN INDENTATION HARDNESS MACHINE OF SPECIAL DESIGN. IN GENERAL THE BORIDES WERE HARDER THAN THE CARBIDES WHICH WERE HARDER THAN THE OXIDES.

JACT 050:0290 (60067). P.HOWELL

ITEM A. REFERENCE: JOURNAL OF THE AMERICAN CERAMIC SOCIETY

LOCALIZED COOLING IN FLUX CRYSTAL GROWTH.

CRYSTAL-GROWTH FLUORINE HIGH-TEMPERATURE LEAD OXYGEN	LARGE, ABOUT 5MM, CRYSTALS ZRO, AL2O3, GA2O3, THO2 Y3 GA5O12, ZNGA2O3 AND ZRO2 WERE GROWN FROM PBO-PBF2 FLUX SYSTEMS USING A TEMPERATURE GRADIENT AND COOLING WITH AIR JET AT CRUCIBLE BOTTOM. GET BIGGER CRYSTALS BY THIS TECHNIQUE.

JACT 050:0325 (60067). P.HOWELL

ITEM B. REFERENCE: JOURNAL OF THE AMERICAN CERAMIC SOCIETY

REFRACTORY-MELT REACTIONS IN VACUUM INDUCTION MELTING..

ALLOY ALUMINUM-OXIDE CALCIUM HIGH-TEMPERATURE MAGNESIUM NICKEL OXYGEN SILICON SILICON-CARBIDE THORIUM WETTING ZIRCONIUM	BY USE OF SESSILE DROP TECHNIQUE MEASURED THE CONTACT ANGLE OF NI BASE ALLOYS (WITH AL, CR, CO, C, TI, AND ZR) ON AL2O3, MGO, ZRO2, CAO, THO2, SIO2 AND SIC REFRACTORIES. USED MICROSCOPIC, X-RAY, AND MICROPROBE TECHNIQUES TO EXPLORE THE INTERFACE REACTIONS. THE STABILITY RELATIVE TO NI ALLOYS IS IN THE ORDER SIC LESS THAN AL2O3 LESS THAN CAO ABOUT THO2 LESS THAN MGO ABOUT ZRO2 LESS THAN SIO2. THE ALLOYING ELEMENTS GREATLY INFLUENCED THE STABILITY.

JACT 050:0349 (70067). P.HOWELL

ITEM C. REFERENCE: JOURNAL OF THE AMERICAN CERAMIC SOCIETY

CRYSTAL GROWTH OF RARE-EARTH ORTHOARSENATES.

ARSENIC CRYSTAL-GROWTH FLUX LANTHANIDE LEAD MELTING OXIDE PHOSPHORIC SALT	GREW RARE EARTH ARSENATE COMPOUNDS FROM LEAD PYROARSENATE (PB2AS2O7) FLUX. 4 DEGREES C/HOUR COOLING FROM 1300-925 DEGREES C GREW CPDS. LAASO4, NDASO4, CEASO4, SMASO4 THRU LUASO4, INCLUDING YASO4. ALSO GREW MIXED RARE EARTH AND MIXED PHOSPHATE ARSENATE CRYSTALS.

JACT 050:0433 (80067). P.HOWELL

ITEM D. REFERENCE: JOURNAL OF APPLIED POLYMER SCIENCE

EFFECT OF AROMATIC GROUPS ON LOCALIZATION OF HIGH ...

ACID AROMATIC CELLULOSE DECOMPOSITION ENERGY FABRIC HIGH PROTECTION RADIATION	CELLULOSE SUBSTITUTED WITH VARIOUS AROMATIC ACIDS OR ALCOHOLS (ESTER OR ETHER LINKAGE) SHOWED INCREASED RETENTION OF BREAKING STRENGTH AFTER IRRADIATION WITH A 60 CO SOURCE. (CELLULOSE IS NORMALLY DEGRADED ON SUCH EXPOSURE.) BENZHYDRYL, TRITYL, BENZOYL, AND CINNAMOYL SUBSTITUTION PROVIDED RADIO PROTECTION FOR A DISTANCE ALONG THE CELLULOSE CHAIN EQUIVALENT TO SEVERAL CELLOBIASE UNITS.

JAPN 011:1129 (70067). T.SAVEREIDE

ITEM A. REFERENCE: JOURNAL OF POLYMER SCIENCE, PART A-1, POLYMER CHEMIST

GRAFTING OF POLYARCRYLONITRILE ON CORN STARCH.

CONCENTRATION GRAFT POLYACRYLONITRIL POLYMER POLYMERIZATION STARCH	ACRYLONITRILE WAS GRAFTED TO CORN STARCH (80 - 95 PER CENT EFFICIENCY) USING PEROXIDE/FE/ASCORBIC ACID INITIATOR. FREQUENCY OF ATTACHMENT WAS ONE PER 300 TO 1100 GLUCOSE UNITS. INCREASING MONOMER CONCENTRATION LENGTHENED GRAFTS BUT DID NOT INCREASE FREQUENCY. INCREASED CONCENTRATION OF PEROXIDE TENDED TO DECREASE EFFICIENCY AND GRAFT LENGTH BUT INCREASED GRAFT FREQUENCY.

JPLC 005:1313 (60067). T.SAVEREIDE

ITEM B. REFERENCE: JOURNAL OF POLYMER SCIENCE

SURFACE LAYERS IN EPOXY POLYMERS.

CURING EPOXY-RESIN HARDNESS LAYER SURFACE	SEVERAL TYPICAL EPOXY POLYMERS WERE SHOWN TO BE TWO PHASE SYSTEMS.. LAYERS OF HARD SPHERES IN AN INTERSTITIAL FLUID WHICH RESEMBLED STARTING MATERIAL IN DENSITY, HARDNESS, AND REFRACTIVE INDEX. RATE OF CURE AFFECTED SPHERE SIZE WHICH IN TURN APPEARED TO AFFECT POLYMER DENSITY AND HARDNESS. THE SURFACE PROPERTIES (CONTACT ANGLE) OF THE CURED POLYMER WERE FOUND TO BE DEPENDENT ON THE SURFACE PROPERTIES OF THE MOLD IN WHICH THE EPOXY WAS CURED AND AND THE EFFECT EXTENDED SEVERAL HUNDRED MICRONS INTO THE POLYMER.

JPSC 011:0949 (60067). T.SAVEREIDE

ITEM C. REFERENCE: KOBUNSHI KAGAKA

BLOCK COPOLYMERIZATION WITH ACRYLONITRILE OF ACRYLATE MONOMERS.

ACTIVATION ADHESIVE BLOCK COPOLYMER PEROXIDE POLYACRYLATE POLYACRYLONITRIL POLYMERIZATION TOGETHER	POLYACRYLONITRILE HAVING HYDROPEROXIDE GROUPS AT ITS ENDS, OBTAINED FROM 2,5-DIMETHYLHEXANE - 2,5 DIHYDROPEROXIDE WAS USED TO INITIATE THE BLOCK COPOLYMERIZATION OF ACRYLATE MONOMERS. THE REACTION WAS CARRIED OUT IN DMSO OR DMF SOLUTION USING ASCORBIC ACID OR FERROUS ION AS A REDUCING AGENT. BLOCK EFFICIENCY OF ABOUT 80 PER CENT WAS OBTAINED. IS THIS CONCEPT USEFUL IN SYNTHESIS OF POLYMERS FOR ADHESIVES. CAN A DIFUNCTIONAL INITIATOR BE USED WITH PROPER MONOMER ADDITION TECHNIQUES TO GIVE NEW MATERIALS WITH MONOMERS IN PRESENT-DAY ADHESIVES.

KOKA 024:0017 (10067). R.TALBOTT

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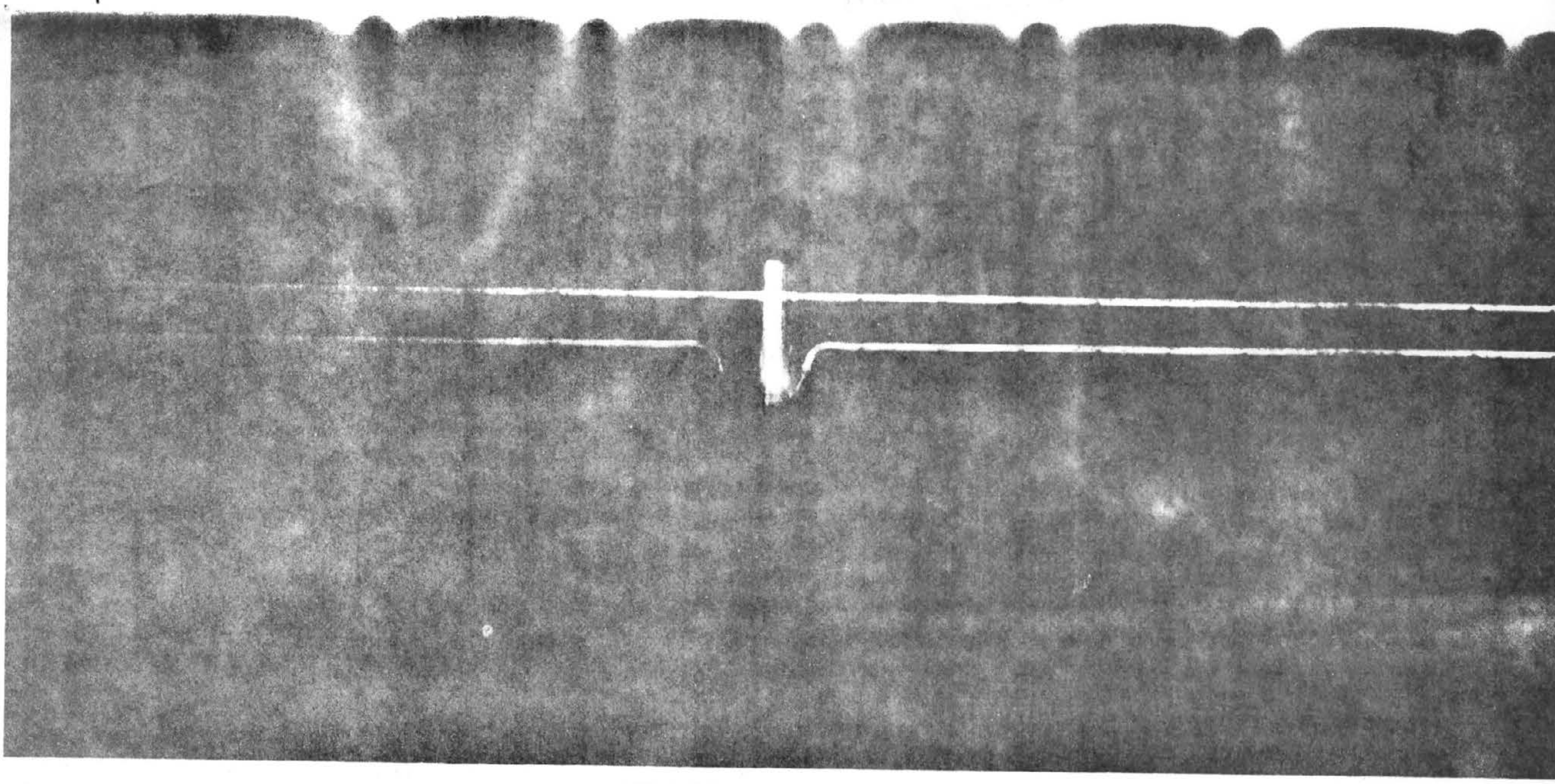
Textile Structures

Serve as Life Preservers

M. M. Platt



Critical failure induced by lateral impact.

Textile Structures

M. M. Platt[1]

It would be fitting here to present a new philosophy of textile mechanics—some as yet unvoiced generalization and approach, whose application would bear the same relationship to textile structures as, say, Lord Rayleigh's method bears to engineering structures. The discovery of such an approach was, in fact, the hope of Harold DeWitt Smith, who envisioned the development of a rational mechanics of textile structures built around engineering concepts.

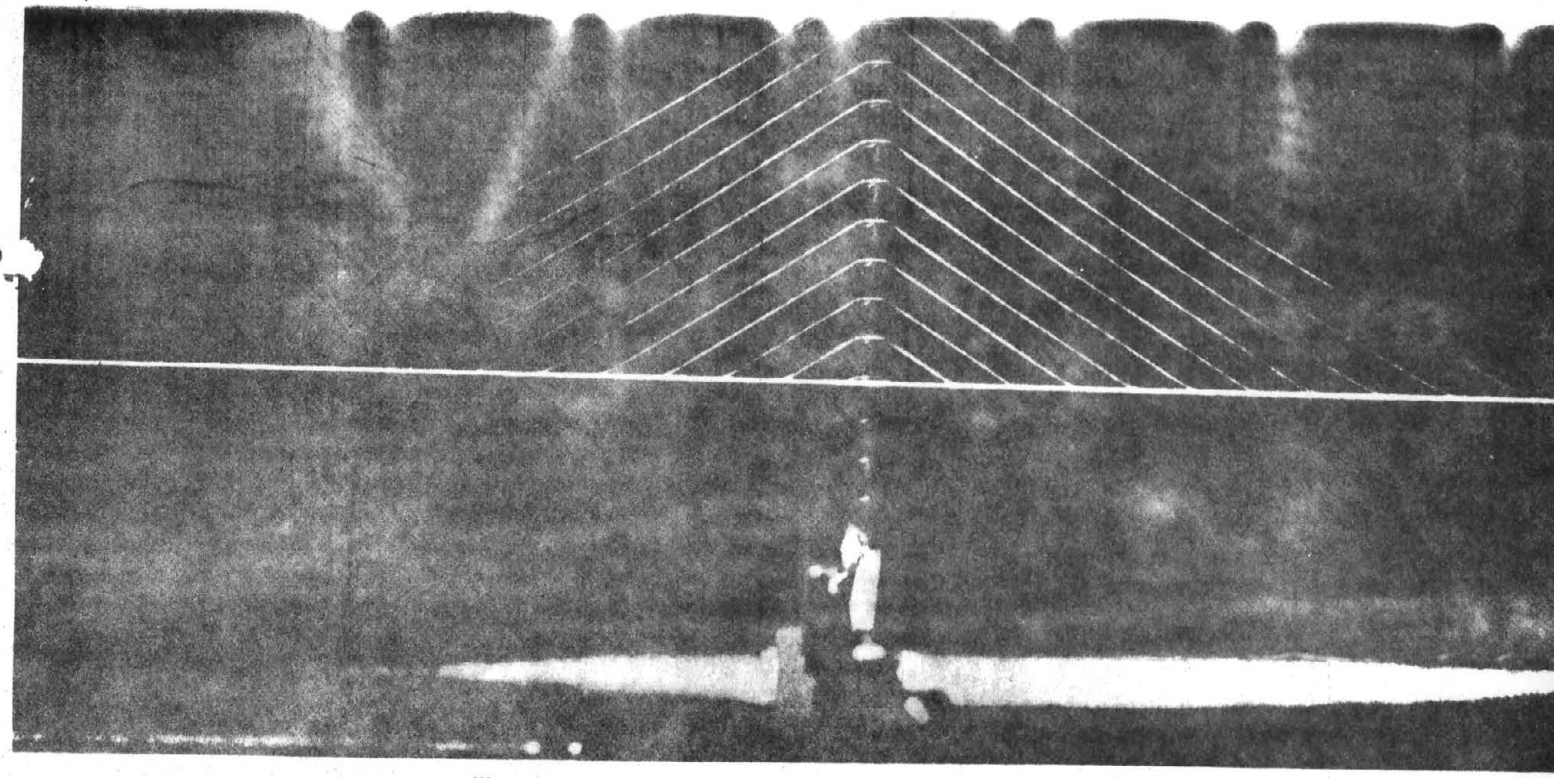
Unfortunately, I do not have a novel philosophy, and moreover, I feel that the solution of most of our future textile mechanics problems is not necessarily to be achieved by any startling new basic concept of action, but instead by detailed analysis of the specific problems encountered. However, at least two favorable aspects currently exist which were absent when I first entered the field of textiles.

Firstly, we have the advent of the computer. Anyone who has worked in the field of textile mechanics can testify to the vast complexity of the problems encountered. The large number of variables, the unique and often-times ill-defined geometry of the textile structure, and the lack of linearity of the basic mechanical properties of fibers, serve as potent barriers to the analytics of problem solving. And without such analytics, principles of performance can only be vaguely, if at all, deduced. To a great extent, the computer has resolved this particular problem since at least the numerics of solutions are now relatively easy to obtain, and repetitive trial and error procedures are feasible. Secondly, and perhaps more importantly from the point of view of the individual researcher, we have the experience to prove that simplification by assumption and idealization of physical form not only are possible for useful textile mechanics research, but, indeed are absolutely necessary. Coupled with the computer, this replacement of complex actuality by simplified ideality, with successive trials minimizing the differences between the two, indeed portends a vastly expanded and useful future for the applied mechanics of textile structures.

At the time I entered the field the computer was relatively unknown. However, I did have the advantage of the support of many people, whose courage, foresight, and patience encouraged me to work in an area for which my formal training seemed ill-suited. Stanley Backer, Walter Hamburger, George Hotte, Stephen Kennedy, Louis Larrick—these are just a few of the names that occur to me. You recognize previous Harold DeWitt Smith Medalists in this group; some of whom contributed to the field by their own research, some by their support of research, and others by both their research and support efforts. Interestingly enough, and for whatever reason, most of this support came via government funding, oftentimes in the face of severe budgetary limitations.

Viewing the more recent past, as well as the future, I note that significant aspects of textile mechanics research are again being prosecuted under government support and/or pressure. Now I do not wish to debate either the causes for this nor its desirabil-

[1] Talk presented to ASTM Committee D-13 on receipt of the Harold DeWitt Smith Memorial Award, 11 October, 1967.



Wave propagation resulting from yarn impact, multiple exposures.

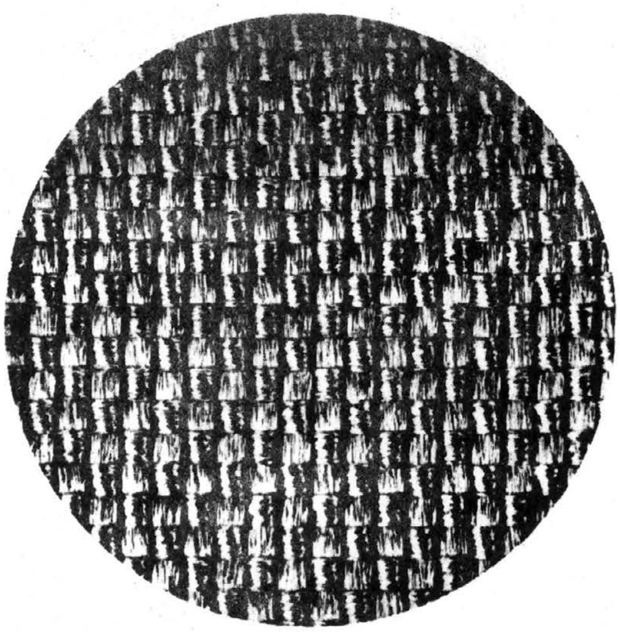
Serve as Life Preservers

ity, or efficiency, but merely to state what to me is an apparent fact. Although it is perhaps obvious, one only has to think in terms of the new materials needed for our space effort, with its weight limitations, severe functional requirements and use environments, to recognize the extent to which new challenges of a public nature have arisen.

However, in considering the extent to which the needs of government have created new textile research areas, one must think in broader terms than just the space effort. In attempting to do so, one becomes immediately aware of how many of these areas are related to the preservation or sustaining of human life, either directly or indirectly. That is, the textile either serves directly as a life sustaining structure in its own right, or is part of a system, the failure of which can result in danger to human life. Such textiles may be termed "life textiles," and I would now like to discuss a few examples of these and indicate some of the basic textile research areas which have resulted as by-products of them.

Two examples exist in the automobile, safety belts and tire cord. In the case of the safety belt, the life preserving aspect is obvious. Not so obvious, however, is the optimization of its performance characteristics, i.e., the diverse engineering considerations that enter into belt design. Certainly visco-elasticity, the dependence of stress-strain properties on strain rate, must be considered, and hence, the need for carrying out tests at higher than conventional laboratory speeds. The belt must not fail, thus its energy absorption must be high, and yet total stretch must be small enough to prevent impact against rigid objects while maximum load limits must be low enough to prevent excessive body loading by the belt itself, else the cure be worse than the disease. Regarding tire cord, it is known that the comparatively rare catastrophic failure called "fatigue" with its potentially calamitous effects, is still far from understood. Recently, however, it has become increasingly clear that tire cord fatigue failure is in fact a system failure, [*1, 11*][2] with the rubber, the cord, and, most significantly, the adhesive layer between the two, playing a vital role in combination. Moreover, the fatigue problem is not reducible to a simple interaction among the three components, but instead is the consequence of a great number of low magnitude stress applications, whose quantitative distribution among the three elements demands rather involved and subtle considerations normally disregarded in analysis and testing. Structurally, the tire system has to be considered as a composite material, and just as in a composite, non-longitudinal stress is highly significant. Small differences in Poisson's ratio among the three components, both in loading and unloading, can create substantial transverse stresses, which when repeated many times can produce the local, discrete discontinuities which are oftentimes detectable just prior to what is commonly called fatigue failure. Detailed, generalized stress analysis of tires still remains to be accomplished so that meaningful laboratory

[2] The italic numbers in brackets refer to the list of references appended to the paper.



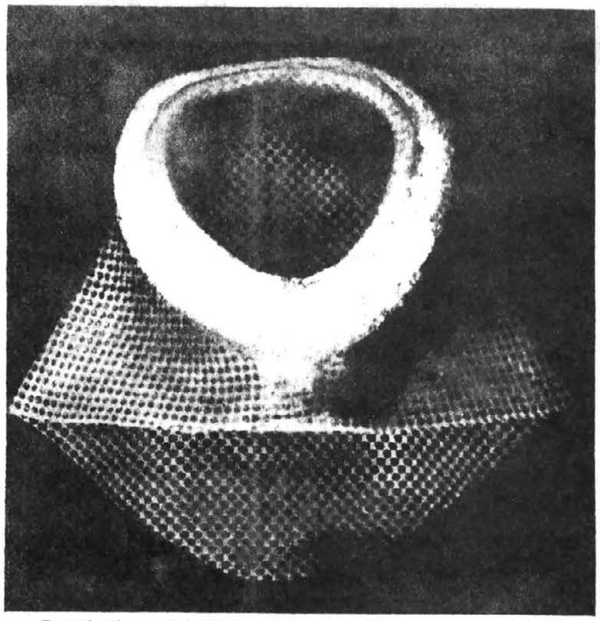
Photomicrograph of metal decelerator fabric.

simulants of the fatigue process can be developed. Significant support both for tire stress analysis and cord-in-rubber systems fatigue research is currently forthcoming from the National Bureau of Standards.

Although not as wide-spread in use as safety belts and tires, parachutes and other aerodynamic decelerator systems are additional examples of textile structures performing a life preserving use. Many studies have lead to a rather refined understanding of the relationships between parachute performance and fabric structure, where the parachute and its load-bearing components are made of conventional, well known polymers such as nylon [*12*]. Strength, energy absorption, and air permeability are all definable and measurable functional requirements which must properly be designed into the structure. By utilizing the geometry of Pierce [*13*], or modifications thereof, a reasonably accurate prediction can be made of normal parachute canopy performance characteristics. Space use, however, has imposed entirely new criteria that need to be satisfied. Foremost among these is the elevated temperature at which decelerators are stored and ultimately deployed and used. These temperature levels, oftentimes in excess of 1000 F, have provided the impetus for the creation of whole new classes of fibers. We now have: the metallics, including stainless steel and the exotic super-alloys; the refractories, including boron, the ceramics, and the carbonaceous residue materials, such as the pyrolyzed organics; and the high-temperature organics, including Nomex, Polybenzimidazole, B.B.B., and others still under development. The metallics posed an interesting challenge in that their high modulus, low yield strains, and low elongation to rupture seemed to be inconsistent with the requirements of high pressure packageability, deployability, and endurance, which demand flexibility, crease recovery, and flex resistance, respectively. Moreover, the process of converting these materials into yarn and fabric structures demanded insight into the twisting and weaving processes either never known for the conventional fibers, or else forgotten during the many years in which they have been produced. In research and development programs supported primarily by the Air Force Materials Laboratory [*3, 4, 6*], fundamental principles of the mechanics of textile structures in bending were applied to the problem. Based upon such principles [*7, 14*], it was clear that one had to minimize the product of the number of individual filaments acting jointly within a yarn as the yarn lies in the fabric, the total number of filaments in the yarn, and the filament rigidity. Practical minimization of this product was accomplished by using the finest filaments available and maintaining as much freedom of motion as possible among them. Additionally, and because of their hardness and low yield strains, successful processing of such structures was accomplished by using larger than conventional radii of curvature of all machine parts contracted and by employing special abrasion resistant guides [*5, 15*]. Once technical feasibility was demonstrated, the production of the ultra-fine diameter metallics was reduced to an economically practical level by the development of novel metallurgical processes such as multifilament bundle drawing [*8*]. Moreover, melt extrusion of ultra-fine metal filament yarns is currently under investigation [*10*]. The potential practical uses of these high temperature materials appear to extend considerably beyond the decelerator application, for example, in high stack temperature gas filtration fabrics for combating the air pollution problem and, because of their strength and modulus, as reinforcement in composites where high strength and dimensional stability are required. Incidentally, the metallics also serve as extremely useful laboratory model tools for studying the theoretical and experimental response of fiber, yarn, and fabric structure to low stress application in bending and torsion, as well as to biaxial fabric tensile stress application.

Recent news articles have placed the subject of body armor material before the public to a greater extent than heretofore. Actually, research on armor materials has been carried out for many years. The goal sought has always been flexible, lightweight, low bulk protective clothing, to be worn primarily by the infantryman and certain aircraft personnel as protection against penetration by high speed fragments and other missiles. Extensive study and development programs have been carried out under the support both of the Navy and the Quartermaster. Although the mechanism of resistance to penetration is not fully understood, the obvious function of the armor is to convert the vast kinetic energy of the fragments into: strain and kinetic energies of particles comprising the armor, surface frictional energy, and other forms of heat. In this manner, the residual speed of the fragment is either reduced to zero or to a tolerable level without severe penetration of the body of the personnel. Highly significant reductions in death and injury have come about as a result of the use of textile materials in such applications. Moreover, research into the pertinent mechanisms has resulted in other more sophisticated analyses than just the "shoot and examine techniques." Primary among these is the study of lateral and longitudinal stress and strain wave propagation, important in part to the mechanism insofar as it relates to the volume of armor material involved in resisting penetration. The highly detailed theoretical and experimental analyses of wave propagation carried out at the National Bureau of Standards [*16, 17, 18*] bear ample testimony to this fallout. Additionally, such terms as "transverse and lateral wave velocity," "sound velocity," "critical velocity and failure" have found their way into the textile research language as a consequence of this work. Finally, the development of such a useful laboratory tool for molecular structure research as the Pulse Propagation Meter can be traced to the body armor problem.

The field of bio-engineering represents an area of application of textiles where the life sustaining function is mandatory, and in contrast to other uses thus far mentioned, potentially applicable to all persons. Here, not only functional mechanical requirements exist, but also compatibility of the textile with the body environment is of paramount importance. Cir-



Prosthetic metal valve reinforced with a polyester tricot fabric and coated with silicone elastomer.

culatory system components are a dramatic example of medical textile applications. Synthetic replacements of natural body parts are termed "prostheses," and among these as circulatory assists we now have: woven or braided tubes acting as aorta replacements, reinforcements for heart valve leaflets and heart patches, and reinforced textile structures serving as diaphragms in contemplated heart replacement pumping devices. Work in these areas is being actively prosecuted under the support of the National Institute of Health [*9*] and the Army [*19*]. All of these circulatory prostheses demand such functional performance requirements as: adequate flexibility, formation and maintenance of proper geometric shape, mechanical durability under long-term repeated bending, and permanence in an often-times hostile environment. Moreover, the textile itself must not create a hostile environment for body tissue, i.e., rejection mechanisms must be absent, as must be carcinogenic effects, and finally, infiltrations must be encouraged so that ultimately engulfment of the prosthetic by natural body tissue can take place, as the synthetic degrades. Great progress has and is being made in these areas. Attendant to their practical development have come about such important, related basic studies as the surface chemistry and physics of interactions between blood and the prosthetic interface, including electro-kinetic effects. Proper blood flow through the synthetic replacements has demanded highly critical and sophisticated application of principles of fluid flow under both laminar and turbulent conditions across and through the synthetic. Excessive internal shear can cause chronic blood cell injury with attendant anemia, while stagnation can cause excessive clotting in, for example, the vicinity of the artificial heart valve. Other medical uses for textile based structures include such passive prostheses as surgical sutures, hernia and other body reinforcements, dialysis filters for use in artificial kidneys, and such active prostheses as flexible durable conductors for electrical stimulation of the heart by, say, a Pacemaker, and finally synthetic muscles which are caused to contract and expand in length by externally applied stimulii.

Reference has already been made to the recent developments in high temperature resistant textiles made of organic and inorganic fibers. Although these developments have been the result of the extreme environmental demands placed on flexible materials for space use, it has been pointed out that their potential

High energy absorbing nylon tapes are used in astronaut couches to cushion G-load shocks.

application in industrial fabrics is great. However, a moment's reflection will indicate other areas which they, or more likely their descendants, hopefully will satisfy. One such area, unfortunately, is where current textile materials, in contrast to performing a life sustaining function, often serve as direct causes of injury or death. I refer specifically to the flammability problem encountered by the consumer in apparel and/or decorative fabrics. Although not a structural mechanics problem, I thought it timely enough to discuss.

At a recent conference [2] on burns and flame retardant fabrics, cosponsored by the government, various medical groups, and insurance companies, the seriousness of the flammability problem was very forcibly discussed, particularly as in regard to clothing. Statistically, it was most convincingly demonstrated that the U. S. has the highest death rate in the world from burns due to fire and explosion, and that they are the leading causes of death in children up to age 4, and the second leading cause in the age groups 5 to 14 years, and over 45 years. While the cause of fire outbreak was not claimed to be always the textile, there is no doubt that body burns resulting from ultimate clothing ignition constitute a major part of the total number. Moreover, courts have been quite consumer oriented in that injury awards for burns exceed those for any other disability. That the entire problem is vast enough to require government support is pointed up by the very high cost involved in burn treatment work alone, estimated currently to exceed ½ billion dollars per year, most of which is supplied by public funds. Presently available fabric flame-proofing treatments, used mostly on cotton, cause so much stiffening and weakening of mechanical properties that they are suitable only for fabrics of relatively great weight. There is no doubt that the July 1, 1954, Federal Flammable Fabrics Act designed for extremely dangerous materials is quite insufficient for ordinary fabrics, and consequently more adequate legislation seems inevitable. Regarding the future, the Information Council on Fabric Flammability has been organized with the intent of further examining the problem, informing the public more meaningfully regarding the potential hazards, and encouraging and hopefully supporting research into treatment and testing. Consequently, it can be expected that consumer demand for less flammable fabrics is inevitable, and our technical developments must anticipate this demand. Since the astronaut tragedy, NASA has been more extensively supporting development of flame resistant textiles, for both mechanical and apparel functions. Although NASA's requirements are in certain respects more stringent than those of the consuming public, it is reasonable to expect that information extremely useful to the solution of this public problem will be forthcoming. As an example, it may well be that only modest application of conventional or modified flame-proofing treatments to fabrics made of the new high temperature resistant fibers could be highly beneficial.

These are just a few of the uses where textiles are so intimately concerned with life. Although the direct total volume and economic value of the textiles involved may be small, the resultant economic value to society is enormous.

In closing, I again would like to express my gratitude to ASTM for giving me this award and conferring upon me the honor of joining the distinguished company of the 17 prior Smith Medalists. Although it may be considered trite, I nevertheless feel that in receiving this award I am merely acting as a conduit for others. For without the help and support of my present and past colleagues, I doubt whether whatever accomplishments I could have made would have entitled me to this honor. It is in this spirit that I accept this award for them as well as for myself.

REFERENCES

[1] Butterworth, G. A. M., Platt, M. M., and Davis, S. J., "The Response of Nylon Tire Cord in Rubber Systems to Cyclical Strain," presented at the 1967 Fall Meeting of the Fiber Society. To be published.

[2] "Conference on Burns and Flame Retardant Fabrics," New York Academy of Medicine, 2–3 December, 1966.

[3] Coplan, M. J., Freeston, W. D., Jr., and Platt, M. M., "Conversion of High Modulus Materials into Flexible Fabric Structures," ASD-TDR-62-851, 1962.

[4] Freeston, W. D., Jr., "Flexible Fibrous Structural Materials," AFML-TR-65-118, 1965.

[5] Freeston, W. D., Jr., et al., "Fine-Wire, Multifilament-Yarn Metal Fabric," AFML-TR-65-313 1965.

[6] Freeston, W. D., Jr. and Gardella, J. W., "New and Improved Materials for Expandable Structures (Phase I—Weaving of Stranded Metal Yarns)," ASD-TDR-62-542, Pt. II, 1963.

[7] Freeston, W. D., Jr. and Platt, M. M., "Mechanics of Elastic Performance of Textile Materials. Part XV: Filament Bending Recovery," *Textile Research Journal*, Vol. 34, p. 308 1964.

[8] Gorton, C. A., McMahon, C. C., and Rizzardi, J. A., "Ultra-Fine High Temperature, High Strength Metallic Fibers," ASD-TDR-62-727, Pt. I, 1962.

[9] Hittman Associates, Inc., "Studies Basic to Consideration of the Artificial Heart Program," National Institute of Health Contract PH 43-66-99, July 1966.

[10] Kafesjian, R., et al., "Melt Spinning Continuous Filaments from High Temperature Alloys and Beryllium," AFML-TR-66-151, Pt. II, 1967.

[11] Klein, W. G., Platt, M. M., and Hamburger, W. J., "An Experimental Study of Tire Cord Fatigue," *Textile Research Journal*, Vol. 32, p. 393, 1962.

[12] Klein, W. G., Lermond, C. A., and Platt, M. M., "Research Program for the Development of a Design Procedure to Engineer Parachute Fabrics," WADC TR-58-65, 1958.

[13] Pierce, F. T., "Geometry of Cloth Structure," *Journal of the Textile Institute*, Vol. 28, T45, 1937.

[14] Platt, M. M., Klein, W. G., and Hamburger, W. J., "Mechanics of Elastic Performance of Textile Materials. Part XIV: Some Aspects of the Bending Rigidity of Singles Yarns," *Textile Research Journal*, Vol. 29, p. 611, 1959.

[15] Sebring, R. E., and Swanson, A. K., "Process Development for Stranding and Plying of Metallic Yarns," AFML-TR-64-342, 1964.

[16] Smith, J. C., McCrackin, F. L., and Schiefer, H. F., "Stress Strain Relationships in Yarns Subjected to Rapid Impact Loading. Part V: Wave Propagation in Long Textile Yarns Impacted Transversely," *Textile Research Journal*, Vol. 28, p. 288, 1958.

[17] Smith, J. C., Blandford, J. M., and Schiefer, H. F., "Stress-Strain Relationships in Yarns Subjected to Rapid Impact Loading. Part VI: Velocities of Strain Waves Resulting from Impact," *Textile Research Journal*, Vol. 30, p. 752, 1960.

[18] Smith, J. C., Blandford, J. M., and Towne, K. M., "Stress-Strain Relationships in Yarns Subjected to Rapid Impact Loading. Part VIII: Shock Waves, Limiting Breaking Velocities and Critical Velocities," *Textile Research Journal*, Vol. 32, p. 67, 1962.

[19] Woodward K. E., Harry Diamond Ordnance Laboratories, "The Army Artificial Heart Pump," U. S. Army Material Command, 1965.

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1120-1	0	1 and 2 pound	126	3.15	-
1680-1	0	2 pound	126	3.15	-
2240-1	0	2 pound	126	3.10	-

Supersedes Page 1 dated 4/1/66

New York Stores Feasted in 1967

NEW YORK. — Powered by the opening of over 2 million square feet of new store space, department and specialty store retailing in metropolitan New York generated a handsome sales increase of about 12 per cent in 1967.

Representing probably the speediest rate of expansion in the nation, last year's opening of over a dozen big stores in the region (mostly the suburbs) did not inflict any significant damage on downtown retailing, which advanced an estimated 5 per cent over 1966.

At least half of the sales improvement is seen accounted for by inflation, the remainder reflecting "real" volume improvement. Nevertheless, retailing observers point out that it was indeed significant that "downtown" continued the modest

See NEW YORK, Page 10

FOCUS

Why Did Diana, Mangel End Deal?

By HARRY BERLFEIN

NEW YORK.—Retail observers believe there were more reasons than a "drop in stock market values" that caused Diana Stores Corp. and Mangel Stores to call off merger plans.

Spokesmen for both companies said Tuesday the downward stock market trend was not conducive to the merger.

Knowledgeable sources contend that opposition from the Mangel family interests was among the prime causes for scuttling plans that would have spawned a 400-store, $300 million volume retail complex.

Both trade and retailing sources were buzzing Wednesday over the divorce action that came a month after merger was first suggested.

There was belief that somewhere along the line some Mangel people questioned whether the merger was necessary. There was also fear, although not confirmed, that the old line employes and many relatives in the Mangel organization would have been phased out.

Sources close to the merger negotiators maintain it

See WHAT, Page 25

9 Chains Hit Peak Volume

Fairchild News Service

Record February sales dominated the retail picture Wednesday.

A group of nine chains reported record dollar sales for last month.

An extra shopping day in February contributed to the sizable gains achieved by almost all these chains.

Among the big volume chains disclosing their sales were J. C. Penney with a gain of 7.1 per cent for the five-week period ended March 2. Penney did not benefit from any extra day as the five-week reporting period had 30 shopping days this year and last.

Montgomery Ward reported a whopping 16 per cent sales gain, noting that 3.9 per cent of this was attributable to

See CHAINS, Page 16

Mini - Minded Japan Takes To Innerwear

TOKYO. — Japan's fashion with-its have helped this country's foundations industry grow practically from scratch within a few years. The young fashion-conscious, figure - conscious under-30 Japanese women aided by the mini skirt and knitwear styles of 1968, are as aware of their inner fashions as they are of their outer fashions. This change is in sharp contrast to the kimono, which formerly hid a multitude of figure sins.

Department store executives estimate the average

See JAPAN, Page 18

Scott and Burlington Near 'Perfect' Fabric

NEW YORK. — The "perfect" fabric may be close at hand.

That, at least, is the inference drawn from a new process unveiled Wednesday, designed to impart new and desirable properties to a broad range of fabrics.

The process, known as graft copolymerization, has been patented by Scott Paper Co. Burlington Industries has been designated by Scott to commercially develop and license the process.

Graft copolymerization, according to Paul C. Baldwin, Scott's executive vice-president, chemically alters the molecular structure of all natural fibers such as cotton, wool and rayon, most nylons, polyvinyl alcohol and such cellulosic fibers as acetate and viscose rayon.

The new characteristics produced are said to include wrinkle-resistance, greater bulk, water-repellency, fire retardation, better dimensional stability, rot resistance, reduction of static electricity and improved adhesive qualities.

Ely R. Callaway, Jr., Burlington president, said the

See NEW, Page 25

WOMEN'S WEAR DAILY, THURSDAY, MARCH 7, 1968

What Ended Diana, Mangel Merger Deal?

Continued from Page One

was Mangel rather than Diana that reneged.

THE MANGEL board and its officers, with the exception of Jared Rosenthal, president, have had a close kinship for many years. The families of Mangel, Diamond and Guzy are deeply entrenched in the operation.

Of the 11 directors on the Mangel board, six have family ties with management. They are Herbert J. Deitz, counsel; Israel A. Diamond, vice-president and treasurer; Phillip F. Frankel, executive vice-president; Emanuel Mangel, assistant treasurer and assistant secretary; Sol Mangel, board chairman, and George M. Jaffin, attorney.

The group controls 110,000 out of 802,000 common shares outstanding.

Mr. Rosenthal, a top merchandiser, was brought in from the outside two years ago to bring the company back to the profit side and inject a new line of command. He did just that.

AS SOON as he took over, he initiated a program of revitalization of existing stores and promotion of charge accounts, coupled with aggressive sales promotion, lifting of merchandise standards, resources and store operations.

From a net loss of $263,547 in 1965, Mangel bounced into the black in 1966 and 1967. The last earning statement for period ended Jan. 31, 1967, show net earnings of $1,362,559. In the previous year the profit rose over $1 million.

Mr. Rosenthal on Wednesday

New Process For Fabrics Gets Unveiled

Continued from Page One

company will evaluate the process in all its areas with a view to using it in its products as well as licensing it nationally and internationally. Executives of both companies said they would be happy to see some commercial products "in a year."

The process works by reacting the fiber (or fabric) to form a thio-carbonate or thio-carbamate, depending on the fiber. This is then exposed to a monomer in the presence of a peroxide. The resultant polymer will have the new characteristics which are predetermined depending on the reagents and monomers used.

In addition to the characteristics listed above, some of the new properties which can be introduced into the fabrics include: Greater resilience, chemical degradation resistance, sterility, quick drying, high energy radiation protective, heat stability, hemostasis (blood clotting ability), ion exchange, soil resistance and variable electrical conductance.

THESE CHARACTERISTICS can be imparted singly or in groups, and are said to survive repeated launderings and dry cleanings.

Doctors Robert W. Faessinger and John S. Conte, Scott researchers who developed the process, said it produces "profound and permant changes in the chemical composition." In chemical terms, they said, "rayon so treated ceases to become rayon; it becomes a new chemical entity."

Mr. Callaway noted that Scott had been working on prototypes but he indicated the most immediate areas for commercial development could be in raincoatings water repellency) and in the fire-resistance field for all fabrics.

In addition, the blood clotting

narket speculation.

MR. ROSENTHAL, like Samel D. May, president of Diana, avored the merger. But Mr. osenthal reportedly was swayed y the Mangel family. Mr. Rosenhal was given a firm hand when e took over, but, apparently he ould not swing the deal.

Outsiders say, that Mangel on econd thought believed it was etter off going it alone. After l, it had rounded the corner and as moving progressively in the scount division.

Some directors felt the combine ould not solve anything. The onomies would be limted. There as store conflict in a number of ies.

DIANA, with its Great Eastern scounter, hovered over the oppers Fair units of Mangel. here was also a question of ho would dominate the new mplex, Diana or Mangel.

Diana has 10 giant Great Easth units on the drawing board the forseeable future. A former countant, Mr. May qualifies the area of finances and adnistration, rather than merndising. His thinking tends vards bigness.

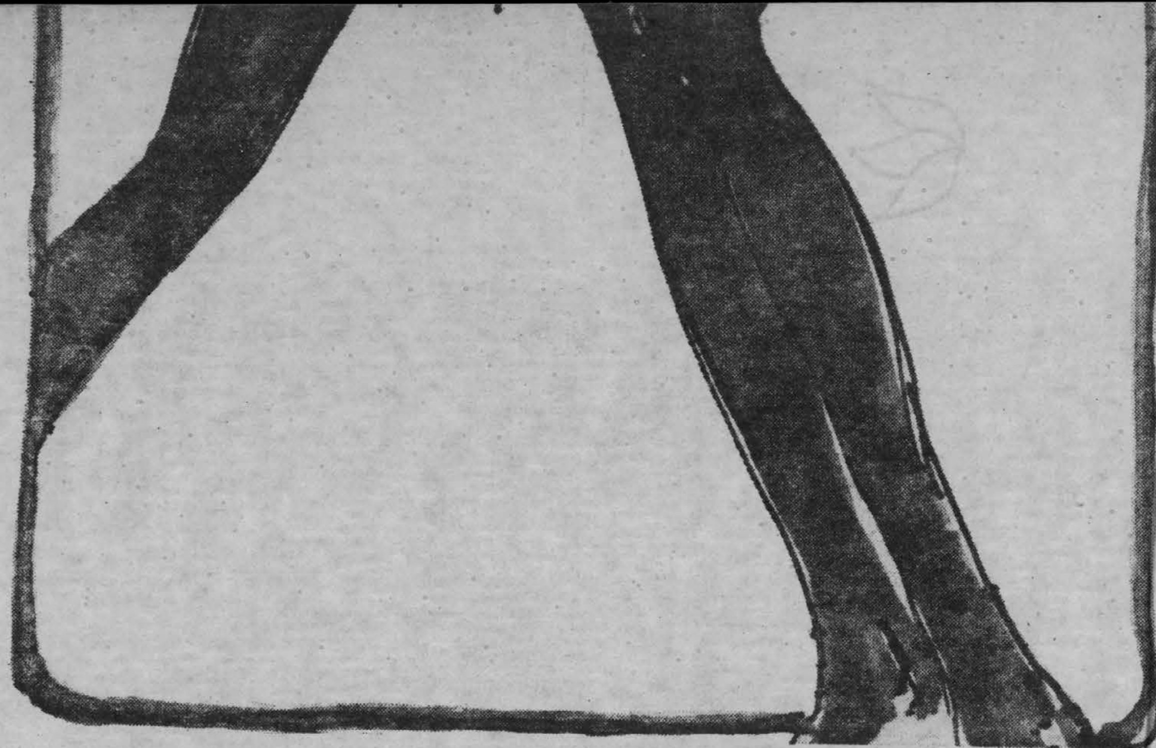
Mangel, founded at the turn of century, has maintained the nservative line with respect to ening new stores or seeking ersification. Its emphasis has n on improving and enlarging sting profitable stores.

Confirm Wales Leaving Rainwear

OSTON.—Wales Manufactur- Co., producer of women's and n's rainwear is leaving the d. This confirms a previous y (WWD, Feb. 28).

enjamin Cohen, president and surer of Wales, confirmed earlier report and stressed decision was prompted solely his desire to return to his practice. "We have stopped ufacturing and selling rains," he said, "and are selling machinery and equipment. are continuing the corporafor other purposes. In fact, are doing some fabric coning."

he company manufactured ic women's rainwear under Lady Wales label.



WILLIAMHOUSE BUYS BRIDES SHOWCASE

NEW YORK. — Williamhouse-Regency, Inc., manufacturer and distributor of cards, stationery and vinyl products, has acquired Brides Showcase International, a bridal franchise operation.

The purchase, for an undisclosed number of Williamhouse-Regency shares, represents the first diversification move into the franchise field, according to Saul Olzman, chairman.

Brides Showcase has current franchises in Washington, D. C., Providence and Staten Island.

In another expansion move, Williamhouse - Regency has agreed to acquire Greenwood Press, Inc., and its three affiliates for an undisclosed amount of stock.

SEARS GROUP POST

BUFFALO, N. Y. — John J. Gilgallon, manager since 1960 of Sears, Roebuck and Co., Main Street store here, has been named group manager for Sears in Syracuse, N. Y.

Mr. Gilgallon will be in charge of eight Syracuse area stores. His successor here has not been named.

SUNSHINE SONY

SONY SCHOTLAND IS SHINING UP THE FASHION IMAGE AT HER NEW PLACE.

Sony is part of the S. A. new places and faces. After summer at Zelinka Matlick, she made the move to Golet and has been busily working on fall . . . "They want a fashion image and have given me a free hand. It is wonderful." As she talks about her new place, she gets very enthusiastic . . . thumbing through her early sketches and matching them with fabrics. "I like to mix fabrics and color . . . sort of a sportswear look." And that's part of Sony's fall . . . she doesn't think coats and suits should be so "limited" . . . so stiff and solid.

Two of the early looks that Sony is concentrating on are vestsuits and Midis. I like the Midi as long as it is applied to a wardrobe of lengths . . . and it must be belted and have narrow shoulders." And Sony is "having fun with the leather division, too." One of her favorite looks is the jumper over leotards . . . plus fur-trimmed and leather Midi coats. "I will also do some evening clothes."

Sony's fall firsts: The plaid sweatery jacket with bicolor long V-neck pull top and pleated swing skirt (left) . . . the V-neck leather jumper over a brown knit leotard (right).

—K. H.

Drawings by Dorothy Loverro

surgical gauze could be treated for making certain bandages and dressings.

Mr. Callaway noted in addition that the process produces different dye selectivity depending on the monomer used to create the new graft copolymer. This means that in the case of blends, there would be different color results with one dye. This opens a greater potential for cross dyeing effects.

The process, according to the researchers, can be applied in the fiber, yarn or fabric stage. The cost, said Mr. Baldwin, would be "within a commercial reality."

GRAFT COPOLYMERIZATION, Drs. Faessinger and Conte noted, is not new. The most commonly used process is the Cyanamid Ceric-Ion process, but it has a number of drawbacks.

These include a limit to the number of monomers usable; side reactions and limited control of the reaction. These drawbacks are eliminated in the Scott process, they said.

The process can be applied to all cellulosics, Mr. Baldwin stated, but paper technology, while being studied, does not appear to be a feasible area because of the cheapness of the paper product.

He added Scott came to Burlington after reaching the conclusion it "is the best company in the textile field to undertake the very broad development and licensing program which is now needed."

Arlan's Plans 6th Unit In St. Louis Area

NEW YORK. — Arlan's Department Stores, Inc., will build a sixth unit in St. Louis. The 90,000-square-foot store will open in the spring of 1969, with construction beginning this summer.

Location is at the intersection of Interstate Highway 270 and Graham Road. Reported previously were two additional Arlan's stores to be opened soon in the St. Louis market.

400-"18
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SALES REPRESENTATIVE
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PHILA PA

ARRIVING PHILA ON ALLEGHANY FLIGHT 801 8:20 AM ON 3/21

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1617 JOHN F. KENNEDY BLVD
PHILA, PA.

ARRIVING PHILA ON ALLEGHANY FLIGHT #801 [illegible] 8:20 A.M. ON 3/21

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3M CO.

3119

NEW PRODUCT IDEA

March 26, 1968

TO: W. S. HUTCHINSON - TECHNICAL PLANNING & COORDINATION - 220-11E

FROM: A. W. BOESE - RETAIL TAPE & GIFT WRAP DIVISION - 220-8W

This is to advise you that the new product idea by Mr. George Byron, Serial No. 13365, dated March 25, 1968, which you referred to me has been sent on to Will Erickson of our Division for handling.

AWB:saj

cc: W. P. Erickson - 220-8W

Interoffice Correspondence 3M COMPANY

Subject: Safety Inspection
Retail Tape & Gift Wrap Lab

cc

R. J. Barghini	230-B
A. W. Boese	220-8W
H. R. Courtney	230-B
T. L. Joseph	230-16
J. N. Korich	230-26
R. D. MacDonald	230-24
G. W. Miller	230-B
G. R. Rabuse	230-24
H. J. Revoir	230-15A
G. A. Seiler	230-B
R. M. Schmidt	230-B
J. F. Schneider	230-B
C. A. Thorpe	230-25

March 27, 1968

TO: T. E. WOLLNER - RETAIL TAPE DIVISION - 230-28
W. C. PEARSON - GIFT WRAP DIVISION - 230-B

FROM: W. F. BITTNER - GIFT WRAP DIVISION - 230-B
L. J. MILLER - RETAIL TAPE DIVISION - 230-27

On March 26, 1968 Messrs. W. F. Bittner and L. J. Miller inspected the Retail Tape and Gift Wrap areas. The following safety violations were found.

S-3 Improper wiring to lamp base.

S-10 Two-prong plug on Sears vacuum cleaner.
Defective wall switch for hood.

S-12 Two-prong plug on Westinghouse iron.
Three (3) one gallon jars of flammable material without protective metal around them.

S-13 Two-porng plug on heating plate.
Yellow grounding wire on floor loose - could cause tripping.

S-15 Two-prong plug on optical bench.

S-70 Two-prong plug on typewriter.
Two-prong plug on fluorescent light on lab bench.
Acetone in gallon jar without protective metal around it.

S-217 Burned out light bulb on hood switch.

S-224 Burned out light bulbs on exhaust switches MSW240 & MSW241.
Crowded top shelf on lab bench - bottles stacked, etc. Could easily be knocked down.
Unsecured fire extinguisher on floor by desk.

WFB LJM

WFB:LJM:jmk

FORM 84-M-10

PURCHASE REQUISITION

REQUISITION NO.

FROM: PURCHASING BUILDING 235-3 | P.A. | DATE 4/11/68

TO: REQUESTED BY B. E. FRANK | PLANT/DEPT. RT & GW DIV. LAB | BLDG. FLR. 230-B(35) | REQUESTERS PHONE NO. 35297

PURCHASE ORDER NO.

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	3119					

DELIVER TO: REQUESTER XX | STORAGE | PLANT | BLDG. | OTHER

RECEIVING REPORTS TO: INSPECTION / QUALITY CONTROL DEPT. NO. | LOCATION | REQUESTER

RETURNABLE CONTAINERS VALUE | DATE NEEDED

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG.	DATE	ADDITIONAL AUTHORIZATION BY	DATE
				[signature]	4/11/68		

PURCHASE FROM:

Societe Rhovyl

SHIP TO

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS | INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
				ASAP

ITEM	QUANTITY	UNIT	DESCRIPTION	PRICE	UNIT
1	20	lbs.	Fibravyl 1.8 denier -- 1½" staple (or 2½")		
2	20	lbs.	Fibravyl 3 denier -- 1½" staple (or 2½")		

DO NOT WRITE IN THIS AREA

TYPE BY	COME-OUT DATE	EST. COMP. DATE

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION
- ☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
- ☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
- ☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
- ☐ OTHER:

FOR CASH PURCHASE ONLY
- ☐ TELEPHONE ORDER
- ☐ PAY FROM WORKING FUND

DATE RECEIVED	FREIGHT CHARGES
PACKING LIST NO.	DATE PREPARED

PURCHASING VALIDATION

GUIDE TO FILLING OUT A PURCHASE REQUISITION

For E requisitions, see Engineering Procedures

3M **PURCHASE REQUISITION**

REQUISITION NO.

PURCHASE ORDER NO.

TO	PURCHASING BUILDING *Fill in Building*	P.A. *Also Purchasing Agent if Confirmation*	DATE *Date Requisition is Originated*
FROM	REQUESTED BY *Your Name,*	PLANT/DEPT. *Location* BLDG. FLR.	REQUESTERS PHONE NO. *Phone No.*

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	See	*Purchasing*	*Commodity Catalog For Expl*	*anation of Accounting Codes*	*and Fixed Asset Definiti*	*ons.*

DELIVER TO: REQUESTER ☐ STORAGE PLANT BLDG. *Indicate Delivery Information*

OTHER ** — See Below*

RECEIVING REPORTS TO: INSPECTION / QUALITY CONTROL DEPT. NO. LOCATION *** SEE BELOW* REQUESTER ☐

RETURNABLE CONTAINERS VALUE *If Known*

DATE NEEDED *Give Definite Realistic Date*

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG. DATE	ADDITIONAL AUTHORIZATION BY DATE
— — — — FOR	*PURCHASI*	*NG USE —*	*— — — —*	*Varies By Division*	*Varies by Division and Commodity*

PURCHASE FROM:

To be decided by, or in conjunction with, Purchasing. If not known, leave blank.

SHIP TO: *Normal Ship To address will be indicated by Purchasing (Special Ship To address indicated by Requester.)*

Check appropriate box. Purchasing Agent will verify from tax schedule

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS

INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
— — — — — — — —	*- - - Will be determined by*	*Purchasing - - - - - - -*	*— — — — —*	*— — — — —*

ITEM	DO NOT WRITE IN THIS AREA	QUANTITY	UNIT	DESCRIPTION	PRICE	UNIT

— Give complete and concise description including Catalog Number if available

— Indicate if equivalent competitive equipment is suitable

— Refer to quotations where applicable

— Group items so that each requisition covers items supplied by only one Vendor (when Vendor is known)

Indicate price and unit - Note if estimated (est)

** If the Purchase is for direct shipment to a 3M customer, record the words "Customer Order" followed by the 3M House Order Number.*

***A copy of the receiving report will not be sent to Inspection, Quality Control or the Requester unless it has been so noted. If a copy is required for Inspection or Quality Control, show that Dept. Number and Location.*

Below For Purchasing Use Only

TYPE BY	COME-OUT DATE	EST. COMP. DATE

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION

- ☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
- ☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
- ☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
- ☐ OTHER:

FOR CASH PURCHASE ONLY

- ☐ TELEPHONE ORDER
- ☐ PAY FROM WORKING FUND

DATE RECEIVED	FREIGHT CHARGES
PACKING LIST NO.	DATE PREPARED

PURCHASING VALIDATION

FORM 84-M-10

3M PURCHASE REQUISITION

REQUISITION NO.

FROM	PURCHASING BUILDING	P.A.	DATE
	235-3		4/11/68

TO	REQUESTED BY	PLANT/DEPT.	BLDG. FLR.	REQUESTERS PHONE NO.
	B. E. FRANK	RT & GW DIV. LAB	230-B(35)	35297

PURCHASE ORDER NO.

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	3119					

DELIVER TO: REQUESTER xx STORAGE PLANT BLDG.

OTHER

RECEIVING REPORTS TO: INSPECTION / QUALITY CONTROL DEPT. NO. LOCATION REQUESTER

RETURNABLE CONTAINERS VALUE

DATE NEEDED

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG.	DATE	ADDITIONAL AUTHORIZATION BY	DATE
				[signature]	4/11/68		

PURCHASE FROM:

Celanese Fibers Co.
522 Fifth Avenue
New York, N. Y. 10036

SHIP TO

TAXABLE FOR RESALE FOR USE DIRECTLY IN THE MANUFACTURING PROCESS

INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
				ASAP

ITEM	QUANTITY	UNIT	DESCRIPTION	PRICE	UNIT
1	20	lbs.	Type 440 Polyester FII (hi-shrink) 1.5 denier -- 1½" staple (or equivalent) in staple length		
2	20	lbs.	Type 440 Polyester FII (hi-shrink) 3.0 denier -- 1½" staple (or equivalent) in staple length		

DO NOT WRITE IN THIS AREA

TYPE BY	COME-OUT DATE	EST. COMP. DATE

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION

- ☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
- ☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
- ☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
- ☐ OTHER:

FOR CASH PURCHASE ONLY

- ☐ TELEPHONE ORDER
- ☐ PAY FROM WORKING FUND

DATE RECEIVED	FREIGHT CHARGES

PACKING LIST NO.	DATE PREPARED

PURCHASING VALIDATION

GUIDE TO FILLING OUT A PURCHASE REQUISITION

For E requisitions, see Engineering Procedures

3M PURCHASE REQUISITION

REQUISITION NO.

PURCHASE ORDER NO.

TO	PURCHASING BUILDING *Fill in Building*	P.A. *Also Purchasing Agent if Confirmation*	DATE *Date Requisition is Originated*
FROM	REQUESTED BY *Your Name,*	PLANT/DEPT. *Location* BLDG. FLR.	REQUESTERS PHONE NO. *Phone No.*

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	See	*Purchasing C*	*ommodity Catalog For Expl*	*anation of Accounting Codes*	*and Fixed Asset Definiti*	*ons.*

DELIVER TO — REQUESTER ☐ — STORAGE PLANT BLDG. *Indicate Delivery Information*

OTHER ** — See Below*

RECEIVING REPORTS TO — INSPECTION / QUALITY CONTROL DEPT. NO. LOCATION *** SEE BELOW* — REQUESTER ☐

RETURNABLE CONTAINERS VALUE *If Known*

DATE NEEDED *Give Definite Realistic Date*

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG. DATE	ADDITIONAL AUTHORIZATION BY DATE
— — — — FOR	*PURCHASI*	*NG USE —*	*— — — —*	*Varies By Division*	*Varies by Division and Commodity*

PURCHASE FROM:

To be decided by, or in conjunction with, Purchasing. If not known, leave blank.

SHIP TO

Normal Ship To address will be indicated by Purchasing (Special Ship To address indicated by Requester.)

Check appropriate box. Purchasing Agent will verify from tax schedule

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS

INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
— — — — — — — — — — — — — — - - -Will be	*determined by*	*Purchasing - - - — — — — —*	*— — — — — — —*	*— — — — — — —*

ITEM		QUANTITY	UNIT	DESCRIPTION	PRICE UNIT

DO NOT WRITE IN THIS AREA

— Give complete and concise description including Catalog Number if available

— Indicate if equivalent competitive equipment is suitable

— Refer to quotations where applicable

— Group items so that each requisition covers items supplied by only one Vendor (when Vendor is known)

Indicate price and unit - Note if estimated (est)

** If the Purchase is for direct shipment to a 3M customer, record the words "Customer Order" followed by the 3M House Order Number.*

A copy of the receiving report will not be sent to Inspection, Quality Control or the Requester unless it has been so noted. If a copy is required for Inspection or Quality Control, show that Dept. Number* ***and Location.

Below For Purchasing Use Only

TYPE BY	COME-OUT DATE	EST. COMP. DATE

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION

- ☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
- ☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
- ☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
- ☐ OTHER:

FOR CASH PURCHASE ONLY

- ☐ TELEPHONE ORDER
- ☐ PAY FROM WORKING FUND

DATE RECEIVED	FREIGHT CHARGES
PACKING LIST NO.	DATE PREPARED

PURCHASING VALIDATION

FORM 84-M-10

3M PURCHASE REQUISITION

REQUISITION NO.

PURCHASE ORDER NO.

FROM	PURCHASING BUILDING 235-3	P.A.		DATE 4/11/68
TO	REQUESTED BY B. E. FRANK	PLANT/DEPT. RT & GW DIV. LAB	BLDG. FLR. 230-B(35)	REQUESTERS PHONE NO. 35297

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	3119					

DELIVER TO: REQUESTER xx | STORAGE | PLANT | BLDG.
OTHER

RECEIVING REPORTS TO | INSPECTION / QUALITY CONTROL DEPT. NO. | LOCATION | REQUESTER
RETURNABLE CONTAINERS VALUE | DATE NEEDED

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG.	DATE	ADDITIONAL AUTHORIZATION BY	DATE
				[illegible signature]	4/11/68		

PURCHASE FROM:

E. I. du Pont de Nemours & Co.
Textile Fibers Dept.
1007 Market Street.
Wilmington, Del. 19898

SHIP TO

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS

INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
				ASAP

ITEM	QUANTITY	UNIT	DESCRIPTION	PRICE	UNIT
1	20	lbs.	First Quality Type 420 2.3 denier -- 1½" staple	$.68 @	
2	20	lbs.	Second Grade Type 100 3 denier -- 1½" staple	$.82 @	
3	20	lbs.	Second Grade Type 101 3 denier -- 1½" staple	$.84 @	
4	20	lbs.	Second Grade Type 200 3 denier -- 1½" staple	$.82 @	
5	20	lbs.	Second ~~Grande~~ Grade Type 201 3 denier - 1½" staple	$.84 @	

DO NOT WRITE IN THIS AREA

TYPE BY	COME-OUT DATE	EST. COMP. DATE

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION
☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
☐ OTHER:

FOR CASH PURCHASE ONLY
☐ TELEPHONE ORDER
☐ PAY FROM WORKING FUND

DATE RECEIVED	FREIGHT CHARGES
PACKING LIST NO.	DATE PREPARED

PURCHASING VALIDATION

GUIDE TO FILLING OUT A PURCHASE REQUISITION

For E requisitions, see Engineering Procedures

3M PURCHASE REQUISITION

REQUISITION NO.

PURCHASE ORDER NO.

TO	PURCHASING BUILDING *Fill in Building*	P.A. *Also Purchasing Agent if Confirmation*	DATE *Date Requisition is Originated*
FROM	REQUESTED BY *Your Name,*	PLANT/DEPT. *Location* BLDG. FLR.	REQUESTERS PHONE NO. *Phone No.*

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	See	*Purchasing C*	*ommodity Catalog For Expl*	*anation of Accounting Codes*	*and Fixed Asset Definiti*	*ons.*

DELIVER TO: REQUESTER ☐ STORAGE PLANT BLDG. *Indicate Delivery Information*

OTHER ** — See Below*

RECEIVING REPORTS TO: INSPECTION / QUALITY CONTROL DEPT. NO. LOCATION ** SEE BELOW · REQUESTER ☐

RETURNABLE CONTAINERS VALUE *If Known*

DATE NEEDED *Give Definite Realistic Date*

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG. DATE	ADDITIONAL AUTHORIZATION BY DATE
— — — — FOR	*PURCHASI*	*NG USE —*	*— — — —*	*Varies By Division*	*Varies by Division and Commodity*

PURCHASE FROM:

To be decided by, or in conjunction with, Purchasing. If not known, leave blank.

SHIP TO:

Normal Ship To address will be indicated by Purchasing (Special Ship To address indicated by Requester.)

Check appropriate box. Purchasing Agent will verify from tax schedule

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS

INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
— — — — — — — — — — — — — - - - Will be determined by Purchasing - - - — — — — —			*— — — — — — —*	*— — — — — — — —*

ITEM		QUANTITY	UNIT	DESCRIPTION	PRICE UNIT
	DO NOT WRITE IN THIS AREA				

— Give complete and concise description including Catalog Number if available

— Indicate if equivalent competitive equipment is suitable

— Refer to quotations where applicable

— Group items so that each requisition covers items supplied by only one Vendor (when Vendor is known)

Indicate price and unit - Note if estimated (est)

** If the Purchase is for direct shipment to a 3M customer, record the words "Customer Order" followed by the 3M House Order Number.*

***A copy of the receiving report will not be sent to Inspection, Quality Control or the Requester unless it has been so noted. If a copy is required for Inspection or Quality Control, show that Dept. Number and Location.*

Below For Purchasing Use Only

TYPE BY	COME-OUT DATE	EST. COMP. DATE	FOR CASH PURCHASE ONLY	DATE RECEIVED	FREIGHT CHARGES
			☐ TELEPHONE ORDER	PACKING LIST NO.	DATE PREPARED
			☐ PAY FROM WORKING FUND		

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION

- ☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
- ☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
- ☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
- ☐ OTHER:

PURCHASING VALIDATION

FORM 84-M-10

3M PURCHASE REQUISITION

REQUISITION NO.

PURCHASE ORDER NO.

FROM	PURCHASING BUILDING 235-3	P.A.		DATE 4/11/68
TO	REQUESTED BY B. E. FRANK	PLANT/DEPT. RT & GW DIV. LAB.	BLDG. FLR. 230-B(35)	REQUESTERS PHONE NO. 35297

CONTROL MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
3119					

DELIVER TO: REQUESTER XX | STORAGE | PLANT | BLDG. | OTHER

RECEIVING REPORTS TO: INSPECTION / QUALITY CONTROL DEPT. NO. | LOCATION | REQUESTER

RETURNABLE CONTAINERS VALUE | DATE NEEDED

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG.	DATE	ADDITIONAL AUTHORIZATION BY	DATE
				[signature]	4/11/8	[signature]	

PURCHASE FROM:

Union Carbide Corp.
Fibers and Fabrics Div.

270 Park Avenue
New York, N. Y. 10017

SHIP TO

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS

INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
				ASAP

ITEM	QUANTITY	UNIT	DESCRIPTION	PRICE	UNIT
1	20	lbs.	Dynel (Reg.) 2 denier -- 1-9/16" staple (or equivalent)	$.95 @	
2	20	lbs.	Dynel (Reg.) 3 denier -- 1-9/16" staple (or equivalent)	$.75 @	

DO NOT WRITE IN THIS AREA

TYPE BY	COME-OUT DATE	EST. COMP. DATE

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION
- ☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
- ☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
- ☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
- ☐ OTHER:

FOR CASH PURCHASE ONLY
- ☐ TELEPHONE ORDER
- ☐ PAY FROM WORKING FUND

DATE RECEIVED	FREIGHT CHARGES
PACKING LIST NO.	DATE PREPARED

PURCHASING VALIDATION

GUIDE TO FILLING OUT A PURCHASE REQUISITION

For E requisitions, see Engineering Procedures

3M

PURCHASE REQUISITION

REQUISITION NO.

PURCHASE ORDER NO.

TO	PURCHASING BUILDING *Fill in Building*	P.A. *Also Purchasing Agent if Confirmation*	DATE *Date Requisition is Originated*
FROM	REQUESTED BY *Your Name,*	PLANT/DEPT. *Location* BLDG. FLR.	REQUESTERS PHONE NO. *Phone No.*

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	See	*Purchasing*	*Commodity Catalog For Expl*	*anation of Accounting Codes*	*and Fixed Asset Definiti*	*ons.*

DELIVER TO: REQUESTER ☐ STORAGE PLANT BLDG. *Indicate Delivery Information*

OTHER ** — See Below*

RECEIVING REPORTS TO: INSPECTION / QUALITY CONTROL DEPT. NO. LOCATION *** SEE BELOW* REQUESTER ☐

RETURNABLE CONTAINERS VALUE *If Known*

DATE NEEDED *Give Definite Realistic Date*

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG. DATE	ADDITIONAL AUTHORIZATION BY DATE
— — — — FOR	*PURCHASI*	*NG USE —*	*— — — —*	*Varies By Division*	*Varies by Division and Commodity*

PURCHASE FROM:

To be decided by, or in conjunction with, Purchasing. If not known, leave blank.

SHIP TO: *Normal Ship To address will be indicated by Purchasing (Special Ship To address indicated by Requester.)*

Check appropriate box. Purchasing Agent will verify from tax schedule

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS

INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
— — — — — — — — — Will be determined by Purchasing — — — — — —			*— — — — —*	*— — — — —*

ITEM	DO NOT WRITE IN THIS AREA	QUANTITY	UNIT	DESCRIPTION	PRICE UNIT

— Give complete and concise description including Catalog Number if available

— Indicate if equivalent competitive equipment is suitable

— Refer to quotations where applicable

— Group items so that each requisition covers items supplied by only one Vendor (when Vendor is known)

Indicate price and unit - Note if estimated (est)

** If the Purchase is for direct shipment to a 3M customer, record the words "Customer Order" followed by the 3M House Order Number.*

***A copy of the receiving report will not be sent to Inspection, Quality Control or the Requester unless it has been so noted. If a copy is required for Inspection or Quality Control, show that Dept. Number and Location.*

Below For Purchasing Use Only

TYPE BY	COME-OUT DATE	EST. COMP. DATE

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION

- ☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
- ☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
- ☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
- ☐ OTHER:

FOR CASH PURCHASE ONLY

- ☐ TELEPHONE ORDER
- ☐ PAY FROM WORKING FUND

DATE RECEIVED	FREIGHT CHARGES
PACKING LIST NO.	DATE PREPARED

PURCHASING VALIDATION

FORM 84-M-10

3M PURCHASE REQUISITION

REQUISITION NO.

PURCHASE ORDER NO.

FROM	PURCHASING BUILDING 235-3	P.A.		DATE 4/11/68
TO	REQUESTED BY B. E. FRANK	PLANT/DEPT. RT & GW DIV. LAB	BLDG. FLR. 230-B(35)	REQUESTERS PHONE NO. 35297

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	3119					

DELIVER TO: REQUESTER [X] STORAGE PLANT BLDG. OTHER

RECEIVING REPORTS TO: INSPECTION / QUALITY CONTROL DEPT. NO. LOCATION REQUESTER

RETURNABLE CONTAINERS VALUE DATE NEEDED

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG.	DATE	ADDITIONAL AUTHORIZATION BY	DATE
				[signature]			

PURCHASE FROM:

Dow Badische Company
Textile Fibers Dept.

350 Fifth Avenue
New York, N. Y. 10001

SHIP TO

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS

INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
				ASAP

ITEM	QUANTITY	UNIT	DESCRIPTION	PRICE	UNIT
1	20	lbs.	Bright 1st quality Acrylic (Type 100) 2 denier -- 1½" staple	$.82 @	
2	20	lbs.	Semi-Bright Industrial Acrylic (Type 500) 3 denier -- 2" staple	$.66 @	

DO NOT WRITE IN THIS AREA

TYPE BY	COME-OUT DATE	EST. COMP. DATE

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION
- ☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
- ☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
- ☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
- ☐ OTHER:

FOR CASH PURCHASE ONLY
- ☐ TELEPHONE ORDER
- ☐ PAY FROM WORKING FUND

DATE RECEIVED	FREIGHT CHARGES
PACKING LIST NO.	DATE PREPARED

PURCHASING VALIDATION

GUIDE TO FILLING OUT A PURCHASE REQUISITION

For E requisitions, see Engineering Procedures

3M **PURCHASE REQUISITION**

REQUISITION NO.

PURCHASE ORDER NO.

TO	PURCHASING BUILDING *Fill in Building*	P.A. *Also Purchasing Agent if Confirmation*	DATE *Date Requisition is Originated*
FROM	REQUESTED BY *Your Name,*	PLANT/DEPT. *Location* BLDG. FLR.	REQUESTERS PHONE NO. *Phone No.*

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	See	*Purchasing*	*Commodity Catalog For Expl*	*anation of Accounting Codes*	*and Fixed Asset Definiti*	*ons.*

DELIVER TO: REQUESTER ☐ STORAGE PLANT BLDG. *Indicate Delivery Information*

OTHER ** — See Below*

RECEIVING REPORTS TO: INSPECTION / QUALITY CONTROL DEPT. NO. LOCATION *** SEE BELOW* REQUESTER ☐

RETURNABLE CONTAINERS VALUE *If Known*

DATE NEEDED *Give Definite Realistic Date*

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG. DATE	ADDITIONAL AUTHORIZATION BY DATE
— — — — FOR	*PURCHASIN*	*G USE —*	*— — — —*	*Varies By Division*	*Varies by Division and Commodity*

PURCHASE FROM:

To be decided by, or in conjunction with, Purchasing. If not known, leave blank.

SHIP TO

Normal Ship To address will be indicated by Purchasing (Special Ship To address indicated by Requester.)

Check appropriate box. Purchasing Agent will verify from tax schedule

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS

INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
— — — — — — — — — — — — — — — - - -Will be	*determined by Purchasing*	*- - - — — — — —*	*— — — — — —*	*— — — — — — —*

ITEM		QUANTITY	UNIT	DESCRIPTION	PRICE UNIT

DO NOT WRITE IN THIS AREA

— Give complete and concise description including Catalog Number if available

— Indicate if equivalent competitive equipment is suitable

— Refer to quotations where applicable

— Group items so that each requisition covers items supplied by only one Vendor (when Vendor is known)

Indicate price and unit - Note if estimated (est)

** If the Purchase is for direct shipment to a 3M customer, record the words "Customer Order" followed by the 3M House Order Number.*

A copy of the receiving report will not be sent to Inspection, Quality Control or the Requester unless it has been so noted. If a copy is required for Inspection or Quality Control, show that Dept. Number* ***and Location.

Below For Purchasing Use Only

TYPE BY	COME-OUT DATE	EST. COMP. DATE

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION

- ☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
- ☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
- ☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
- ☐ OTHER:

FOR CASH PURCHASE ONLY

- ☐ TELEPHONE ORDER
- ☐ PAY FROM WORKING FUND

DATE RECEIVED	FREIGHT CHARGES
PACKING LIST NO.	DATE PREPARED

PURCHASING VALIDATION

FORM 84-M-10

3M PURCHASE REQUISITION

REQUISITION NO.

PURCHASE ORDER NO.

FROM / TO	PURCHASING BUILDING	P.A.		DATE
	235-3			4/11/68
	REQUESTED BY	PLANT/DEPT.	BLDG. FLR.	REQUESTERS PHONE NO.
	B. E. FRANK	RT & GW DIV. LABORATORY	230-B(35)	35297

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	3119					

DELIVER TO: REQUESTER XX | STORAGE | PLANT | BLDG. | OTHER

RECEIVING REPORTS TO | INSPECTION / QUALITY CONTROL DEPT. NO. LOCATION | REQUESTER

RETURNABLE CONTAINERS VALUE | DATE NEEDED

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG.	DATE	ADDITIONAL AUTHORIZATION BY	DATE
				A Boone	4/11/68		

PURCHASE FROM:

Courtaulds North America Inc.
104 W. 40th Street
New York, N. Y. 10018

SHIP TO

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS | INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
				ASAP

ITEM	QUANTITY	UNIT	DESCRIPTION	PRICE	UNIT
1	20	lbs.	Fiber 24 1.5 denier -- 1-9/16" staple	$.36 @	
2	20	lbs.	Fiber 24 3 denier -- 1-9/16" staple	$.36 @	

DO NOT WRITE IN THIS AREA

TYPE BY	COME-OUT DATE	EST. COMP. DATE

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION
- ☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
- ☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
- ☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
- ☐ OTHER:

FOR CASH PURCHASE ONLY
- ☐ TELEPHONE ORDER
- ☐ PAY FROM WORKING FUND

DATE RECEIVED	FREIGHT CHARGES
PACKING LIST NO.	DATE PREPARED

PURCHASING VALIDATION

GUIDE TO FILLING OUT A PURCHASE REQUISITION

For E requisitions, see Engineering Procedures

3M PURCHASE REQUISITION

REQUISITION NO.

PURCHASE ORDER NO.

TO	PURCHASING BUILDING *Fill in Building*	P.A. *Also Purchasing Agent if Confirmation*	DATE *Date Requisition is Originated*
FROM	REQUESTED BY *Your Name,*	PLANT/DEPT. *Location* BLDG. FLR.	REQUESTERS PHONE NO. *Phone No.*

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	See	*Purchasing C*	*ommodity Catalog For Expl*	*anation of Accounting Codes*	*and Fixed Asset Definiti*	*ons.*

DELIVER TO — REQUESTER ☐ STORAGE PLANT BLDG. *Indicate Delivery Information*

OTHER ** — See Below*

RECEIVING REPORTS TO — INSPECTION / QUALITY CONTROL DEPT. NO. LOCATION *** SEE BELOW* — REQUESTER ☐

RETURNABLE CONTAINERS VALUE *If Known*

DATE NEEDED *Give Definite Realistic Date*

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG. DATE	ADDITIONAL AUTHORIZATION BY DATE
— — — — FOR	*PURCHASI*	*NG USE —*	*— — — —*	*Varies By Division*	*Varies by Division and Commodity*

PURCHASE FROM:

To be decided by, or in conjunction with, Purchasing. If not known, leave blank.

SHIP TO

Normal Ship To address will be indicated by Purchasing (Special Ship To address indicated by Requester.)

Check appropriate box. Purchasing Agent will verify from tax schedule

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS

INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
— — — — — — — — —	*Will be determined by*	*Purchasing — — — — —*	*— — — — —*	*— — — — —*

ITEM	DO NOT WRITE IN THIS AREA	QUANTITY	UNIT	DESCRIPTION	PRICE UNIT

— *Give complete and concise description including Catalog Number if available*

— *Indicate if equivalent competitive equipment is suitable*

— *Refer to quotations where applicable*

— *Group items so that each requisition covers items supplied by only one Vendor (when Vendor is known)*

Indicate price and unit - Note if estimated (est)

** If the Purchase is for direct shipment to a 3M customer, record the words "Customer Order" followed by the 3M House Order Number.*

A copy of the receiving report will not be sent to Inspection, Quality Control or the Requester unless it has been so noted. If a copy is required for Inspection or Quality Control, show that Dept. Number* ***and Location.

Below For Purchasing Use Only

TYPE BY	COME-OUT DATE	EST. COMP. DATE

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION

- ☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
- ☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
- ☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
- ☐ OTHER:

FOR CASH PURCHASE ONLY

- ☐ TELEPHONE ORDER
- ☐ PAY FROM WORKING FUND

DATE RECEIVED	FREIGHT CHARGES
PACKING LIST NO.	DATE PREPARED

PURCHASING VALIDATION

FORM 84-M-10

3M PURCHASE REQUISITION

REQUISITION NO.

PURCHASE ORDER NO.

FROM	PURCHASING BUILDING 235-3	P.A.		DATE 4/11/68
TO	REQUESTED BY B. E. FRANK	PLANT/DEPT. RT & GW DIV. LAB	BLDG. FLR. 230-B(35)	REQUESTERS PHONE NO. 35297

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	3119					

DELIVER TO: REQUESTER XX | STORAGE | PLANT | BLDG. | OTHER

RECEIVING REPORTS TO | INSPECTION / QUALITY CONTROL DEPT. NO. LOCATION | REQUESTER

RETURNABLE CONTAINERS VALUE | DATE NEEDED

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG.	DATE	ADDITIONAL AUTHORIZATION BY	DATE
				Andrews	4/11/68		

PURCHASE FROM:

Beaunit Fibers
Division of Beaunit Corp.
261 Madison Avenue
New York, N. Y. 10016

SHIP TO

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS | INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
				ASAP

ITEM	QUANTITY	UNIT	DESCRIPTION	PRICE	UNIT
1	20	lbs.	Xena 1.25 denier -- 1½" staple	$.45 @	
2	20	lbs.	Xena 1.5 denier -- 1½" staple	$.40 @	
3	20	lbs.	Polyester Hi. Ten. Type 10 2.25 denier -- 1½" staple	$.61 @	

DO NOT WRITE IN THIS AREA

TYPE BY	COME-OUT DATE	EST. COMP. DATE

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION
☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
☐ OTHER:

FOR CASH PURCHASE ONLY
☐ TELEPHONE ORDER
☐ PAY FROM WORKING FUND

DATE RECEIVED	FREIGHT CHARGES
PACKING LIST NO.	DATE PREPARED

PURCHASING VALIDATION

GUIDE TO FILLING OUT A PURCHASE REQUISITION

For E requisitions, see Engineering Procedures

3M **PURCHASE REQUISITION**

REQUISITION NO.

PURCHASE ORDER NO.

TO	PURCHASING BUILDING *Fill in Building*	P.A. *Also Purchasing Agent if Confirmation*	DATE *Date Requisition is Originated*
FROM	REQUESTED BY *Your Name,*	PLANT/DEPT. *Location* BLDG. FLR.	REQUESTERS PHONE NO. *Phone No.*

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	See	*Purchasing C*	*ommodity Catalog For Expl*	*anation of Accounting Codes*	*and Fixed Asset Definiti*	*ons.*

DELIVER TO: REQUESTER ☐ STORAGE PLANT BLDG. *Indicate Delivery Information*

OTHER ** — See Below*

RECEIVING REPORTS TO: INSPECTION / QUALITY CONTROL DEPT. NO. LOCATION *** SEE BELOW* REQUESTER ☐

RETURNABLE CONTAINERS VALUE *If Known*

DATE NEEDED *Give Definite Realistic Date*

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG. DATE	ADDITIONAL AUTHORIZATION BY DATE
— — — — FOR	*PURCHASI*	*NG USE —*	*— — — —*	*Varies By Division*	*Varies by Division and Commodity*

PURCHASE FROM:

To be decided by, or in conjunction with, Purchasing. If not known, leave blank.

SHIP TO

Normal Ship To address will be indicated by Purchasing (Special Ship To address indicated by Requester.)

Check appropriate box. Purchasing Agent will verify from tax schedule

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS

INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
— — — — — — — — — — — — — — — -Will be determined by Purchasing - - - — — — — — —			*— — — — — —*	*— — — — — — —*

ITEM | DO NOT WRITE IN THIS AREA | QUANTITY | UNIT | DESCRIPTION | PRICE UNIT

— Give complete and concise description including Catalog Number if available

— Indicate if equivalent competitive equipment is suitable

— Refer to quotations where applicable

— Group items so that each requisition covers items supplied by only one Vendor (when Vendor is known)

Indicate price and unit - Note if estimated (est)

** If the Purchase is for direct shipment to a 3M customer, record the words "Customer Order" followed by the 3M House Order Number.*

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Below For Purchasing Use Only

TYPE BY	COME-OUT DATE	EST. COMP. DATE

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION

☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
☐ OTHER:

FOR CASH PURCHASE ONLY
☐ TELEPHONE ORDER
☐ PAY FROM WORKING FUND

DATE RECEIVED	FREIGHT CHARGES
PACKING LIST NO.	DATE PREPARED

PURCHASING VALIDATION

FORM 84-M-10 (3-67)

3M

PURCHASE REQUISITION

REQUISITION NO.

PURCHASE ORDER NO.

FROM: PURCHASING BUILDING 235-3 | P.A. | DATE 4/11/68

TO: REQUESTED BY B. E. FRANK | PLANT/DEPT. RT & GW DIV. LAB | BLDG. FLR. 230-B(35) | REQUESTERS PHONE NO. 35297

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	3119					

DELIVER TO: REQUESTER XXX | STORAGE | PLANT | BLDG.

OTHER

RECEIVING REPORTS TO | INSPECTION / QUALITY CONTROL DEPT. NO. LOCATION | REQUESTER

RETURNABLE CONTAINERS VALUE | DATE NEEDED

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG.	DATE	ADDITIONAL AUTHORIZATION BY	DATE
				[signature]	4/11/68		

PURCHASE FROM:

FMC Corporation
American Viscose Division
Fiber Operations
1617 John F. Kennedy Blvd.
Philadelphia, Pa.

SHIP TO

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS

INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
				ASAP

ITEM	DO NOT WRITE IN THIS AREA	QUANTITY	UNIT	DESCRIPTION	PRICE	UNIT
1		20 lbs.		Avisco Extra Strength .75 denier -- 1-9/16" staple	$.40 @	
2		20	lbs.	Avisco Fiber 101 1.5 denier -- 1-9/16" staple	$.56 @	
3		20	lbs.	Avisco Fiber 43 1 denier -- 1-9/16" staple	$.39 @	

TYPE BY	COME-OUT DATE	EST. COMP. DATE

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION
- ☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
- ☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
- ☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
- ☐ OTHER:

FOR CASH PURCHASE ONLY
- ☐ TELEPHONE ORDER
- ☐ PAY FROM WORKING FUND

DATE RECEIVED	FREIGHT CHARGES
PACKING LIST NO.	DATE PREPARED

PURCHASING VALIDATION

GUIDE TO FILLING OUT A PURCHASE REQUISITION

For E requisitions, see Engineering Procedures

3M PURCHASE REQUISITION

REQUISITION NO.

PURCHASE ORDER NO.

TO — PURCHASING BUILDING: *Fill in Building* | P.A. *Also Purchasing Agent if Confirmation* | DATE: *Date Requisition is Originated*

FROM — REQUESTED BY: *Your Name,* | PLANT/DEPT.: *Location* | BLDG. FLR. | REQUESTERS PHONE NO.: *Phone No.*

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	See	*Purchasing C*	*ommodity Catalog For Expl*	*anation of Accounting Codes*	*and Fixed Asset Definiti*	*ons.*

DELIVER TO — REQUESTER ☐ | STORAGE | PLANT: *Indicate Delivery Information* | BLDG.
OTHER: * *— See Below*

RECEIVING REPORTS TO — INSPECTION / QUALITY CONTROL DEPT. NO. LOCATION: ** SEE BELOW | REQUESTER ☐

RETURNABLE CONTAINERS VALUE *If Known*

DATE NEEDED *Give Definite Realistic Date*

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG.	DATE	ADDITIONAL AUTHORIZATION BY	DATE
— — — — *FOR*	*PURCHASIN*	*G USE —*	— — — —	*Varies By Division*		*Varies by Division and Commodity*	

PURCHASE FROM:

To be decided by, or in conjunction with, Purchasing. If not known, leave blank.

SHIP TO

Normal Ship To address will be indicated by Purchasing (Special Ship To address indicated by Requester.)

Check appropriate box. Purchasing Agent will verify from tax schedule

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS

INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
— — — — — — — — — — — — — — - - -	*-Will be determined by*	*Purchasing - - - — — — — —*	— — — — — — —	— — — — — — —

ITEM	DO NOT WRITE IN THIS AREA	QUANTITY	UNIT	DESCRIPTION	PRICE	UNIT

— Give complete and concise description including Catalog Number if available

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— Refer to quotations where applicable

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Indicate price and unit - Note if estimated (est)

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Below For Purchasing Use Only

TYPE BY	COME-OUT DATE	EST. COMP. DATE

FOR CASH PURCHASE ONLY
☐ TELEPHONE ORDER
☐ PAY FROM WORKING FUND

DATE RECEIVED	FREIGHT CHARGES
PACKING LIST NO.	**DATE PREPARED**

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION
- ☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
- ☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
- ☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
- ☐ OTHER:

PURCHASING VALIDATION

FORM 84-M-10 (3-67)

3M PURCHASE REQUISITION

REQUISITION NO.

PURCHASE ORDER NO.

FROM	PURCHASING BUILDING 235-3	P.A.	DATE 4/11/68
TO	REQUESTED BY B. E. FRANK	PLANT/DEPT. RT & GW DIV. LAB	BLDG. FLR. 230-B(35)
		REQUESTERS PHONE NO. 35297	

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	3119					

DELIVER TO: REQUESTER XX | STORAGE | PLANT | BLDG. | OTHER

RECEIVING REPORTS TO | INSPECTION / QUALITY CONTROL DEPT. NO. LOCATION | REQUESTER

RETURNABLE CONTAINERS VALUE | DATE NEEDED

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG.	DATE	ADDITIONAL AUTHORIZATION BY	DATE

PURCHASE FROM:

American Enka Corporation

Enka, NORTH CAROLINA 28728

SHIP TO

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS

INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
				ASAP

ITEM	DO NOT WRITE IN THIS AREA	QUANTITY	UNIT	DESCRIPTION	PRICE	UNIT
1		20	lbs.	Fiber H.M. 1.5 denier - 1-9/16" staple	$.36 @	
2		20	lbs.	Fiber H.M. 3 denier -- 1-9/16" staple	$.36 @	

TYPE BY	COME-OUT DATE	EST. COMP. DATE	FOR CASH PURCHASE ONLY	DATE RECEIVED	FREIGHT CHARGES
			☐ TELEPHONE ORDER	PACKING LIST NO.	DATE PREPARED
			☐ PAY FROM WORKING FUND		

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION

- ☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
- ☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
- ☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
- ☐ OTHER:

PURCHASING VALIDATION

GUIDE TO FILLING OUT A PURCHASE REQUISITION

For E requisitions, see Engineering Procedures

3M PURCHASE REQUISITION

REQUISITION NO.

PURCHASE ORDER NO.

TO	PURCHASING BUILDING *Fill in Building*	P.A. *Also Purchasing Agent if Confirmation*		DATE *Date Requisition is Originated*
FROM	REQUESTED BY *Your Name,*	PLANT/DEPT. *Location*	BLDG. FLR.	REQUESTERS PHONE NO. *Phone No.*

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	See	*Purchasing C*	*ommodity Catalog For Expl*	*anation of Accounting Codes*	*and Fixed Asset Definiti*	*ons.*

DELIVER TO — REQUESTER ☐ STORAGE PLANT BLDG. *Indicate Delivery Information*

OTHER ** — See Below*

RECEIVING REPORTS TO — INSPECTION / QUALITY CONTROL DEPT. NO. LOCATION *** SEE BELOW* REQUESTER ☐

RETURNABLE CONTAINERS VALUE *If Known*

DATE NEEDED *Give Definite Realistic Date*

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG.	DATE	ADDITIONAL AUTHORIZATION BY	DATE
— — — — FOR	*PURCHASI*	*NG USE —*	*— — — —*	*Varies By Division*		*Varies by Division and Commodity*	

PURCHASE FROM:

To be decided by, or in conjunction with, Purchasing. If not known, leave blank.

SHIP TO

Normal Ship To address will be indicated by Purchasing (Special Ship To address indicated by Requester.)

Check appropriate box. Purchasing Agent will verify from tax schedule

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS

INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
— — — — — — — — — — — — — — — — - - -Will be determined by Purchasing - - — — — — — —			*— — — — — —*	*— — — — — —*

ITEM	DO NOT WRITE IN THIS AREA	QUANTITY	UNIT	DESCRIPTION	PRICE	UNIT

— Give complete and concise description including Catalog Number if available

— Indicate if equivalent competitive equipment is suitable

— Refer to quotations where applicable

— Group items so that each requisition covers items supplied by only one Vendor (when Vendor is known)

Indicate price and unit - Note if estimated (est)

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Below For Purchasing Use Only

TYPE BY	COME-OUT DATE	EST. COMP. DATE

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION

- ☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
- ☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
- ☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
- ☐ OTHER:

FOR CASH PURCHASE ONLY

☐ TELEPHONE ORDER

☐ PAY FROM WORKING FUND

DATE RECEIVED	FREIGHT CHARGES
PACKING LIST NO.	DATE PREPARED

PURCHASING VALIDATION

FORM 84-M-10

3M PURCHASE REQUISITION

REQUISITION NO.

FROM: PURCHASING BUILDING 235-3	P.A.	DATE 4/11/68
TO: REQUESTED BY B. E. FRANK	PLANT/DEPT. RT & GW DIV. LAB	BLDG. FLR. 230-B(35)
REQUESTERS PHONE NO. 35297		

PURCHASE ORDER NO.

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	3119					

DELIVER TO: REQUESTER XX | STORAGE | PLANT | BLDG. | OTHER

RECEIVING REPORTS TO | INSPECTION / QUALITY CONTROL DEPT. NO. LOCATION | REQUESTER

RETURNABLE CONTAINERS VALUE | DATE NEEDED

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG.	DATE	ADDITIONAL AUTHORIZATION BY	DATE
				[signature]	4/11/68		

PURCHASE FROM:

Goodyear Company
Chemical Dept.

SHIP TO

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS

INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
				ASAP

ITEM	QUANTITY	UNIT	DESCRIPTION	PRICE	UNIT
1	1	gallon	Pliolite Latex ~~XXX~~ #440		
2	1	gallon	Pliolite Latex #460		
3	1	gallon	Pliolite Latex ~~XXXX~~ #480		
4	1	gallon	Pliolite Latex #491		
5	1	gallon	Pliovic Latex (Vinyl) #400		
6	1	gallon	Pliovic Latex (Vinyl) #300		
7	1	gallon	Chemigum Latex #520		
8	1	gallon	Chemigum Latex #550		
9	1	gallon	Chemigum Latex #247		

DO NOT WRITE IN THIS AREA

TYPE BY	COME-OUT DATE	EST. COMP. DATE

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION
- ☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
- ☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
- ☐ SHIP TO A BRANCH - TO P. A. AT BRANCH
- ☐ OTHER:

FOR CASH PURCHASE ONLY
- ☐ TELEPHONE ORDER
- ☐ PAY FROM WORKING FUND

DATE RECEIVED	FREIGHT CHARGES
PACKING LIST NO.	DATE PREPARED

PURCHASING VALIDATION

GUIDE TO FILLING OUT A PURCHASE REQUISITION

For E requisitions, see Engineering Procedures

3M PURCHASE REQUISITION

REQUISITION NO.

PURCHASE ORDER NO.

TO — PURCHASING BUILDING: *Fill in Building* | P.A.: *Also Purchasing Agent if Confirmation* | DATE: *Date Requisition is Originated*

FROM — REQUESTED BY: *Your Name,* | PLANT/DEPT.: *Location* | BLDG. FLR. | REQUESTERS PHONE NO.: *Phone No.*

CONTROL	MAIN A/C	SUB. A/C	JOB NO.	PROJECT/CLASS	SHOP WORK ORDER	A.F.E. NO.
	See	*Purchasing C*	*ommodity Catalog For Expl*	*anation of Accounting Codes*	*and Fixed Asset Definiti*	*ons.*

DELIVER TO — REQUESTER ☐ | STORAGE | PLANT: *Indicate Delivery Information* | BLDG.

OTHER: ** — See Below*

RECEIVING REPORTS TO — INSPECTION / QUALITY CONTROL DEPT. NO. LOCATION: ** SEE BELOW | REQUESTER ☐

RETURNABLE CONTAINERS VALUE: *If Known* | DATE NEEDED: *Give Definite Realistic Date*

VENDOR NO.	P.A. INITIALS	DATE PLACED	REQ. CHECKED	APPROVED DEPT. SIG.	DATE	ADDITIONAL AUTHORIZATION BY	DATE
— — — — FOR	*PURCHASI*	*NG USE —*	*— — — —*	*Varies By Division*		*Varies by Division and Commodity*	

PURCHASE FROM:

To be decided by, or in conjunction with, Purchasing. If not known, leave blank.

SHIP TO: *Normal Ship To address will be indicated by Purchasing (Special Ship To address indicated by Requester.)*

Check appropriate box. Purchasing Agent will verify from tax schedule

☐ TAXABLE ☐ FOR RESALE ☐ FOR USE DIRECTLY IN THE MANUFACTURING PROCESS

INVOICE TERMS

SHIP VIA	F.O.B.	FRT. TERMS	SHIP DATE	SHIP TO ARRIVE BY
— — — — — — — — — — — — — — — — — — — -Will be determined by Purchasing - - - - - - - - -			*— — — — — —*	*— — — — — —*

ITEM	DO NOT WRITE IN THIS AREA	QUANTITY	UNIT	DESCRIPTION	PRICE	UNIT

— Give complete and concise description including Catalog Number if available

— Indicate if equivalent competitive equipment is suitable

— Refer to quotations where applicable

— Group items so that each requisition covers items supplied by only one Vendor (when Vendor is known)

Indicate price and unit - Note if estimated (est)

** If the Purchase is for direct shipment to a 3M customer, record the words "Customer Order" followed by the 3M House Order Number.*

***A copy of the receiving report will not be sent to Inspection, Quality Control or the Requester unless it has been so noted. If a copy is required for Inspection or Quality Control, show that Dept. Number and Location.*

Below For Purchasing Use Only

TYPE BY	COME-OUT DATE	EST. COMP. DATE

ST. PAUL PURCHASE ORDER - SPECIAL DISTRIBUTION

- ☐ CONTROL 4 OR A.F.E. - TO PROPERTY ACCOUNTING DEPT.
- ☐ OUTSIDE PROCESSING - TO INVENTORY CONTROL DEPT.
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FOR CASH PURCHASE ONLY

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DATE RECEIVED	FREIGHT CHARGES
PACKING LIST NO.	DATE PREPARED

PURCHASING VALIDATION

(1)

4/22/68

Clean room applications

Discussion with John Pearson

2-3M Products in field
Retail – Industrial Masks
Industrial – Clean Matt.

(1) Overall problem in clean rooms is to hold particles of .5 micron and over to 100 particles per cubic ft of air

(2) Ave of normal air 100,000 particles per cu ft of air and up.

(3) Filtration system can reduce and maintain this ave (1) without room occupancy.

(4) Clothing of polyester and nylon used (filament?) with polyester being preferable. Static electricity a problem.

3M masks preferable from comfort angle but second in filtration value.

Clothing consists of hair covering or hoods and and either gowns or 2 piece jumpers which are preferable.
Over boots also used.
Twill + taffeta weaves used.
Poor clothing and storage are problems.

Good or adequate laundry facilities

Major contamination broken fibers and other particles that are emitted from people and under clothing passing either thru or openings of cover clothing

Paper clothing not satisfactory from fiber loss.

Nonwovens not used or evaluated as far as is known

(2) Papers used in work have to be highly bonded to resist fibration. — A film with writing surface preferable?

Suggested thots

~~John~~ Joam (breathable) laminated to clothing mat.

Inner garment (disposable) of non woven to retain particles

Total disposable non woven garment)

4/22/68

W. Erickson - Make an interest

G. Endahl - Discuss with next week

NONWOVEN PRODUCTS HISTORY

1939 -- Tape Laboratory

Objective: To develop a fibrous web of noncorrosive materials as an Electrical Tape backing.

1940

Attempts to form a wet laid paper of cellulose acetate fiber failed through a lack of technical feasibility.

Work started on dry dispersal of fibers.

A sample card was purchased for program.

Heat bonding technique developed (cellulose acetate as thermo-fiber).

Attempts to develop tape backing dropped due to product's lack of strength.

The project continued as a general exploratory effort on nonwoven webs.

1941

Program discontinued at end of year due to the war.

1942

Program reinstated late in year.

Objective: Development of lens cleaning tissues and packaging that would be non-scratching and lint free.

1943

Product Fabrication Laboratory organized under R. G. Drew with nonwoven project.

1944

Sixty inch garnett installed with heat bonding roll.

Backing developed and manufactured for Abrasive Division's Trimite Polishing Cloth.

First ribbon developed and market tested.

1945

First "Mistlon" type ribbon produced and sold as a resale ribbon.

1946

Improved "Mistlon" developed, produced, and sold as a resale item and in long rolls for in-store gift wraps.

1947 to
1949

"SASHEEN" type ribbon developed and Pilot Plant operation set up to produce for sale.

"LACELON" type ribbon developed and marketed.

Ribbon Group split off of Profab Laboratory and was assigned to Central Manufacturing Development under Dr. B. J. Oakes.

1950 to
1952

"DECORETTE" ribbon developed and added to line.

1953

Gift Wrap Division organized -- A. H. Redpath, General Manager.

1955

Developed thermo-bonded Polyester web for electrical applications.

Developed fibrous polyester web laminated to polyester film as electrical insulation.

1957

Molded product development started with objective to develop formed brassiere cups, shoulder pads, etc.

1958

Dust masks developed and test sales started.

1959

Medical mask developed and test sales started.

1960

Weather mask developed and test sales started.

1961

Major effort to develop production techniques and equipment for masks.

. . . .

Profab continued work on nonwovens developing the Rando Web techniques of web forming and others.

Products developed in Profab and present Division assignment.

Nonwoven Product	Division	Year Introduced
Fibermat	DM & S	1956
Dusting Fabric	Retail Tape	1957
Scotchbrite	BS & CP	1958
Micropore	Medical	1960
Aseptex Mask	Medical	1961
Dampner Sleeve	Printing Products	1962
Adhesive carrier web used in AF110, AF126, and others	AC & S	1963
Microdon dressing	Medical	1965
Filtron Mask	Medical	1966
Coban Elastic Bandage	Medical	late in 1968
Fabric Drape	Medical	late in 1968
Hairset Tape	Retail	1968

Prepared by: A. W. Boese

Date: May 6, 1968

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PRODUCT IDENTIFICATION BY PRODUCTION TECHNOLOGY

HEAT BONDED PRODUCTS

SASHEEN Ribbon	Garnett - beam - hot drum
Electrical web	Rando Web - hot drum
Abrasive backing	Garnett - hot drum (Trimite Polishing Cloth)
Masks (one step)	Rando Web - vacuum modling

Resin Bonded

Dusting Fabric	Rando Web - squeeze roll - textilizer
Hair Styling Tape	Rando Web - squeeze roll - embossing
Masks (2nd step)	Drip saturated
Medical Products	Rando Web - squeeze roll - some items textilized
Building Products	Rando Web - impregnation
Carrier web adhesive	Rando Web - squeeze roll
Dampner roll cover	Rando Web - squeeze roll
Filament Tape	Beams yarn resin bonded in matrix to film.

Spun Bonded

LACELON Ribbon	Oscillating spinnerette heads - wet bonded
DECORETTE Ribbon	Oscillating spinnerette heads - wet bonded yarn and "SASHEEN" overlay.

Hot Melt Air Blown

Medical face mask filter

Prepared by: A. W. Boese
Nonwovens Project Manager

Date: May 6, 1968

3M TECHNOLOGY AND EQUIPMENT

FIBER HANDLING

Carding

Garnett machine
Rando web

Opening and preparatory equipment

Bonding

Heated drums for thermoplastic bonding
Squeeze roll applicators for resin bonding
Spray bonding for high loft products
Drip flooding (as face masks)
Vacuum bonding (three dimensional or flat goods)

Extrusion bonding

Spinnerette oscillating wet bonding
Hot melt -- air carrier forming on screen

Vacuum molding -- thermo-bonding

Beam lay down

Filament tape -- in resin matrix
"Sasheen" process - heat bond

Physical bonding (experimental equipment)

Needling
Tacking
Tow spreading

Wet process

Paper making
Electrostatic fiber orientation (not used for this presently but 3M Technology)

General (3M Technology)

Calendering
Embossing
Coating
Textilizing -- post web forming of carded web
Fiber spinning

Prepared by: A. W. Boese - Nonwovens Project Manager
Date: May 6, 1968

RESEARCH AREA

Basic Development

Web Forming

1. Rando Web
   Shingling of web -- methods to overcome or modify.

2. Garnett or card
   Layering of web -- methods to get layer unification.

3. Achieve better blends both Rando and card.

Resin Impregnation

1. Eliminate migration

2. Determine value of resin -- fiber adhesion or mechanical anchorage of resin and fiber.

Thermo-bonding

1. Pressing tech. or heating to get bonding without loss of fiber identification.

General

Calendering
Embossing
Textilizing, etc.

Raw Materials

Characteristics and properties of fibers.

Adhesive -- water dispersion -- solvent

New resin systems developed by 3M (or others)

Up-to-date literature and Patent file -- 3M and outside
Up-to-date fiber and chemical files
Up-to-date equipment file.

Prepared by: A. W. Boese
Nonwoven Project Manager

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Industrial Mask	Retail Tape	1958

Non-Woven Technologies

cc: R. M. Adams
H. L. Anderson
A. W. Boese
F. S. Copeland
C. F. Courtman
R. L. Hansen
C. E. Myers
N. E. Petersen
P. D. Tritschler
H. T. Wingfield

May 7, 1968

TO: R. I. BYHOFFER
A. D. PEARSON

FROM: L. W. LEHR

As you probably know, Mr. Al Boese has for the past few months had the assignment of studying new equipment, fibers and coating techniques for non-wovens. He has built a good file on this subject and is quite current in the art. In addition, his laboratory has done some experimental work on unifying coating techniques for non-wovens.

Al has kindly offered to act as a consultant for our various problems in non-wovens, and I would suggest, particularly with regard to our Facilities Planning Program, that we use Al where non-wovens are concerned. We want to be certain that we are utilizing the best known approaches in this field. All trade literature indicates that it is almost an exploding market and there are undoubtedly many new processes evolving.

By copy of this letter I would also suggest that Duke Wingfield and Paul Hansen keep in touch with Al, particularly with respect to the problems which we have in trying to develop new tape backings on surgical dressings, first aid dressings and pads, fabric drapes, carrier webs and/or backings for topical medications. I am sure that Al will be most helpful...he is certainly most willing to help.

R. I. Byhoffer
A. D. Pearson

May 7, 1968

This field of non-wovens is one of critical importance to 3M, and one in which the expertise of a person with a background such as Al has can be most helpful, not only to our division but throughout the company.

LWL:st

P.S.

Would the tacking machines that SCOTCHBRITE uses be of any help to us in dressing or flat mask manufacturing?

Interoffice Correspondence 3M COMPANY

Subject: STATIC NEUTRALIZATION EQUIPMENT

Mr. A. W. Boese 220-8W
Retail Tape & Gift Wrap Div.
FB U5
PM OB

May 10, 1968

TO: PRODUCTION MANAGERS (ST. PAUL)
DIVISION ENGINEERS (ST. PAUL)
BRANCH FACTORY PLANT MANAGERS
BRANCH FACTORY PLANT ENGINEERS

FROM: ROBERT J. KUNZ-MARKETING SUPERVISOR, NUCLEAR PRODUCTS-TCAAP 675

Would the neutralization of static electricity in your operation increase productivity? improve quality? eliminate a fire or explosion hazard? In a nutshell, would an investment in static elimination equipment reap manifold benefits for your division or plant and, therefore, for 3M Company? These are questions that should be given serious thought.

Based on inquiries that we have received over the last couple of years, many of you will answer one or more of the above questions in the affirmative. But did you know that there is a group — Nuclear Products — within 3M Company that can, and will, help you with your static problems?

Since our entry into the static neutralization field nearly three (3) years ago we have been successful in building a nice business, a business that is increasing rapidly with time. We have placed the "normal" 3M laboratory effort on this product line, and now feel that we are fairly "expert" in the field of static electricity — its generation, effects, and neutralization.

We came on the market in July 1965 with one product — a nuclear static eliminator. Since that time we have added two more static eliminators and a static meter. More products are being added with each passing month. With the present product line we feel that we have a solution for nearly every static problem.

Now we request that you think seriously about taking advantage of this technology and these products in your operation. Many people within 3M have found us to be most cooperative and helpful — there are over 100 of the nuclear devices in use within the company at this time. But we know that there are more money-wasting static problems that could be solved, and we'd like a crack at them.

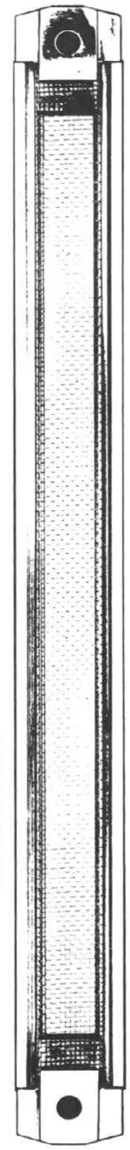
I have taken the liberty of enclosing descriptive literature on each of our present four (4) products, as well as a paper which briefly describes static generation and neutralization. Please remember that the prices are "list", not "transfer".

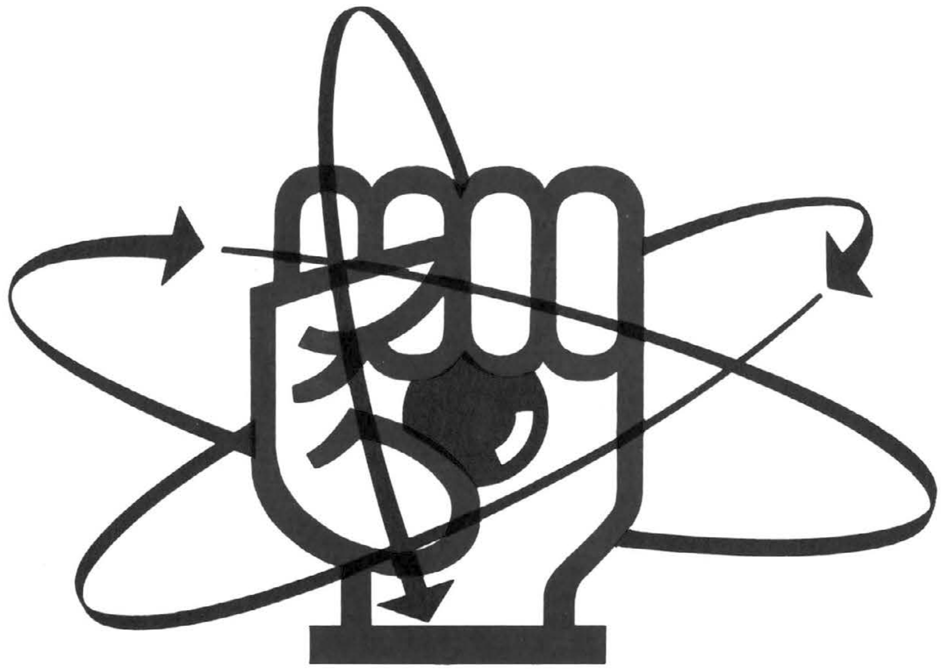
To get started on the solution to <u>your</u> problem merely phone me on 633-9420. I am at your service.

Robert J. Kunz/sd RJK
Enclosures

3M BRAND

"210" STATIC ELIMINATOR





The U.S. Atomic Energy Commission has issued to 3M Company license GL-214 which permits the manufacture and distribution of these static eliminators to general licensees. This means that you are permitted to lease this device without the need for a formal license application.

All statements, technical information and recommendations contained herein are based on tests we believe to be reliable, but the accuracy or completeness thereof is not guaranteed, and the following is made in lieu of all warranties, express or implied.

Seller's and manufacturer's only obligation shall be to replace such quantity of the product proved to be defective. Neither seller nor manufacturer shall be liable for any injury, loss or damage, direct or consequential, arising out of the use of or the inability to use the product. Before using, user shall determine the suitability of the product for his intended use and user assumes all risk and liability whatsoever in connection therewith.

No statement or recommendation not contained herein shall have any force or effect unless in an agreement signed by officers of seller and manufacturer.

Nuclear Products 3M COMPANY

3M CENTER · ST. PAUL, MINNESOTA 55101

J-S210(18.5)JO

Now you can save money by solving static problems with the 3M Brand "210" Static Eliminator

Sure, you have static problems—and you have static elimination equipment, gadgets and devices.

But, do they really solve your problems? If not, 3M's nuclear powered Static Eliminator may be your answer—because it takes over where others leave off—and in a new and effective way.

High level or low—the "210" handles all kinds of static problems. It is effective where others fail—in reducing voltages to near zero levels. And it is done with nuclear power in a completely safe way.

The "210" works by producing ionized air which neutralizes both positive and negative static charges that create profit-robbing problems.

Now—you can truly eliminate those last traces of static without the nuisance of cords, power supplies and costly maintenance—and you can move the static eliminator around to wherever static problems hit—all for just pennies a day.

EVER HAVE THESE KINDS OF PROFIT-ROBBING STATIC PROBLEMS?

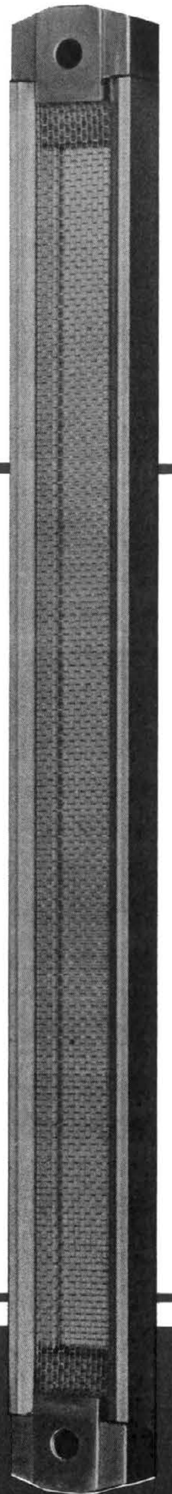
Fires and Explosions
Dust Accumulation
Feeding Jams
Improper Delivery
Handling Problems
Uneven Jogging
Rejected Material
Undesirable Surface Properties
Personnel Discomfort (shocks and sparks)
Operation of Equipment at Reduced Speeds
Excess Waste
Poor Quality
Material Breakage

To name but a few!

APPLICABLE IN THESE INDUSTRIAL AREAS:

Plastics
Paper
Printing
Packaging
Textile
Rubber
Foam
Computer
Photographic

And the list goes on!



HERE ARE SOME OF THE FEATURES OF THE "210" STATIC ELIMINATOR

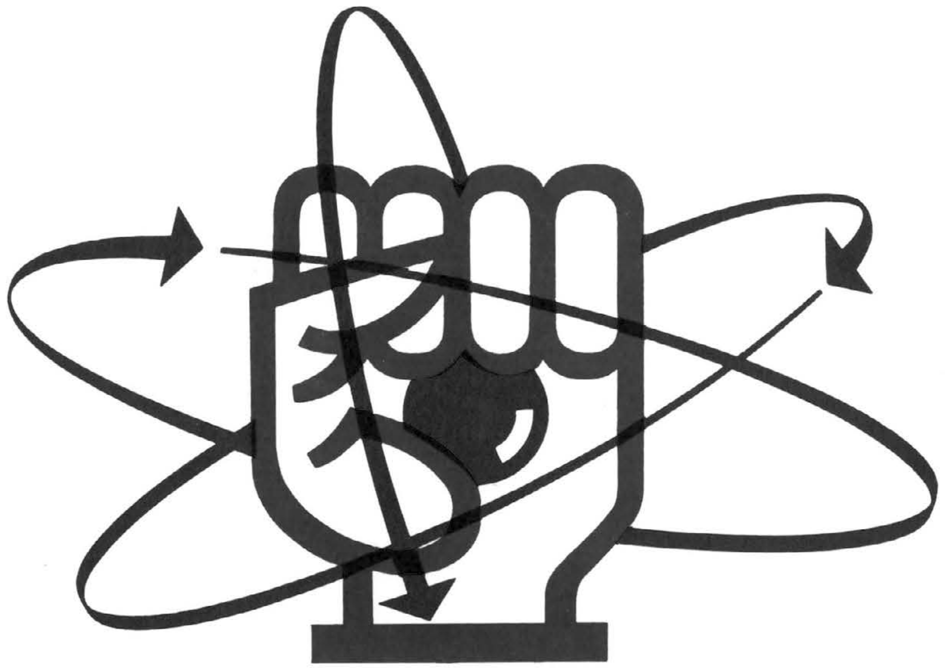
- Reduces static charges to near zero levels
- Completely portable—static problems can move around; the "210" can be moved right with them
- No operational expense—self-powered; uses no electricity
- Nothing to fail mechanically or electrically
- Simple to install—no wires; no fancy connections
- Compact—fits almost anywhere
- Completely safe—no hazard from the nuclear power source
- Can be used safely in volatile areas—no fire or explosion hazard

PHYSICAL SPECIFICATIONS

- *Thickness—½"*
- *Width—1⅜"*
- *Length—2¾" greater than active length*
- *Model Number—210*
- *Mounting Holes—0.257" at each end*
- *Temperature Limit—200°F Ambient*
- *Isotope—Po-210*
- *Emission—Alpha*
- *Activity—1.5 millicuries/inch*

LEASING SERVICE

The normal useful life of this device is one year. AEC regulations require that the device be leak tested each twelve months. To satisfy both requirements the device is leased on a renewable 12 month basis. At the end of each 12 month period a fresh device is shipped to the customer and the old device is returned to 3M Company.



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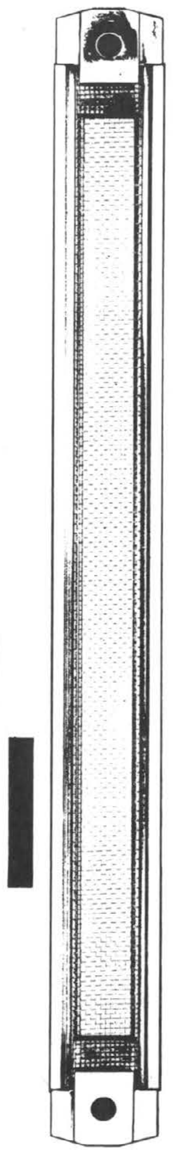
Nuclear Products 3M COMPANY
3M CENTER • ST. PAUL, MINNESOTA 55101

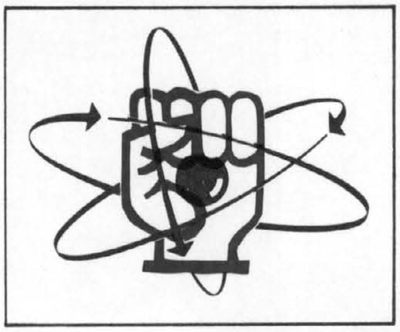
J-S210(18.5)JO

3M BRAND

"210" STATIC ELIMINATOR



3M BRAND "210"
STATIC ELIMINATOR



PRICE LIST
EFFECTIVE JANUARY 1, 1968

ANNUAL LEASE CHARGES
(Minimum Lease—1 Year)

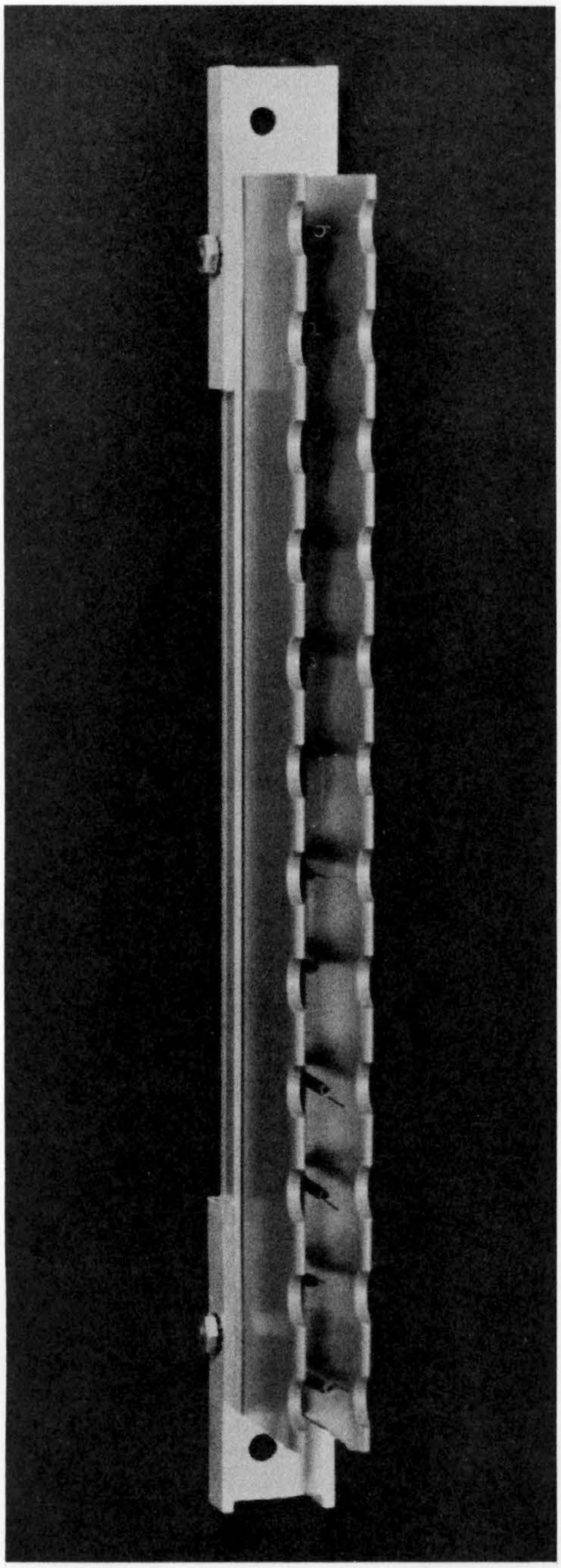
Active Length in Inches	Annual Charge	Approximate Cost per Day
2	$125	$ .34
4	145	.40
6	165	.45
12	185	.51
18	205	.56
24	225	.62
30	245	.67
36	265	.73
38	275	.75
42	285	.78
48	305	.84
60	345	.95
72	385	1.05
78	405	1.11
84	425	1.16

Terms: Net 30 days.
All prices F.O.B. St. Paul, Minn., and subject to change without notice.
Bar length is 2¾" longer than active length quoted above.
All bars are custom manufactured to order only after properly executed 3M Lease Agreements are received.
Delivery: Standard sizes—2 weeks after receipt of signed lease agreement.
Custom sizes—4 weeks after receipt of signed lease agreement.
Quantity discounts available upon request.
Terms and Conditions of lease as stated in our 3M Brand "210" Static Eliminator Brochure apply.

Nuclear Products 3M COMPANY
3M CENTER • ST. PAUL, MINNESOTA 55101

J-S210PL(18.5)R2

NOW!
FROM 3M NUCLEAR



The 3M BRAND "105" STATIC ELIMINATOR

- Unlimited capacity — designed to cope with high levels of static charge
- Built-in maintenance through leasing program
- Inexpensive method of reducing personnel shock problems

PRICE LIST
EFFECTIVE FEBRUARY 1, 1968

ANNUAL LEASE CHARGES
(Minimum Lease—1 Year)

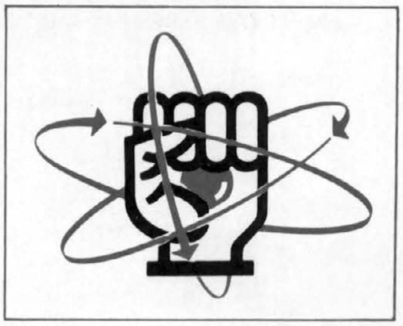
Active Length in Inches	Annual Charge	Approximate Cost per Day
12	$35	$.10
18	40	.11
24	40	.11
30	45	.12
36	45	.12
38	50	.14
42	50	.14
48	50	.14
60	55	.15
72	60	.16
78	65	.18
84	65	.18

Terms: Net 30 days.
All prices F.O.B. St. Paul, Minn. and subject to change without notice.
Bar length is 2″ longer than active length quoted above.
All bars are custom manufactured to order only after properly executed 3M Lease Agreements are received.
Delivery: 2 weeks after receipt of signed lease agreement.
Quantity discounts available upon request.
Terms and Conditions of lease as stated in our 3M Brand "210" Static Eliminator Brochure apply.

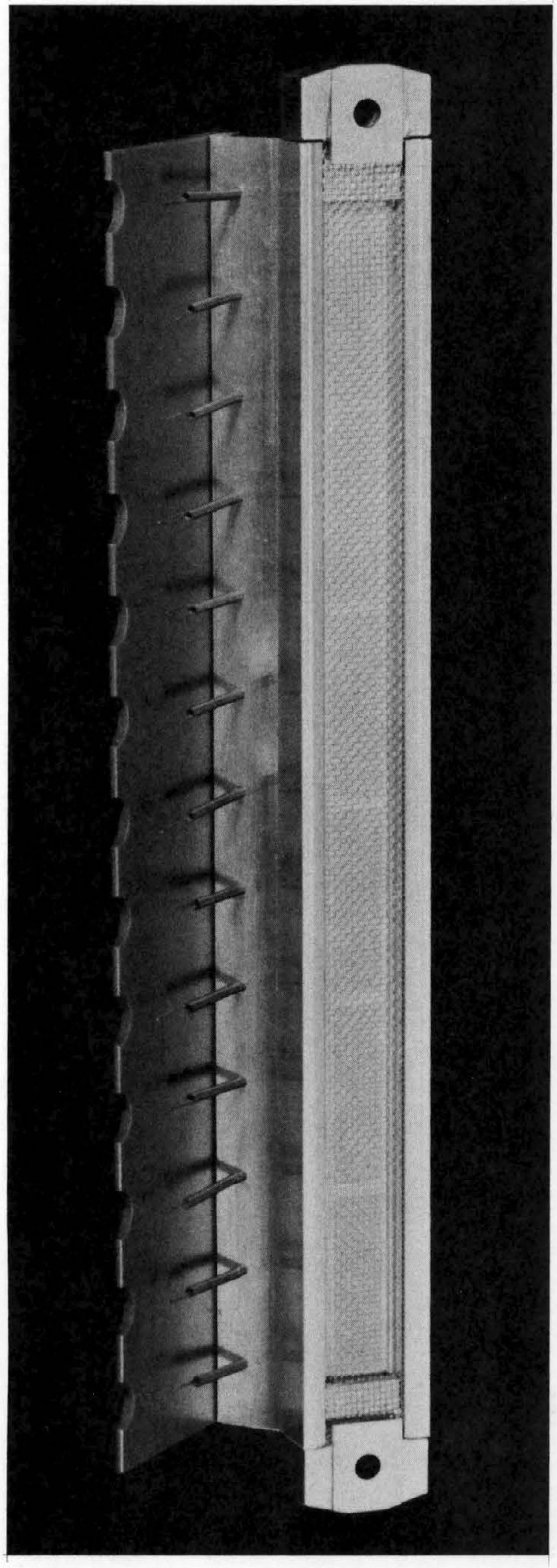
Nuclear Products 3M COMPANY
3M CENTER · ST. PAUL, MINNESOTA 55101

J-S105(28.5)R2

NOW!
FROM 3M NUCLEAR



The
3M BRAND "315"
STATIC ELIMINATOR



- Combines the unlimited capacity of an induction system with the ultra-efficiency of the nuclear system
- This product can solve *your* static problems — and still for only pennies per day

PRICE LIST

EFFECTIVE FEBRUARY 1, 1968

ANNUAL LEASE CHARGES
(Minimum Lease—1 Year)

Active Length in Inches	Annual Charge	Approximate Cost per Day
12	$210	$ .58
18	235	.64
24	255	.70
30	280	.77
36	300	.82
38	315	.86
42	325	.89
48	345	.95
60	390	1.07
72	435	1.19
78	460	1.26
84	480	1.31

Terms: Net 30 days.

All prices F.O.B. St. Paul, Minn. and subject to change without notice.

Bar length is 2¾" longer than active length quoted above.

All bars are custom manufactured to order only after properly executed 3M Lease Agreements are received.

Delivery: Standard sizes—2 weeks after receipt of signed lease agreement.
Custom sizes—4 weeks after receipt of signed lease agreement.

Quantity discounts available upon request.

Terms and Conditions of lease as stated in our 3M Brand "210" Static Eliminator Brochure apply.

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J-S315(28.5)R2

Nuclear Products 3M COMPANY

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NUCLEAR STATIC ELIMINATORS – THEIR DEVELOPMENT AND USES

Joseph J. Keers and Robert J. Kunz

The elimination of static electricity, long a thorn in the side of persons in the processing industries, can now be made a reality through the use of 3M Brand Static Eliminators. This new product for the first time combines efficiency, safety, and economy in a nuclear static eliminating device. And one need not apply for an A.E.C. license to possess this device.

Every year thousands, even millions of dollars are lost in the processing industries as a result of static electricity. This loss can take many forms such as fires, rejected products owing to dirt or streaks, and even total loss of production because of inability to operate, not to mention the personnel problems.

A static charge occurs when two materials come into contact and then separate. A simple explanation of this phenomenon is that there is a transfer of electrons from one surface to the other, dependent upon a difference in the affinity of the surfaces for electrons. Thus, when metal is rubbed with wool, the metal assumes a negative charge because of a greater affinity for electrons and the wool becomes positively charged due to a loss of electrons. The true mechanism of the electrification of material is much more complex; however, the transfer of electrons is a major factor.

The amount of charge on the surface depends largely on the conductivity of the material. Good conductors, such as metals, tend to lose their charge immediately, whereas poor conductors, such as plastic, paper and fabrics, hold the charge for long periods of time, even up to weeks under the right conditions.

Uncontrolled static can cause a wide variety of problems in processing plants. Shocks from electrostatic discharge causing involuntary muscular reaction may cause operating personnel to be caught in the moving parts of the machinery. Fire and explosion of flammable vapors in coating operations can result from very weak static charges. The fabrication of a product in some cases could be next to impossible without elimination of the static charges because of handling and web control or streaks and other defects in coatings. As simple as the cause of static electricity may be, the method of how best to eliminate it can be complex.

The basic requirement is to produce a conductive path that will allow the charge to drain off or otherwise be neutralized. This is accomplished by two methods: making the surface of the material conductive by coating the surface with a conductive medium such as water vapor or conductive chemicals, or by making the air around the surface conductive by ionization, i.e. breaking up the air into positively and negatively charged particles.

The efficiency of nuclear static eliminators as a class has been known for some time. However, A.E.C. licensing requirements have long been a deterrent to widespread use in processing industries. Now that the 3M Brand Static Eliminator has been authorized for distribution to general licensees, with no application needed for this general license, it is expected that this useful device will soon realize its full potential as a useful industrial tool.

Nuclear Products 3M COMPANY
2501 HUDSON ROAD • ST. PAUL, MINNESOTA 55119
TELEPHONE 612-645-0321

The first system of coating the surface is not always effective and the addition of a coating is often detrimental to the product. The ionization of air can be accomplished with three types of static neutralizers: nonpowered, powered, and nuclear (self-powered).

The nonpowered unit consists of either needles or metallic brushes suspended above the surface to be neutralized. The highly charged surface sets up a potential gradient between the needle or bristle points and the charged body. When a threshold level of voltage is achieved the air will ionize, creating a conductive path to ground through the needles. This system is known as the induction method of ionization, because of the induced charge in the static eliminator. There is no external source of power required in this system.

In the powered system, the electrical needle bar is simply the reverse of the induction needle bar. Here needles spaced along the length of a bar have a high voltage applied to them. This can range from 5,000 to 15,000 or more volts depending upon the construction. This high voltage creates a high potential gradient at the needle points to overstress the surrounding air, causing it to ionize.

The nuclear static eliminator is a self-powered ionizer of air molecules. Certain radioisotopes emit a doubly positive charged particle called an alpha particle. As the alpha particle, spontaneously emitted from the isotope, streaks through the air it interacts with electrons in the air molecules causing them to float in space as free electrons leaving the rest of the molecule positively charged. This ionization, or generation of positive and negative charges, produces a conductive path between the surface to be neutralized and the static eliminator.

The use of nuclear material to eliminate static is not new. However, the design of a nuclear static eliminator that meets all requirements for safety, along with efficiency and economy, is new. There are two major safety considerations in the manufacture of such a device – containment of the isotope and external radiation. The isotope must be contained in such a way as to prevent any possible hazard to the user and yet the containment cannot be so great as to prevent the alpha particles from leaving the surface.

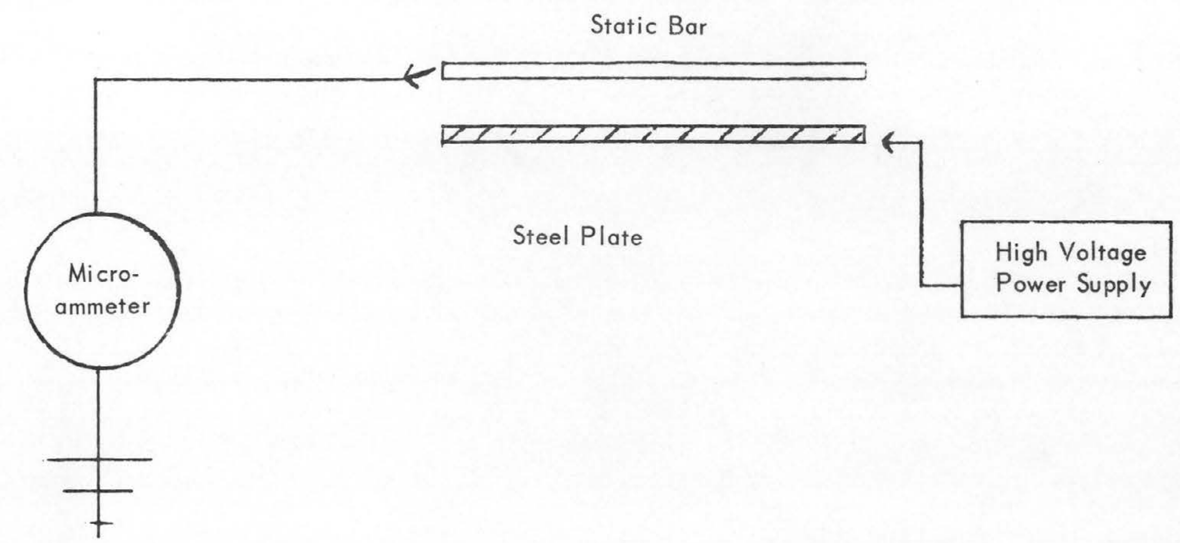
The development of 3M Brand Radiating Microspheres has presented a convenient method of containing the isotope and yet allowing the emission of the alpha particles. The Microsphere is a ceramic bead in which the isotape can be absorbed and then permanently sealed. The size of these beads is very small, normally ranging from 20 – 80 microns in diameter. Because of this small size there is little absorption of the energy of the alphas.

The isotope used in the 3M Static Eliminators is Po^{210}, which has the advantage of being a pure alpha emitter. Other alpha emitters, such as radium and americium, have both an alpha and gamma emission. The gamma is extermely penetrating and care must be taken to shield against the external radiation hazard. Since the alpha can be stopped by any thin covering, no special shielding is required for a Po^{210} static eliminator.

The only other possible hazard associated with radioisotopes is that of ingestion. Since isotopes react chemically like any stable compound, they can be absorbed by the body metabolism if they are taken internally. Although this is highly unlikely with a static eliminator, the Microspheres provide for this contingency because they make the isotope chemically inert.

In the construction of the static eliminator, the Microspheres are coated onto a thin metal foil, which is then mounted in a specially designed housing. It is designed to give the most effective ionization pattern and provide a good ground to conduct away the charge. A steel screen is used to protect the active surface from damage and yet permit the passage of the greatest number of alphas to ionize the air.

The effectiveness of any static eliminator is measured by its ability to remove charge. In order to compare eliminators, the ionization current that the bar will produce at certain voltages is used as a yardstick. This is given as microamperes of current and is measured by suspending the bar above a charged plate and measuring the current to ground. A diagram is shown below.



Generally speaking, 1/6 μ amp of current per lineal foot of bar will reduce static charges to a negligible level. A new bar will produce about 1 μ amp per foot, but since the nuclear material decays continuously the useful life will be approximately one year. At that time a full-strength static eliminator is procured.

The use of a nuclear static eliminator for a particular application depends upon a number of considerations: static charge levels encountered, speed of material being processed, level to which static charge must be reduced, and environmental conditions, to name a few. No general rules can be set down for material speeds and initial static charge levels, because each situation seems to be unique. Trial and error is the best method to determine the applicability of the nuclear device. The 3M device has been successfully utilized in industrial applications covering a wide range of voltages. As a general rule the nuclear device is most effective where a requirement for reduction of static charge to negligible levels is required. For instance, if the problem is eliminated by reducing static charge to the 5,000–10,000 volt range, a powered or non-powered system may suffice. If, however, it is required that the charge level be reduced to 1,000 volts or less, then the nuclear device is probably the best solution. If the application is such that a flammable atmosphere is involved, the nuclear device is a must, because other systems may cause a fire or explosion from an arc discharge.

The installation of a nuclear eliminator is not difficult. Usually the problem arising from the static is obvious and the bar is simply mounted in an area over the web or sheet at approximately 1 – 3 inches distance depending on the available space. The best position is determined by the elimination of the problem caused by the static.

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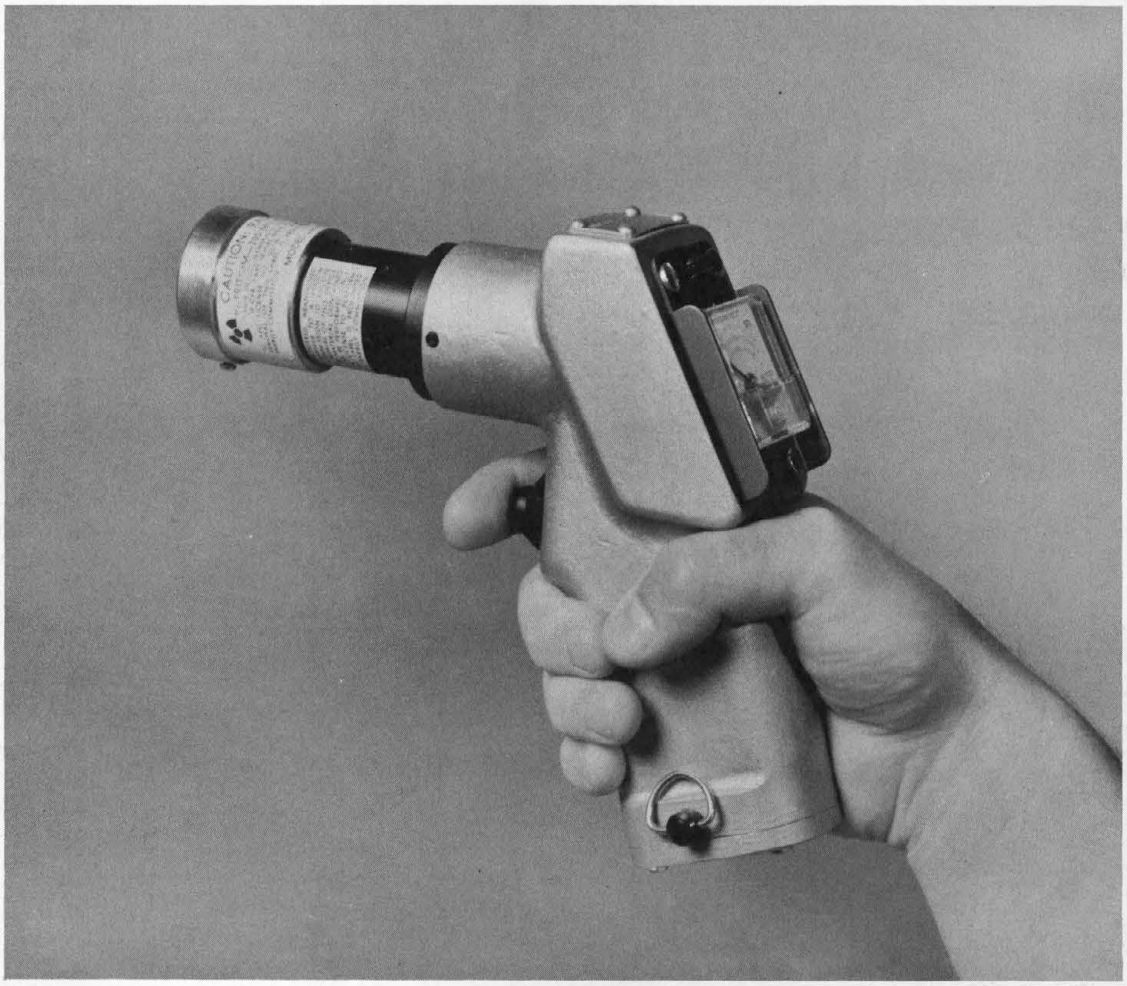
Nuclear Products 3M COMPANY

3M CENTER ST. PAUL, MINNESOTA 55101

MODEL 701 STATIC METER



DESCRIPTION

The 701 Static Meter is a pistol-shaped electronic instrument with a self-contained battery power supply. It features a linear tri-scale meter that quantitatively indicates both positive and negative static voltages, without contacting the surfaces to be measured.

APPLICATIONS

- Detection of static trouble spots in manufacturing processes; plastics manufacturing and handling, textiles, printing and other paper handling, operations with electrical and thermal insulating materials.
- Checking quality of conductive rubber, plastics, fabrics and other materials by detecting and measuring static charge storage.
- Measurement of performance effectiveness of electrostatic neutralizers.
- Monitoring static charge build-up in hazardous areas; hospitals, explosives manufacture and storage, combustible fuels handling, areas of combustible dust accumulation.
- Measurement of electric field potentials.
- Measurement of electrostatic voltage on loose materials; powders, liquids, fibers, etc.

J-SMF-1 (97.1)R

SIMPLE PROCEDURE

The operator holds the 701 in his hand like a gun and points its barrel toward the material or object to be tested. The spacing between the object and the tip of the instrument determines the full scale sensitivity (see below). The button on the hand grip of the 701 is squeezed and the meter is read. The position of the indicator on the meter designates both the quantitative voltage and the polarity (+ or —) of the charge accumulation on the object under test.

PRINCIPLE OF OPERATION

A special high resistance voltage measuring element located in the barrel of the 701 couples to the atmosphere by means of a radioactive Beta Emitter (Tritium). The voltage assumed by the internal element is determined by the strength of the voltage field being measured. The voltage read on the meter of the 701 is the potential difference between the object under test and the tip of the 701 with reference to ground, provided the operator is grounded. If there is any question, a good ground should be held by the free hand of the operator while taking the reading.

ONE SIMPLE ADJUSTMENT

The only adjustment necessary for proper operation of the 701 is that of turning the knurled knob above the meter face for zero volts prior to use. The adjustment is made while blocking the hole in the barrel tip with a conductive object. This insures that no voltage exists while the adjustment to zero is made.

SPECIFICATIONS

VOLTAGE-OPERATED: This instrument quantitatively responds to electrostatic charge or voltage.

FAIL-SAFE: Will not zero if batteries are weak or if instrument is damaged.

IONIZING SOURCE: Tritium, 12½-year half-life. A.E.C. licensed.

TEMPERATURE EXTREMES: +5°F to +150°F.

INPUT RESISTANCE: 10^{12} ohms minimum.

MAXIMUM INPUT CAPACITY: 20 MMFD.

MAXIMUM ENERGY REQUIRED FROM MEASURED SOURCE: 10^{-12} joules.

MULTIPLE RANGES: 5KV, 10KV, 20KV, 50KV, 100KV and 200KV.

METER SCALE: Mid-scale zero with 10 divisions ± from zero.

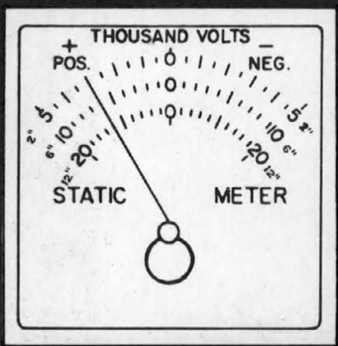
MERCURY BATTERIES: Two (2) each Eveready 216 and one (1) Mallory RM12R or AA penlight.

NORMAL BATTERY LIFE: 100 hours continuous @ 15°F or higher.

HOUSING: Cast aluminum.

OVER-ALL DIMENSIONS: 7¼" x 2¾" x 7".

ACTUAL WEIGHT: 3 pounds with batteries.



The above sketch of the tri-scale meter face represents a typical reading obtained with the 701. With the range multiplier in place and at a separation of 2 inches between the tip of the 701 and the charged object, the voltage reading is 30,000 + VDC. At 6 inches the reading is 60,000 + VDC and at 12 inches, 120,000 + VDC. With the range multiplier removed, each reading would be reduced by a factor of ten.

701 CALIBRATON NOTE

The factory calibration of the 701 is made from a flat 12" wide square surface. Variations in the geometry and area from this of a measured object will cause slight variations in the 701 reading. This is due to the 701's ability to actually measure electrostatic force. Electrostatic force will not only vary with the distance from the charge source but also with the size and shape of the object carrying the charge. The larger the surface area, the greater the electrostatic force.

If extreme accuracy is necessary the only valid method is to make a model to scale (the same as in polarized light stress analysis) and then run a calibration curve of the 701 utilizing hard voltages applied to the model from a voltage standard up to 20,000 VDC using a clamp over the switch. Do not hand hold for "hard" voltage measurements! It is not necessary to check range multiplier.

CAUTION NOTICE: The 701 is intended for measurement of low energy, high "static" voltages where "spark-over" will not present a hazardous condition. It is not recommended for measuring "hard" voltages which could be dangerous if the instrument is hand-held for that purpose.

The 701 with its chain-held Range Multiplier removed from position in barrel tip. Standard ranges of 5KV, 10KV and 20KV full scale readings are obtained in this manner on the tri-scale.

The 701 with Range Multiplier in place in barrel tip. With the Multiplier in place, the ranges are increased to 50KV, 100KV and 200KV full-scale readings on the tri-scale.

IMPORTANT NOTICE TO PURCHASER

All statements, technical information and recommendations contained herein are based on tests we believe to be reliable, but the accuracy or completeness thereof is not guaranteed, and the following is made in lieu of all warranties, express or implied.

Seller's and manufacturer's only obligation shall be to replace such quantity of the product proved to be defective. Neither seller nor manufacturer shall be liable for any injury, loss or damage, direct or consequential, arising out of the use of or the inability to use the product.

MINNESOTA MINING & MFG. CO.

FIELD LETTER OF J. A. Gierok CITY East Rochester, New York

DATE May 23, 24, 1968

TO *F. S. Copeland

*A.W. Boese-220-8W
R.I. Byhoffer-42-4E
*L.W. Goerke-Hutch
*P.E. Hansen
*A.E. Johnson-42-4E
A.D. Pearson-220-7W
*J.R. Starkey-219
*H.B. Walden-230-B

PURPOSE: Observe manufacturer's trial of 2K Rando-Webber (108")

SUMMARY: 3M Representatives of Medical Products Laboratory, Hutchinson Production, New Products-AC&S, Ribbon Laboratory and Tape Engineering took part in the manufacturer's trial run of 2K Rando-Webber. The persons with a * before their name in the copy list, plus the writer, observed the machine trial. Curlator Corporation plants visited were located in East Rochester, and Palmyra, New York. The 108" Rando-Webber produced acceptable formation (dry webs only) and indicated that we could get acceptable fiber weights for surgical tape backing, elastic bandage cover web and adhesive carrier web.

DETAILS: Persons contacted while at Curlator Corporation were Jim Miller and Dick Castor.

On May 23, special opening equipment was evaluated at the East Rochester plant for 1" 1.5 denier rayon tow and 3/4" 1.5 denier rayon staple. Tow opening was not satisfactory - there was an undesirable number of "married" fibers. The staple opened satisfactorily.

The balance of May 23 was spent at the Palmyra plant observing and assisting in the evaluation of the Rando-Webber that will become part of the 2K Maker at the Hutchinson plant.

Under the direction of Dick Castor, the following dry webs were produced:

1 9/16" 3 denier Dacron - 7 lbs/ream
1" 1.5 denier Rayon Tow - 12 lbs/ream
3/4" 1.5 denier Rayon Staple - 6 lbs/ream

The machine was evaluated with a solid nose bar. A notched nose bar will also be supplied by Curlator.

THIS MARGIN TO BE USED FOR OFFICE NOTES, ETC.

1-FL-2

The ability to change the saber tube (eliptical adjustment) while the machine was running showed how web formation could be changed by varying the air velocity between the lickerin roll and saber tube. Web formation with tow was the best with high velocity (least clearance), while staple required less velocity to minimize the characteristic fiber clumps.

The condenser screen used on the 108" machine appeared to be as satisfactory as the condenser roll on narrower machines.

The hydraulic-disc brake on the lickerin roll is a desirable safety feature.

J.A. Gierok
JAG/bjp

SCIENCE & TECHNOLOGY

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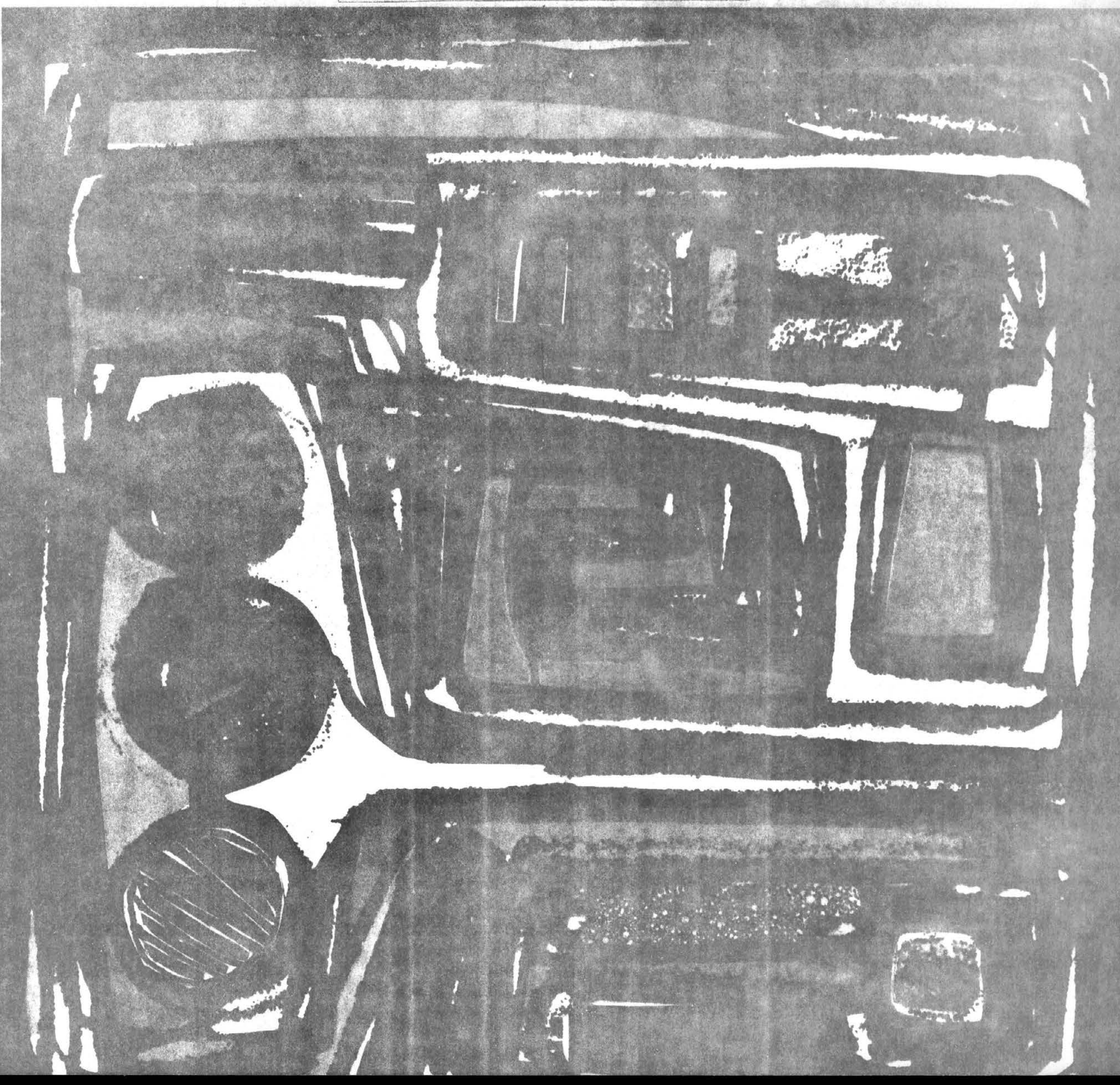
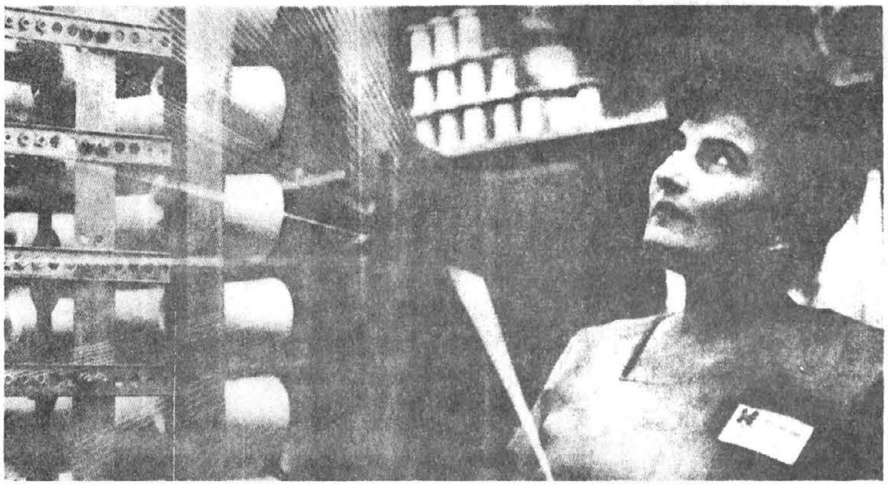


THE TECHNOLOGY OF TEXTILES

BY

RENEE FORD

THE TECHNOLOGY OF TEXTILES
The newest engineering materials are textiles that can take it—flexible structures fabricated from an astonishing array of man-made fibers having an extensive range of mechanical properties. Associate editor Renée Ford, whose main interest in textiles until recently has been for their decorative aspects, interviewed America's leading textile specialists to draw together the many threads of this technological tapestry. At right she examines a creel—for holding bobbins of yarn—at the Fabric Research Laboratories, whose researchers provided invaluable assistance in the final stages of preparing this article.



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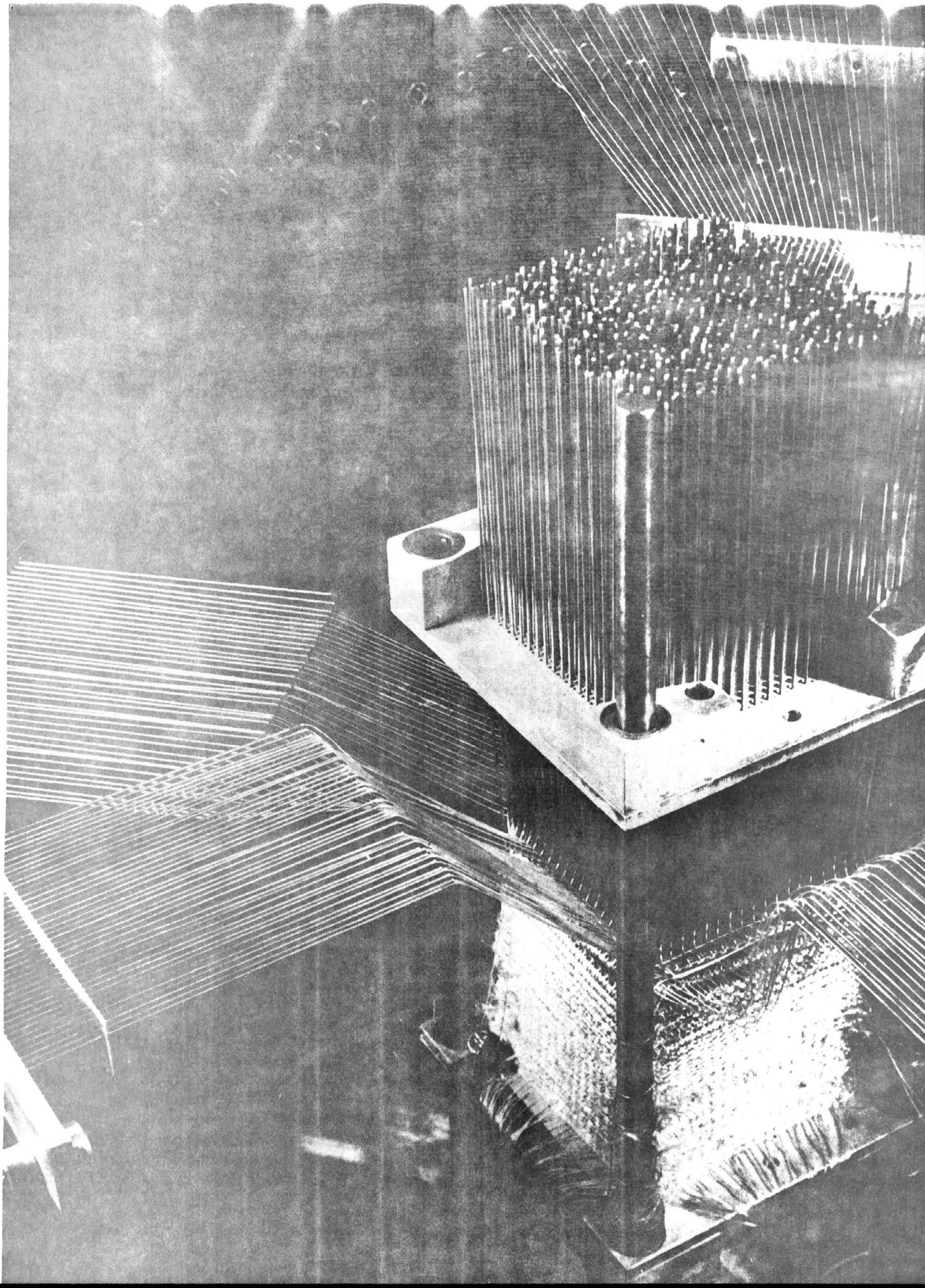
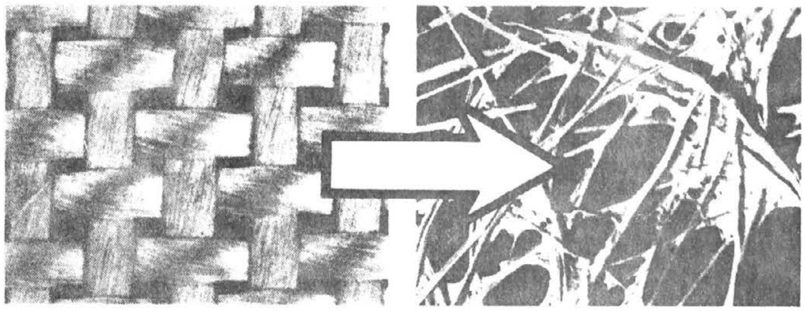


We've come a long way from the centuries-old 2-D plain weave. Now we can add the vertical to the horizontal and make 3-D reinforced materials or subtract the loom to make bonded nonwovens.



THE TECHNOLOGY OF TEXTILES

Man-made fibers ranging from polymers to ceramics have properties that would astonish Mother Nature. Woven into fabrics, they are bringing a new dimension to the world of engineering materials

by Renée Ford, associate editor

IN BRIEF: *In the last decade and a half there has been a textile revolution. Man-made fibers unlike anything in nature have been produced. They have extraordinary properties of strength, energy absorption, and temperature resistance. And textile technologists can tailor-make fibers and flexible structures of all sorts with an almost endless variety of properties to suit particular purposes. To take maximum advantage of their unique characteristics, engineers must now learn how to design for these new structural engineering materials. The textile revolution has in fact led to a materials revolution.—R.F.*

■ Most of us naturally tend to think of textiles in our roles as consumers. And so we are more likely to be concerned with the way they look, feel, and cost than with their tensile strength, abrasion resistance, or elastic modulus. Furthermore, since textiles have been around for quite some time—the earliest existing fabric, found in Egypt and made of flax fibers, is dated about 7000 B.C.—we don't usually think of textiles as the product of a highly sophisticated technology. Yet the theories used by textile scientists to study fibers and fabrics are the same ones used by engineers working with structural steel. Textiles like steel come in a variety of forms with many different properties, and as with steel you can come pretty close to getting what you want to do a job.

Fibers, the basic elements of textiles, have been described as "tiny microscopic beams." Textile fibers are thus structural engineering materials which engineers now have available along with the more traditional materials—metals, wood, and concrete—to solve their problems. But first engineers need to get acquainted with what can be done to tailor fibers into a variety of structures so that they will be stimulated to think of textiles in a new light—for "nontextile" purposes.

Today's textile industry has the know-how to design fibers and fabrics to meet specific needs. What is involved is a combination of materials and engineering technology. The result is a configuration of fibers that can do the best job.

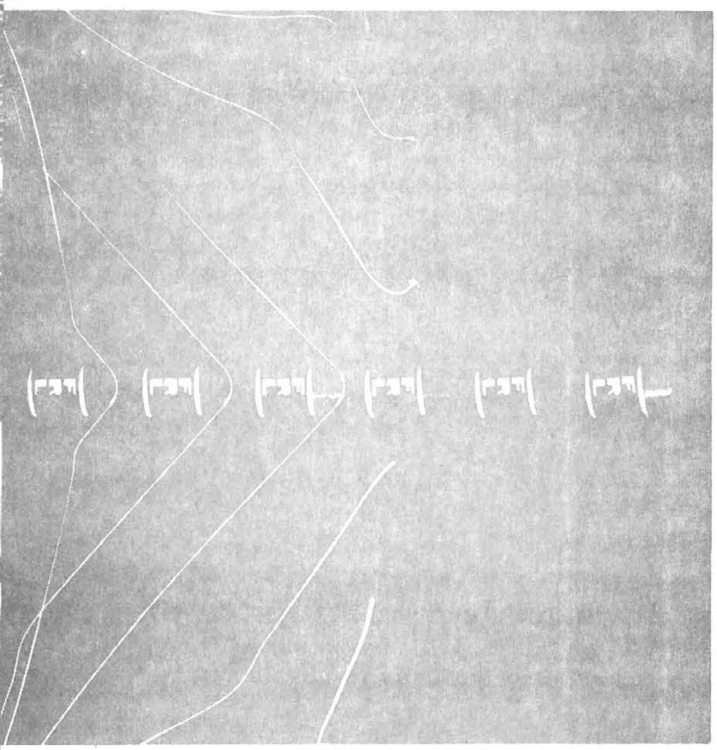
Apparently there are still a great many misconceptions about what a textile is on the part of many materials and design specialists. If you think of a textile as an engineered, flexible structure in the ordinary sense—that is, one that can be easily bent—and if you want a structure like that, then the thing to do is to make it out of fibers. There are many kinds of fibers available and many ways of putting them together, so the particular properties you need can be met by a combination of the fibers used and the methods of assembling them. The textile scientists are trying to get across the philosophy that you can go to them with your problem and they'll try to design something for it.

The properties of any textile structure—a rope, a filter [illegible] a gliding parachute—are a result of the tailored assembly of minute flexible beams which make up the structure. As in rigid structures, these properties depend upon the basic elements and their geometric relationships in the structures. The variety of ways in which the basic elements—for example, I-beams—can be arranged in rigid structures is limited by their inherent stiffness. But when the basic elements are flexible, like fibers, there is almost no limit to the structural variations possible. Some common examples are shown in the illustrations, but even these are only a small sampling of the tremendous diversification possible in flexible structure design.

The mechanical properties of any textile structure are determined to a large extent by the mechanical properties of the fibers from which it is made. But the configurations in which these fibers find themselves and their interactions within the structure also exert a large, sometimes even dominant, effect on the properties of the structure. Because the geometry of fibrous structures is extremely complicated, clear-cut mechanical engineering-type computation is almost impossible. Much progress has been made, however, by using idealized models to provide an understanding of the response of textile structures to applied stress. These have formed a basis for sound engineering design.

The accompanying table gives you a qualitative idea of the ways in which the properties of a woven fabric can be modified by changing some of the controllable aspects of its construction. If it looks complicated here, the interactions between the constructional variables (the left-hand column) make it even worse in practice. Similar cause and effect tables can be drawn up for a host of other flexible structures—ropes, braids, knits, nonwovens, felts, and the like. The complete picture is tremendously complex. Despite this apparently overwhelming untidiness, by combining the appropriate choice of fiber with sensible engineering, flexible structures can be designed to provide specialized properties for specific applications.

One way to find out whether a material can take it is to shoot a missile at it. Multiple-image photography shows a cord as it breaks.

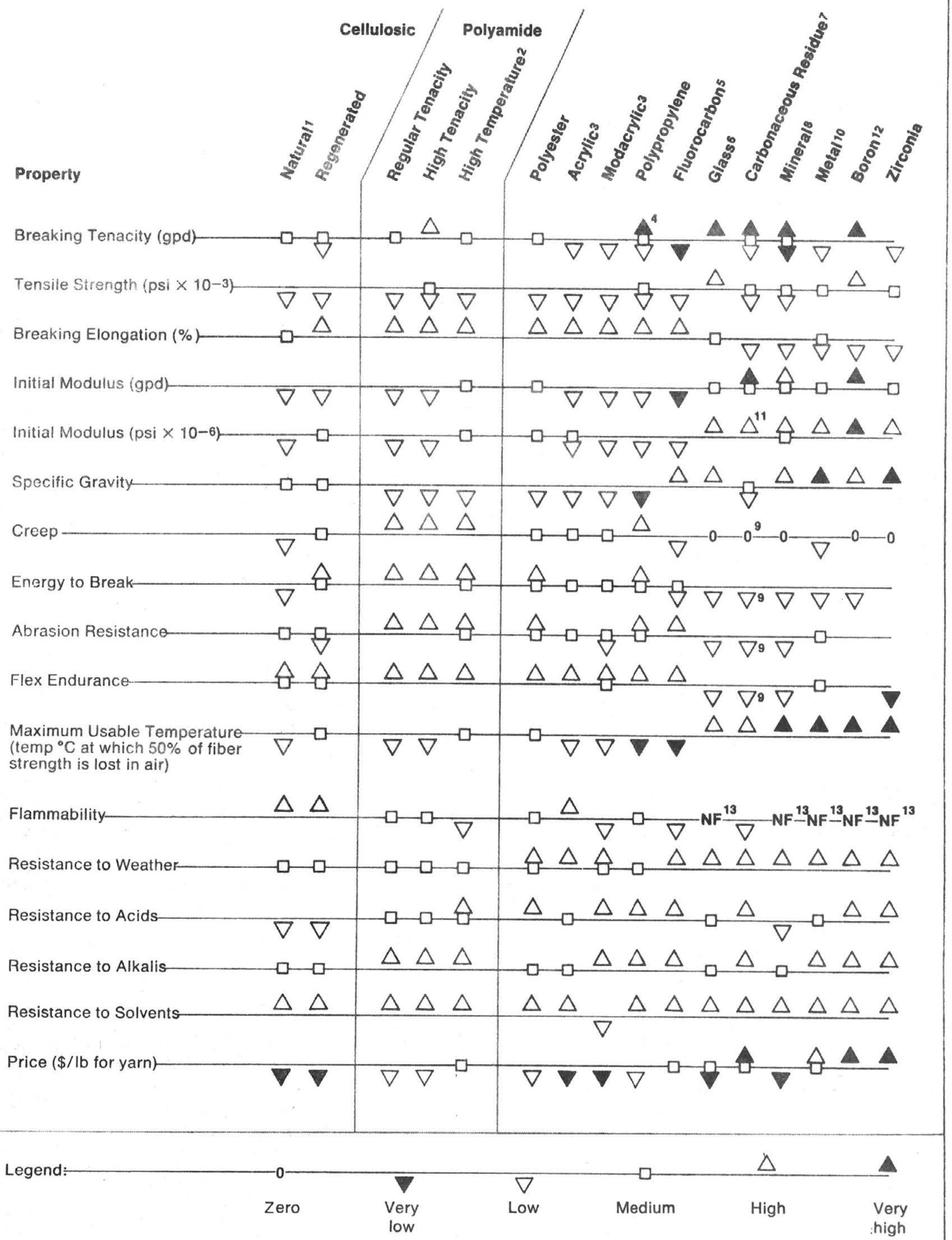


Up until World War II, the field of fibers was not a very broad one. The selection was limited to such natural fibers as cotton, jute, wool, flax, asbestos, and silk, or the rayons—the synthetic fibers first developed in the late 19th century. Viscose rayon, the first chemically produced commercial fiber, is primarily regenerated cellulose, in which the starting material is obtained from wood pulp or cotton linters (a waste product). So, even though the rayon-making process involves some elegant chemistry, the product still has a chemical composition somewhat similar to the natural fiber, cotton.

The real breakthrough in the man-made fiber field came just before World War II when Wallace Carothers at DuPont invented nylon, a polyamide fiber unlike anything that exists in nature. Except for parachutes and ropes for the Armed Services, it wasn't developed commercially until after the war. And then there was a veritable explosion of man-made polymers suitable for making fibers. Thus today, besides the natural fibers, we have not only many varieties of polyamide fibers, but also polymeric fibers based on polyesters, acrylics, modified acrylics (modacrylics), and olefins like polypropylene (see ANATOMY OF PLASTICS, Jan. 1968).

It is theoretically possible to make fibers out of just about any material. Some of the most successful have been made from glass, quartz, metals, graphite, and most recently from ceramics. I will talk about some of the exciting developments in this area later. But the chief characteristic of a polymer, if it's going to make a useful fiber, is a sufficiently high molecular weight, usually not less than 12,000. One analogy is a bowl of spaghetti. When you reach into a bowl of cooked spaghetti and start pulling, you pick up a lot of strings together because they are long and adhere to each other. On the other hand, if you cheat, and cut it up, you don't pull anything out. There isn't enough length to the structural members to develop strength. Without some force to hold the polymer chains together, they will slide apart the way two pencils do. What is needed is some kind of inter-

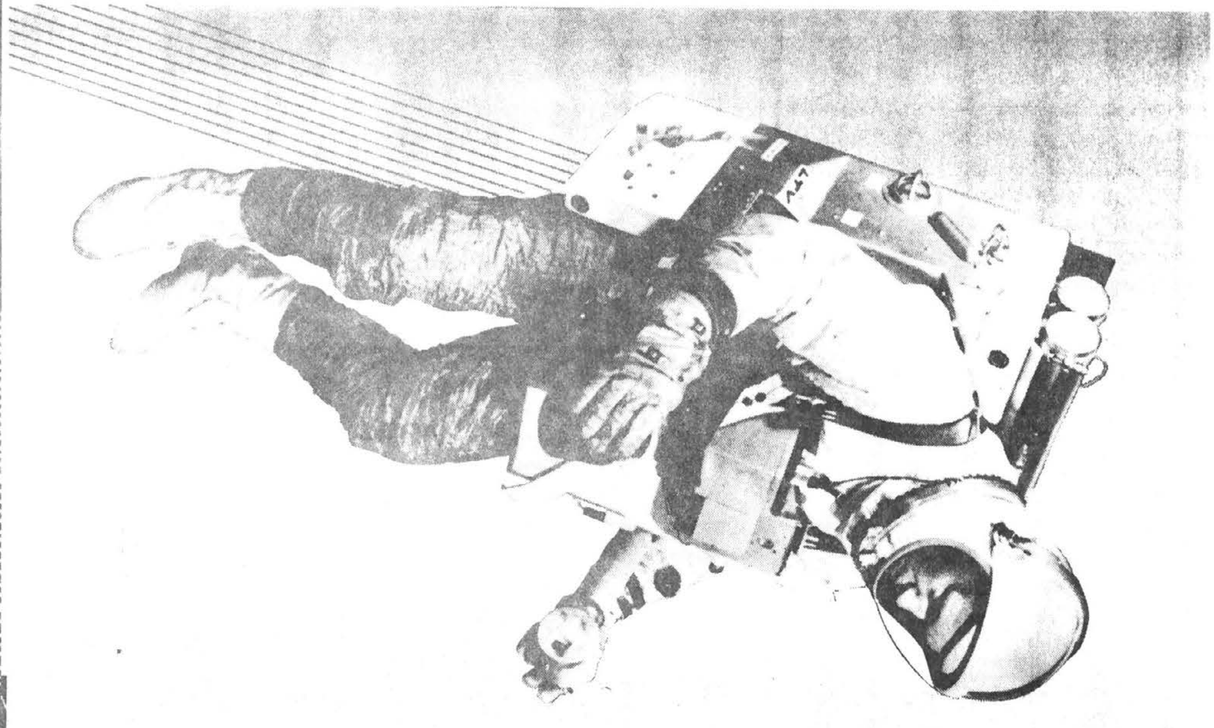
INDUSTRIAL FIBER PROPERTIES



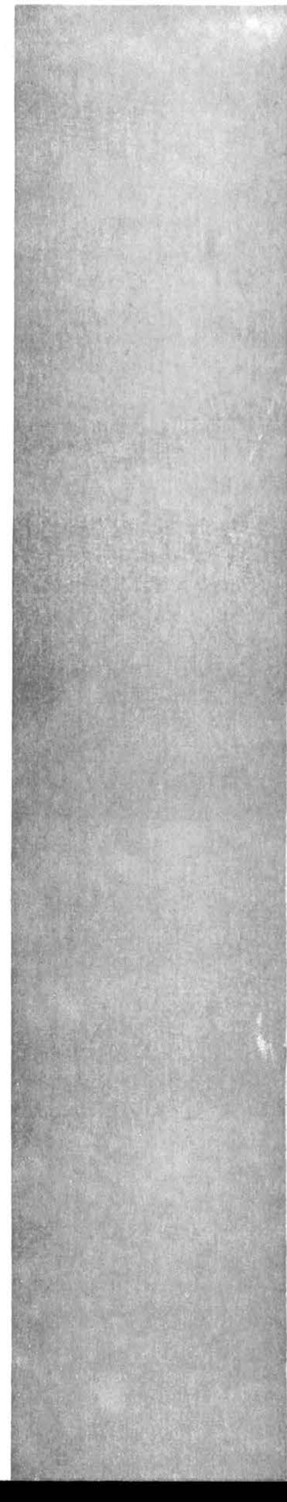
Notes: 1. Dry, cotton (staple) **2.** Nomex **3.** Staple **4.** Commercial yarn 3-7 gpd **5.** Teflon **6.** E&S glass **7.** Carbon and graphite yarn **8.** Chrysotiles **9.** Uncoated fibers **10.** 0.0005-in. diameter fibers **11.** 100 × 10−6 psi has been measured in laboratory **12.** 0.005-in. diameter fiber **13.** Nonflammable action—either physical or chemical—between the chains, to give them the necessary cohesion (see FIBER SCIENCE, Dec. 1964).

There are fundamentally three ways of making a fiber from a polymer. They are all based on converting an intractable polymeric material to some tractable form and then converting this to a fiber. In *melt spinning*, the polymer is melted to form a viscous fluid, extruded through a tiny hole and cooled. In some cases, the polymer is dissolved in a solvent and the solution squeezed through a hole and then, as in the case of *dry spinning*, the solvent is evaporated or, in *wet spinning*, the solution is extruded into a precipitating bath. Extrusion produces a uniform, continuous filament billions of yards long with few or no defects. In this respect, man outdoes the silkworm, which he started out to imitate.

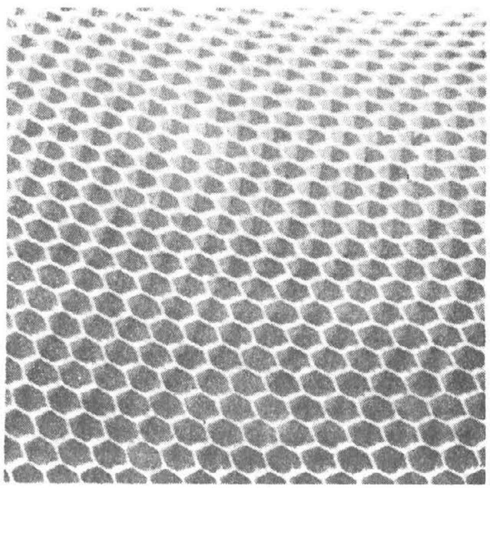
Over 4 billion of the 9 billion pounds of fibers consumed last year were man-made. This is a pretty startling figure considering what relative newcomers these man-made fibers are to the textile industry. The big market for all fibers is in consumer products. The gross retail value of apparel alone sold across the counter in 1967 came to 34 billion dollars, approximately 5% of our GNP and larger by 4 billion dollars than the retail sales of the total automotive industry. And this figure does not



Woven flexible metal fabric protects this astronaut from getting a most uncomfortable hot seat from the plume of his rocket-maneuvering unit. These metal pants were worn on the Gemini IX mission.



These hollow fibers, each smaller than a human hair, can take pressures of 600 psi. Twenty million of them packed together are the heart of a new process for water desalination and waste water treatment.



Tough honeycomb of lightweight pure Nomex fiber paper chars but doesn't support combustion. It will form the core of the interior panels in the Boeing 747 jet transport. As a bonus, the paper saves about one ton in total weight.

even include the sizable home furnishings and industrials markets.

Today's textile industry includes much more than in the pre-nylon days. At that time, it was largely a fabricating industry buying cotton, silk, wool, rayon, and acetates, then processing these fibers on equipment developed over hundreds of years, like the card, the loom, and the knitting machine. With the advent of the man-made fibers, a tradition-bound industry was linked with the chemical industry, one of the most sophisticated scientifically and technologically. The fiber-producing industry is in effect a new industry created by the chemical industry in a natural expansion of its interests in polymers. But even though the chemical industry only supplies fibers, it has had to concern itself with every step of fiber processing and fabric production in order to more effectively sell the fibers it creates. The chemical industry's involvement with the textile industry has brought about an orientation toward the utilization of research and development in an industry whose technology had largely developed by a more leisurely evolutionary process. About 150 million dollars a year is now spent on fiber research alone.

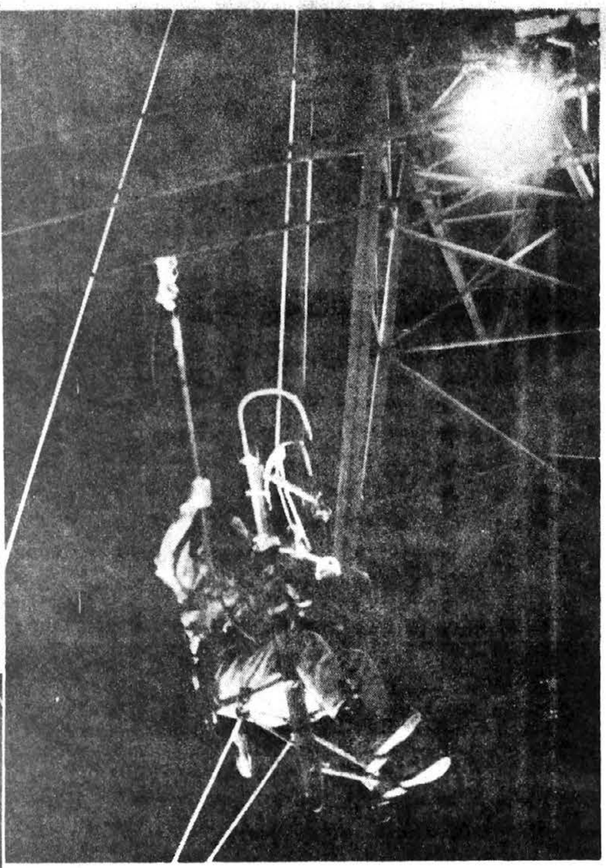
It is expected that by 1970, the consumption of synthetic fibers will rise to about 75%

of the total. Though most of this will obviously be for consumer goods, industrial uses are becoming increasingly significant. The purpose of this article is to tell you about those developments in fiber producing and processing which are of particular importance for industrial purposes. In contrast to apparel use, for example, where aesthetic characteristics are a major factor, industrial fibers must have the mechanical properties to make them perform under various stress conditions.

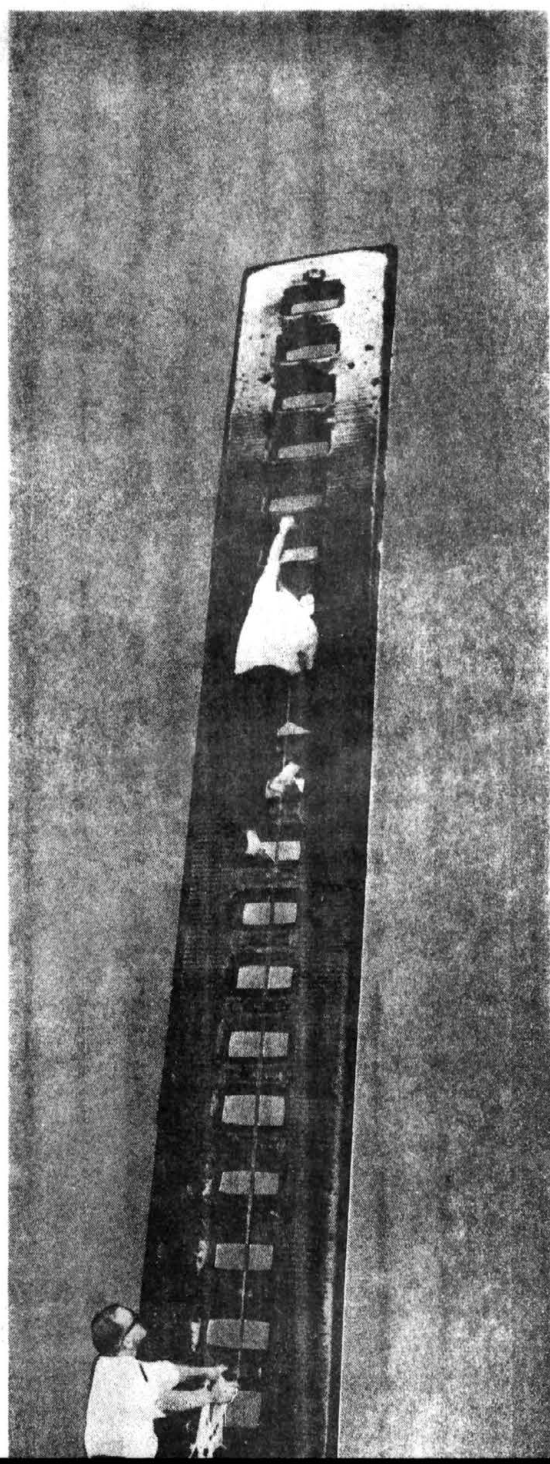
The investment in research has paid off in knowledge which relates the properties of fibers with their molecular structure and organization. This understanding of the functional relationship between structure and properties makes it possible for the textile scientist to say, "If I want these properties, then I need this kind of structure."

Thin but strong

One of the principal properties of man-made fibers is their great strength. To appreciate the relative advantages of fibrous materials used as structural elements, engineers must learn to think of common concepts such as material strength in terms which may seem strange. Tensile strength expressed in psi makes good sense when the cross-sectional area can be controlled over broad ranges, and



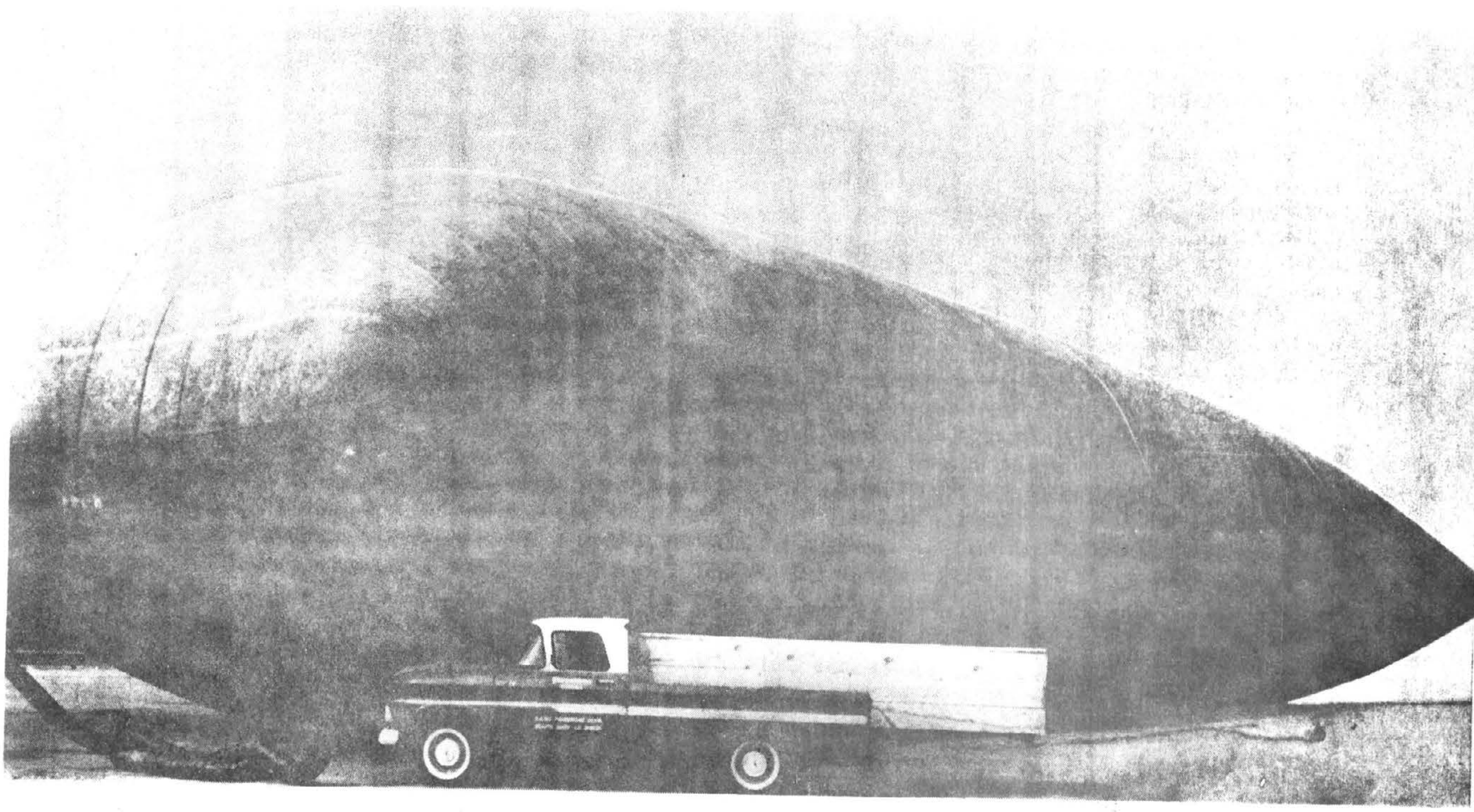
This linesman is working 150 ft up at a test facility for a $^3/_4$-million-volt transmission line. His suit, woven of beta glass fiber and conducting graphite yarn, shields him from a potentially lethal current flow from the line by keeping him at the line voltage. The arcing you see is the suit's being charged via a short conducting pole.



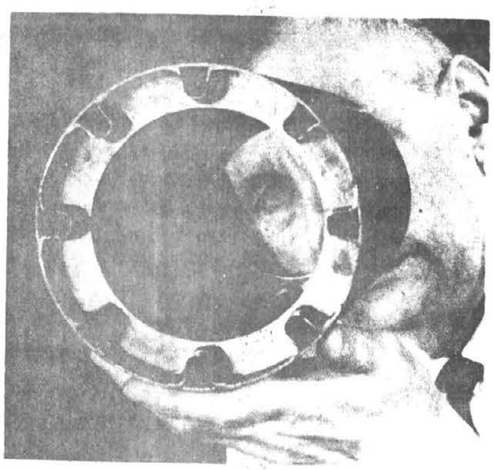
A 26-ft inflated ladder of coated polyester fabric is strong enough to hold a 200-lb person yet can be easily lifted by one hand. Collapsed, it fits through the hatch of a Saturn V rocket.

when the available materials all have about the same density. But the basic characteristic of a fiber, flexibility, results from its very small cross section and cannot be greatly varied without changing a fiber into a rod. In addition, the range of specific gravity of the available fibers is large—from <1 for polypropylene to approximately 8 for metals. Consequently you have greater control over the weight of a fiber structure of any given strength than, for example, a bridge builder has over his structure. This is why fiber strength expressed in psi units doesn't work and why a different approach is adopted.

The critical parameters in textile fibers—cross-sectional area and density—are combined in a basic measure, linear density, which is mass per unit length. The most common textile unit of linear density, denier, is the mass in grams of a 9000-meter length of fiber or yarn. This odd unit, ingrained in the textile industry, came from France. It is the length of silk fiber which weighs the same as a small French coin, the denier. This happens to be 9000 m. (Recently an attempt has been made to introduce some semblance of scientific order with the tex unit, the mass in grams of a 1000-m length. It has not made much headway so far.) The strength of a fiber can be expressed as the breaking tenacity in force per



When it's collapsed, this rubber-coated polyester fabric storage container is transported by the small pick-up truck. Inflated, it holds grains, liquids, or gasses.



Graphite-yarn-reinforced resin was used to make this 6-in. model of an aircraft fuselage, complete with filament-wound shell and premolded strengthening rings and stringers. It demonstrates that graphite yarn, although normally quite brittle, is suitable for structures with sharp-radius curves if the filaments are small enough.

unit linear density, for example grams per denier, a unit which combines the effects of tensile strength, cross-sectional area, and density. This approach may seem unusual to structural engineers, but fibers are materials with out-of-the-ordinary characteristics. Tenacity clearly expresses perhaps the most significant fiber characteristic, the ability to attain high strength at very low weight. Consider, as an example, the comparison between metal and high-tenacity nylon shown in the table of industrial fibers. The tensile strength of steel is about 200,000 psi, that of nylon about 100,000 psi. But the tenacity of nylon (grams per denier) is four times greater than steel. In other words, a nylon rope weighing 1 lb per 100 ft has four times the strength of a steel cable with the same linear density (and maybe even more than four times because of the greater efficiency with which the strength is translated.

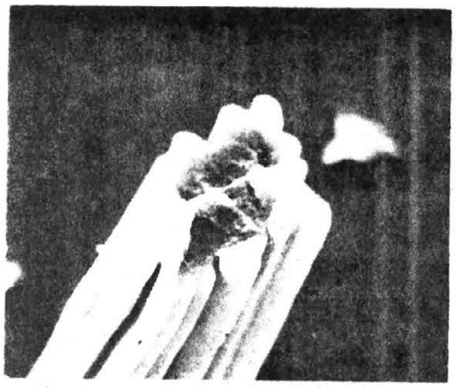
An advantage of working with this unit is its simplicity. It gives you a direct sense of strength to weight which you don't get with psi. A problem currently under investigation suggests how it works. A new type of parachute, the gliding descent decelerator, requires a fabric with extremely low air permeability under biaxial load. It also must have high tear strength and tensile strength combined with light weight. Tenacity shows directly what the relation is between strength per unit width and weight per unit area in the fabric. Supposing you have a fiber with all the appropriate properties which has a tenacity of 5 g per denier and you have found that to achieve the needed fabric strength you must use enough fiber so that the fabric will end up weighing 2 oz per square yard. Tenacity tells you that you can cut the fabric weight in half by using a fiber with a tenacity of 10 g per denier in place of one with 5 g per denier.

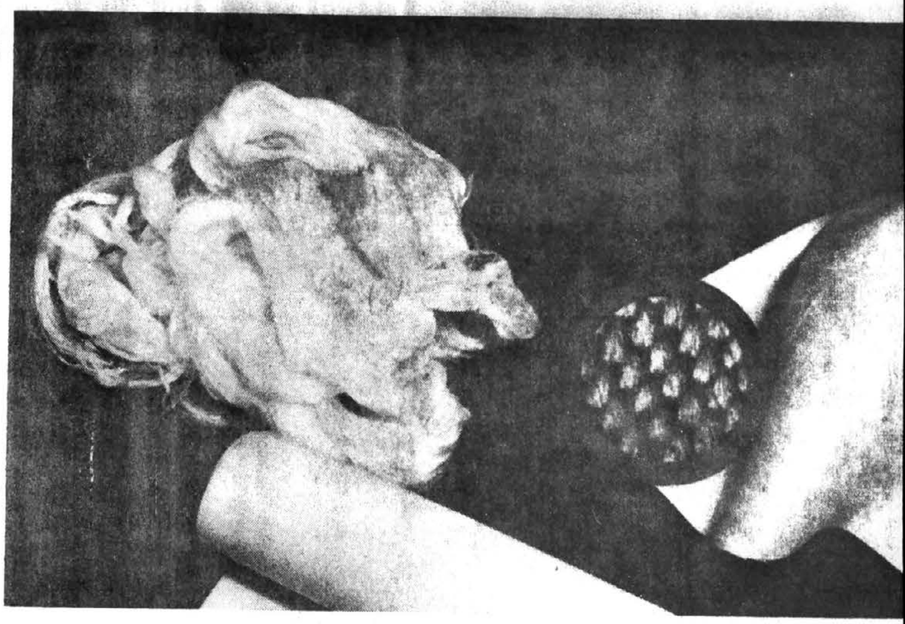
It is only when strength and modulus are considered on a gram-per-denier basis that the remarkable advantages of some of the newer fibers like boron and graphite can be fully appreciated. And it is because such high strengths and high moduli are available at very low weights that these materials present an exciting prospect for the development of composites which may revolutionize our approach to the design of load-bearing structures currently made from metals or other common structural materials.

However, man-made fibers are not born strong, so to speak. It is mainly the three-dimensional organization of the polymer chains with respect to each other, their degree of crystallinity and their alignment in the direction of the fiber axis, rather than a particular chemical structure, which is largely responsible for the exceptional strengths of these materials. However a correlation does exist between the chemical nature of the polymer molecule and the degree of order obtainable in the fiber structure. This supramolecular organization is generally achieved by a process called *drawing*. The filament formed immediately after extrusion is not a useful textile fiber because it lacks a well-developed molecular architecture—its molecules are in a relatively amorphous, disoriented state. Such fibers have high elongation and low strength. In the drawing operation, the polymer chains are aligned with respect to the fiber axis. This step is followed by annealing which crystallizes them so that they become stabilized in the drawn configuration. The resulting fiber now has both strength

THE CERAMIC TEXTILES ASSAULT THERMAL BARRIERS

The flexibility of the fine-diameter zirconia (ZrO_2) fibers, shown below magnified 5 x 10^3X, makes it possible to fabricate them into almost any conventional textile form, yarn, felt, and woven. The woven fabric is shown being heated to 4000°F in air.





and resistance to inelastic stretching.

A cotton plant produces ribbon-like fibers. But it can't be induced to produce them round or triangular or dumbbell-shaped. Man-made fibers on the other hand, are made in all of these shapes and modifications of them. One of the effects of changing shape is on the bending characteristics. A similar situation exists in structural steel with I beams. An I beam is much stiffer than the same linear mass made in a circular cross section, for example. The same holds true for a fiber. If it is made in an I shape, it is more rigid and the fabric woven from it feels stiffer.

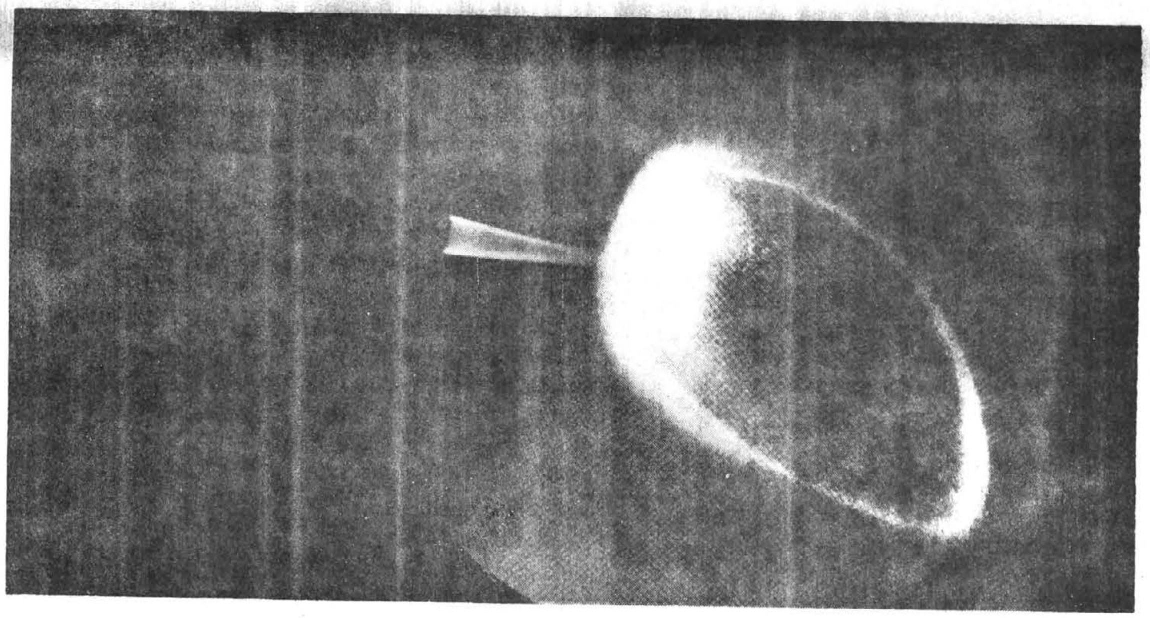
Fiber cross-sectional shapes can be changed either by altering the shape of the holes through which they are extruded or by modifying the conditions immediately after extrusion. One could run through the entire alphabet in terms of I beams. The most common natural and man-made fiber cross section is circular. However, the modacrylics are generally pear-shaped and the acetates crenulated, for example. Another effect of changing the cross section away from circularity is that it almost always increases the surface area per unit weight of the fiber. This is of particular importance in filtration applications. In cigarette filters, for example, there is a constant effort to achieve maximum filtering power for the minimum amount of fiber.

Chemical alterations can also be carried out during the extruding step which affect ultimate physical properties. You can pretreat fibers to control their response to a given environment, and the ability to change the environment in the vicinity of the polymer at every stage of the processing offers many additional possibilities. In fact, you can make voids or avoid voids or even make a continuous void in the fiber. After extrusion, during drawing, the time, temperature, and applied stress all have their effects on the final product.

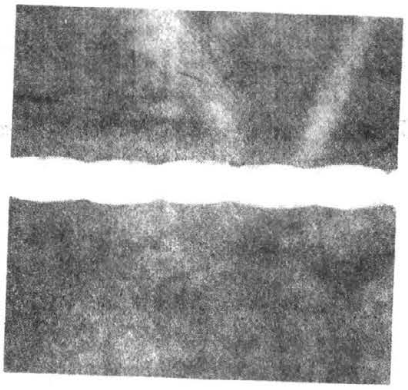
A tire tale

The largest single industrial use of synthetic fibers is tire cord. They're the reason tire blowouts are so rare these days. An enormous amount of flexing takes place in tires and they must be able to recover their shape after tremendous impacts. Cotton cord, which was the reinforcement until the middle thirties, has a relatively low breaking tenacity—only about one half that of the high-tenacity continuous filament man makes. The first continuous-filament fiber, rayon, completely replaced cotton. This was largely due to the great weight saving, thus considerable cost reduction and improved performance.

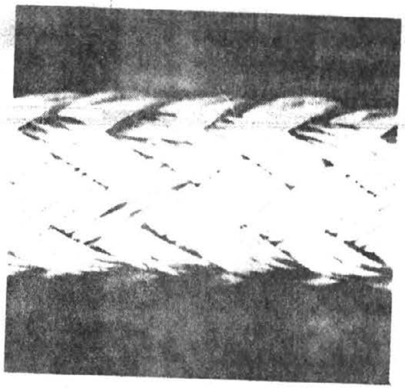
When nylon came on the scene, its unusually high energy-absorbing characteristics plus its strength and toughness made it very desirable for tire making. But nylon didn't completely push rayon out of the tire field because of a peculiar deficiency. Nylon creeps. If you take nylon and put it under tension—keep pulling it—it will gradually stretch a little bit further out. The same thing happens in the opposite direction when you remove the tension, it relaxes a little bit. When a car is parked, the weight of the car on the bottom of the tire tends to offset the pressure of the air inside the tire, the cords creep and the tire develops a flat spot. Then when the car starts up again you get a kind of bumping sound for a few miles as the round wheel moves over the flat spot, until the tire builds up enough frictional heat to make the cord creep and the tire as-



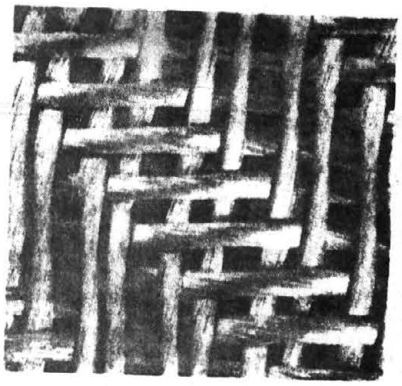
FLEXIBLE TEXTILES STRUCTURES COME IN MYRIAD FORMS



. . . infinitely long fibers twisted together



. . . many ends of yarn braided together



. . . two perpendicular sets of yarn woven together

sume a perfectly round shape again. Whereas most of the people I've spoken to have been unaware of flat spotting with their own cars, the problem plagues the automobile manufacturers. They feel it makes their cars sound faulty to a potential customer comparison-driving cars from a new car showroom. As a result rayon tires, which are dimensionally stable and don't flat spot, have been standard as original equipment but practically all the replacement passenger tires have been nylon. Naturally many attempts, so far unsuccessful, have been made to make an improved nylon. The hottest newcomer to the tire cord scene is polyester. Presumably it has all the advantages of nylon without flat spotting. But it took a lot of work to overcome its original problem, poor adhesion between the cord and rubber. And, according to its proponents, it also took a lot of work—almost 10 years—to overcome the resistance of tire manufacturers to change the way they put a tire together. However, the tire cord battle is far from over, with continuous-filament glass coming into the picture as well as a new combination fiber made of both nylon and polyester. In addition rayon's mechanical properties have been much improved as a result of a recent upsurge of research on the part of the rayon producers. Industrial consumers are much more particular about what they get than the apparel area. There has to be a great deal of driving force to get a manufacturer as large as a tire company to make a big switch in production methods. The natural tendency is to get set up and run forever. The tire story is far from over since we are still a long way from the perfect reinforcement fiber and tire construction.

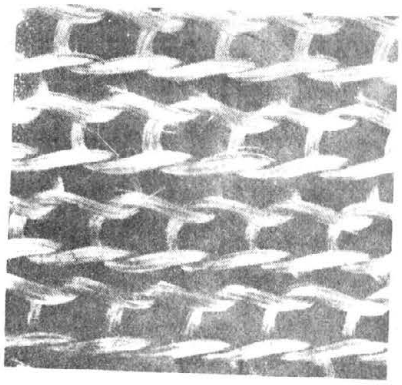
Improving on nature

The man-made fiber properties of low-density, high-energy absorption, abrasion resistance, and ability to withstand enormous impacts are exploited in a number of ways. Cordage—rope from ¼ in. to 18 in. in diameter—has traditionally been made with hard vegetable fibers like hemp and jute. These have been very extensively replaced by nylon and polypropylene. Unlike the natural materials, polymeric fibers don't mildew, rot or absorb moisture. Nylon makes the best tow rope. It's high stretch readily absorbs the shock of the seas, permitting faster towing. It also saves your car bumper. And this property makes it good for mountain-climbing rope and parachute harnesses. Polypropylene is unique in that it is less dense than water and therefore floats, an advantage in a number of marine applications. From these few examples you can see how rope can be tailored to your needs by choosing the right fiber and putting it into the right structure.

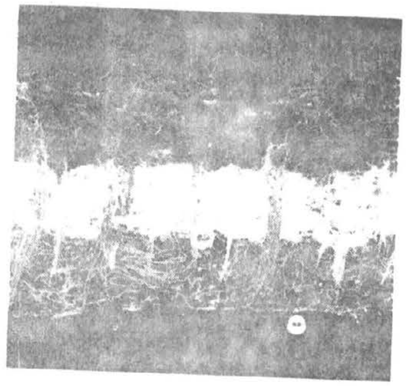
Polyester, which resists growth under tension, takes the buffeting of the wind without becoming floppy or saggy. It has been widely adopted for sailcloth. The acrylics have outstanding resistance to the elements. In areas with high humidity they have been replacing cotton in sandbags for the military. Tests on acrylic sandbags buried in a river for four years show strength retention of close to 98%. Acrylics make good awnings and tents also.

Since mobility in the field is more important than stability, military needs have sparked the acceleration toward nonclassical materials. Coated nylon and polyester fabrics may sound like unconventional materials for constructing storage buildings, radomes, or air-dropped hospitals, but they provide the lightest possible weight with the best strength. They have given rise to a wide variety of inflated structures which take only a little blowing to keep up and have a low cost per square foot. When coated with a light-colored vinyl and blown up with heated air, they make great winter pool and tennis court domes too. You can lean up against them or hit them; the structure just gives and comes back to its original shape.

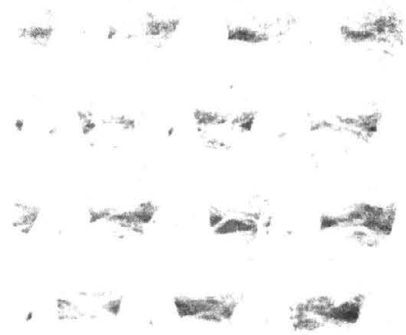
The fibers mentioned so far have their limitations as well as strengths. But textile scientists have learned to manipulate them in so many ways that each fiber can be produced



. . . one or more sets of yarn knitted together



. . . an array of fibers mechanically joined together



. . . two perpendicular sets of yarn stitched together

with a considerable range of properties. When dealing with an industrial application where specifications and uniquely suited properties are involved, if the end use is large enough, then the properties will be tailor-made for that particular purpose. Tire cord is a good example. Apparel fibers, for example, would be completely unsuitable because of the high tenacity and endurance requirements. If we go from the standard tire to a radial tire, many of the specs that are now acceptable would have to be changed. As the industrial application specifications require change, the fibers will be modified.

A fundamental limitation shared by all the common synthetic organic fibers is their relatively low melting points. So there has been a continuing push to develop high-temperature textile materials that withstand flash fire and can be exposed to elevated temperatures for prolonged periods of time without losing mechanical integrity. One of the first of such fibers to be developed came from DuPont. And not unsurprisingly it is a relative of nylon, a polyamide with a benzene ring in the backbone. Nomex, as it is called, can operate continuously at about 400°F. At this temperature, the common man-made fibers have lost most of their strength, have melted, or become badly degraded.

High-temperature materials are expensive, and so they must be worth the extra cost. The government, which sponsored most of the original research, makes parachute packs and aviator's uniforms out of woven Nomex. "Paper" made from the fibers is a high-temperature insulator for electric motors. And the "paper" made into honeycomb core is forming much of the interior of the new Boeing 747. Here the combination of high strength-to-weight ratio and flame resistance were the deciding factors. The weight reduction alone

WOVEN-FABRIC PROPERTIES

If You Increase Only[3]	Uniaxial Tensile Strength	Initial Extensibility	Tearing Strength	Stiffness	Air Permeability	Abrasion Resistance	Resistance to Shear	Flex Endurance	Bursting Strength	Energy to Break	Thickness	Thermal Conductivity	Moisture Transmission
Fiber Linear Density (cross-sectional area)				↑	↑	↑		↓			↑	↓	↓
Yarn Linear Density	↑	↓	↑	↑	↓	↑	↑	∩	↑	↑	↑	↓	↓
Yarn Twist	∩	↑		↑	↑	∩	↑	∩	↓	2	↑	↓	↓
Angle of Yarn Relative to Plane of Fabric	↓	↑	↓	↑	↓	4	↑	↑	↓	↑	↑	↓	↓
Yarns/in.	∩	↓	↓	↑	↓	↑	↑	↓	∩	∩	↑	↓	↓
Interlacings per Unit Area (weave pattern)	↓	↑	↓	↑	↓	↑ 1	↑	↓	↓	2	2	2	

Notes: 1. In certain applications where requirements are essentially unidirectional, the yarns running in that direction can be protected from abrasion by providing a cover of crosswise yarns. In these cases this trend does not apply. 2. Not predictable except in terms of specific fabric geometries. 3. The effect of varying each factor independently of all others is depicted. This is usually not possible, and in fact the changes in any properties will be the result of a complex set of interactions too complicated to illustrate in tabular form. 4. Dependent upon fiber properties and type of abrasion.

Prepared by Fabric Research Laboratories, Inc., Dedham, Mass.

comes to about one tenth of a pound per square foot of interior.

Another fiber in the same temperature range, but with unique characteristics of its own, is one made from a polymer containing only carbon and fluorine atoms, commercially called Teflon. This polymer is so inert that it must be made into a fiber by a rather devious process in which one product is destroyed in order to produce another. Certainly one might wonder why anyone would go through so much trouble to make a fiber when a very useful resin form of the material exists. It is because, after the fiber is drawn, it has 30 times the compressive strength and 25 times the tensile strength of the resin. In both forms it has the lowest coefficient of friction of any known material and is also highly resistant to corrosion as well as being able to operate in a temperature range from 400°F below zero to 550° above. By weaving the fiber with another less inert fiber like cotton or asbestos as backing, it can be bonded to metal surfaces. In this form it is ideally suited for self-lubricating bearings in high-load/low-speed applications where the resin alone doesn't work.

High-performance fibers, with respect to flame and temperature resistance, are becoming increasingly important particularly for aerospace. Two of the newest ones, developed jointly by the Air Force Materials Laboratory and the Celanese Corp., are called PBI and BBB. Both these materials show better tensile properties at higher temperatures than those currently commercially produced. But for the time being at least, they are only being made in relatively small runs for the government. However, organic fibers like these are rapidly creeping up on glass and metal.

The way-out ones

The next group of man-made fibers are not based on organic polymers. They operate over an extremely high temperature range and one of the newest, tantalum carbide fiber, goes to the highest temperature any material can tolerate—over 5000°F. Such exotic materials are developed initially for aerospace and hypersonic aircraft. But down-to-earth applications are also being actively pursued. Fiber manufacturers cannot afford to build a plant for too limited a market.

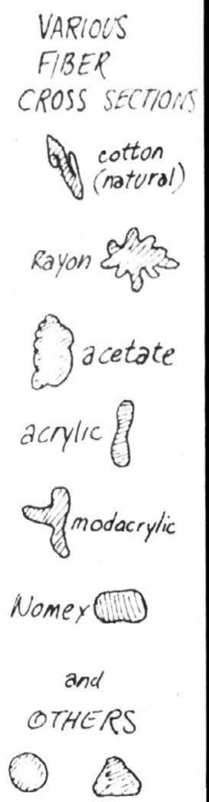
At the bottom of the list, so to speak, is glass fiber, which is manufactured by the conventional process of melt spinning. It is the only one, so far, of the so-called inorganic man-made fibers (to distinguish them from the typical organic long-chain polymeric fibers) which has found large-scale use in the textile industry. Most of the technology for the newest advancement in tire construction, belted bias-ply tires, is based on glass fiber belting. Two bands of glass-fiber cord are placed around two plys of another fiber like polyester woven into a crisscross or "bias" design. Up until this development, the relatively poor flex and abrasion resistance of glass fibers have been their chief handicaps in competing for a share of the lucrative tire-cord market. This has been somewhat offset by extruding finer-diameter fibers. In other respects, glass fibers are good insulators, strong though brittle, and highly resistant to chemical attack, heat, and microbial degradation. These properties make webs of glass fibers excellent for insulation and filtration.

In the early 1960's the Air Force saw a need for flexible fiber structures with high tensile strengths at high temperatures. They were thinking of decelerators—i.e., parachutes—for supersonic aircraft, reentering space capsules, and similar applications. The big question was whether the temperature characteristics needed for the advancing technology could be achieved. At that time a study indicated that metals were the only available materials that could potentially do the job. But there was no existing technology for making a flexible fiber structure from metal. What has to be done first is to go to extremely small-diameter wire, around one third of a mil. When a wire is that fine, you think of it in textile terms as a fiber.

The technology for processing steel fiber into a textile structure was worked out by a group of textile engineers at the Fabric Research Laboratories. They wove the first sample, the size of a postage stamp, on a toy loom. To convince skeptics that metal could actually be woven into a useful fabric, a necktie was made. It was worn at appropriate gatherings by an Air Force Colonel who would walk around and from time to time hold a blowtorch cigarette lighter under it. Today, multifilament yarns composed of metal fibers as fine as 0.0005 in. in diameter are woven into textile-like fabrics. And these flexible materials can even be joined with metal thread by conventional sewing.

A recent evaluation of a superalloy fabric showed that, on a strength-to-weight basis, metal fabrics at the present time are superior to other woven materials at temperatures in air of 1000°F and up. Stainless-steel fibers are currently commercially available both as yarn and as fabric. Besides high-temperature endurance, most metal fibers are good electrical conductors, and they are all good thermal conductors. These properties suggest a number of possibilities for commercial applications—for dispersing static electricity, for heating elements, and for dissipating heat, when woven in combination with other fibers. All these exotic fibers are a challenge to the imaginations of design engineers.

The best and lightest weight high-temperature material in commercial production today is quartz fiber which will go to 2700°F. However, glass fibers in general have a relatively low modulus—about 16 million psi and steel has about 30 million psi. So when



boron fiber came along a few years ago with 55 million psi, it was a real breakthrough, the first of the new high-performance fibers. However, boron fiber is made by vapor deposition on a tungsten wire. This produces a large, stiff filament, several mils in diameter and because of its brittleness virtually impossible to weave. Therefore boron fibers have found their main application as reinforcement in composite structures.

Beyond boron there is now graphite fiber. With a specific gravity under 2, graphite fiber has the highest modulus to weight ratio of any existing material. At Union Carbide, still in the laboratory stage, graphite fibers have been made with a tensile modulus of 100 million psi. However, commercially produced graphite fibers are closer to 50 million psi at present. Since the only way you can get materials with these properties is in fiber form, they are incorporated into a matrix. This is where the composites come in.

There is one more group of fibrous materials so new that they are still in the developmental stage. These are ceramic multiple filament yarns and flexible textiles. Besides the tantalum carbide fiber mentioned earlier, metallic tungsten and the oxides of zirconium, tantalum, aluminum, columbium, and titanium have all been made in fabric form. In the process developed by Union Carbide, the molecular holes which normally exist in an organic polymeric fiber are filled with molecules of the refractory material, then, after pyrolysis and sintering, the matrix material is burned away. The final fiber or fabric, now completely inorganic, is an exact duplicate of its precursor, the organic polymeric material. Nature does something similar in the formation of petrified wood. This procedure can be followed starting with an organic material in any form: yarn, cloth, or felt. And the fibers can be made as long as desired (see illustration).

These materials have relatively high densities but they have exceptional temperature and chemical resistance as well as excellent insulating properties. Zirconia felt is the only existing insulation for temperatures in the 4000°F range. These are the temperatures hypersonic aircraft will experience on reentry from high altitudes. Nuclear and other similar high-temperature furnaces will also be needing such insulation. At these temperatures the common metals have melted and in an oxygen atmosphere graphite is destroyed. So these very new flexible ceramics fill a special place on the total materials scene.

Until recently, the advances in fiber technology have not been matched by similar advances in textile technology. However, over the years there has been a small but active and growing group of textile technologists. They have developed the know-how to alter the mechanical properties of textiles at every stage of their processing. The fabric design can even affect such properties as tear strength, and crease and wrinkle resistance.

Two of the newer weaving developments are contour weaving, in which a seamless shape like a cone or radome can be formed, and 3-D weaving, in which a composite material with filament reinforcement woven in all three directions is the end product. The mechanical properties in the three orthogonal directions are altered by varying the combined fibers.

Neither warp nor woof

But the really exciting textile happening is the recent emphasis on nonwovens. These materials bypass the loom entirely in going from fiber to fabric. Bonded nonwovens are a combination of polymeric binding material with fiber. Together they make a strong structure. Spun-bondeds are made by taking the fiber as it emerges from the extruder and depositing the multifilaments on a moving sheet. These are patterned to produce a continuous uniform sheet of material. When coated, spun-bondeds form a thin, strong, durable fabric. Their properties are largely determined by what is done after formation. For industrial purposes their chief advantages are uniformity in thickness and weight plus electrical insulating properties.

The new synthetic leathers are another type of nonwovens along with felt. Felt is made by entangling fibers. Wool felts easily because of a peculiarity in its fiber structure, the one that also causes it to shrink when washed. Man-made fibers lacking this are converted to felt by heat shrinking or a process called needle-punching. Nonwovens have a number of industrial applications as battery separators, filters, electrical insulation, and packings. Disposable materials—misnomered paper fabrics—are also nonwovens. The rising cost of laundering and dry cleaning may soon find most of us sleeping on disposable sheets and wearing such disposable items of clothing as underwear and shirts.

Fibers are also the basis for high-strength composite structures, a whole new class of materials, made possible primarily by the evolution of the high-performance fibers discussed earlier. These are still expensive stuff for the everyday world, but they won't always be. Eventually we can anticipate automobile bodies, machinery and even buildings constructed with future variations of such materials. It will mean a whole new approach to design, something we have already begun to see with Fiberglass boats. But perhaps even more startling to contemplate is the possibility of replacing steel as a construction material with something stronger and lighter that can be preformed in any desired shape. And all based on that tiniest of beams, a fiber.

Should you wish to become further enmeshed in this subject, you'll find the references in To Dig Deeper.

TO DIG DEEPER

Where to find more information on our article subjects

THE TECHNOLOGY OF TEXTILES

Textile technologists make up for their relative sparsity by turning out a considerable body of literature. Here is a sampling of some of the best. Two books by Ernest R. Kaswel, president of the Fabric Research Laboratories, are highly recommended: The first, *Textile Fibers, Yarns, and Fabrics* (Reinhold, 1953; out of print but available from Ernest R. Kaswell, FRL, 1000 Providence Highway, Dedham, Mass. 02026; $12) is a survey of the comparative behavior and properties of these materials. The second, *The Wellington-Sears Handbook of Industrial Textiles* (write Industrial Advertising Dept., West Point-Pepperell, 11 W. 40 St., N.Y.C. 10018; 1963, $15) is a useful and comprehensive guide to the latest scientific and technical information on industrial textiles. Two reports, both highly readable and valuable to anyone interested in what textile technologists have said about the engineering properties of fibers are: "Textile Fibers—An Engineering Approach to Their Properties and Utilization" by Harold DeWitt Smith (Am. Soc. for Testing and Materials, 1944), and "A Technology for the Analysis, Design, and Use of Textile Structures as Engineering Materials" by Hamburger (ASTM, 1955). These were both given as Edgar Marburg Lectures before the ASTM. See also a report prepared by Arthur D. Little, Inc., entitled "The Mechanical Properties of Fibrous Materials (CFSTI, Springfield, Va. 22151; No. PB 170391, $3).

The following books and reports on various aspects of textile technology are also recommended: *High Temperature Resistant Fibers*, edited by Frazer (Wiley Interscience, Vol. 17 of the *Polymer Review Series*, to be publ. Dec. 1968, $17.50). "Investigation of 3-D Fabrication of Ablative Materials," (N67-14920, NAS-9-5207, NASA CR-65560, Nov. 1966; Avco Corp.). *Nonwoven Textiles* by R. Krcma (Textile Trade Press, Manchester, England, 1962; translated in 1967). *Nonwoven Fabrics* by Buresh (Reinhold, 1962, $8.50). *Ceramic and Graphite Fibers and Whiskers* by McCreight et al. (Academic, 1965, $12). *Composite Materials* by Holliday (Am. Elsevier, 1966, $24). *Modern Composite Materials* by Broutman and Krock (Addison-Wesley, 1967, $18.50).

There are excellent articles on every aspect of fiber science in *The Encyclopedia of Polymer Science and Technology* (Wiley Interscience). The journals (in English) which report most of the studies on the mechanics of textile materials are *The Textile Research Journal* (Textile Research Institute, Princeton, N.J.), and the *Journal of the Textile Institute* (The Textile Institute, Manchester, England).

THE COVER

ALFRED P. INGEGNO, Jr., received formal art training at Hamilton College, Pratt Institute, and the Brooklyn Museum Art School. He's had several one-man shows of paintings and drawings, mostly in the N.Y. area. He describes this month's cover as a representation of such concepts as mold, force, texture direction, and mass in terms of idealized structures and color forms.

PICTURE CREDITS

18—AVCO
19-20—Fabric Research Laboratories
21—Table prepared for *Science & Technology* by FRL
22—FRL; DuPont
23—DuPont
24—Union Carbide Corp.; DuPont
25—DuPont; Union Carbide
26-27—Union Carbide
28-29—FRL; table prepared for *S&T* by FRL

3M TECHNICAL REPORT SUMMARY

DATE:

TO:
Technical Communications Center, 201-2S

NEW BUSINESS VENTURES LABORATORY, DEPT. #

MICROFILM COPIES:

cc: B. E. Frank

Title
4th Quarterly Report, 1968

Project:	#
To: W. S. Friedlander	Leave Blank
By: A. W. Boese	Employee No.
Objective:	Notebook Ref.:
	No. of Sheets:

ABSTRACT and Conclusions

New 3M Chemicals reported? ☐ Yes ☐ No

No. of Data Sheets:

Security:

Open ☐ Closed ☐

KEYWORDS: (include general, specific, and 3M product terms)

SPECIFIC PROBLEMS remaining to reach stated objective.

October 1968

Several heavy webs (in the range of 120# ream weight) were made for Robert Barghini, with a blend of vinyon-polyester fibers, to be tested as a face-mask starting material.

Curt Larson of the Ribbon Laboratory, who is attempting to flameproof the current standard ribbon construction, requested that we duplicate ribbon backing material for him. We made a group of webs for him, and subsequently treated some of them with padding solutions (containing flameproofing materials) which he supplied.

Samples of high modulus rayon webs, bonded with Rhoplex HA-8, were submitted to the Tape Lab as a backing for packaging tape.

The International Division is considering the manufacture of scouring pads in several foreign countries. For equipment flexibility, and possibly a superior product, it might be advantageous if a garnett could be used to produce webs for this product. Such webs were readily made on the laboratory card, and submitted to Lloyd Legacy of the BS & CP laboratory for testing. In our presence, he coated the materials we supplied, plus some of their present standard web for a control. Following a cure, the materials were given the standard tests. The garnett material proved to be satisfactory for scouring pads.

Our work with John Ryan's group, to produce a superior dusting fabric, continued during October (and thru November and December). Several changes were made in our technique which enabled us to produce larger sample webs (now 7" x 18" instead of the former 6" x 8"). A series of webs were submitted to Dick Jackson for testing. They were made from a variety of fibers and fiber blends.

November 1968

Several individuals from the Decorative Products group came to us for specialized webs:

John Masters needed a material to provide a laminating bond between DiNoc and a polyester film. We supplied him with blended webs of cellulose acetate and polyester, bonded with both acrylates and vinyls.

Willard Kukonen wanted a web that could be laminated to a substate and then take an emboss. Trial webs were made for him.

Gary Hauschildt was searching for a material which could be printed with a wood-grain pattern and also laminated to a synthetic resin substrate for synthetic wood. A variety of webs were made up, the most promising of which turned out to be an all cellulose acetate web, bonded with an acrylate. (Calendaring was necessary before satisfactory printing was achieved.)

Dick Jackson picked an all polypropylene web, bonded with an acylate, as the outstanding web for his dusting purposes. More similar webs were made, in a range of weights, for him to test further.

December 1968

Additional all cellulose acetate webs, in various weights, were made up for Gary Hauschildt to try in his printing and laminating operations. His work is far enough along so that a factory experiment on the Fairmont garnett machine is being planned.

Additional dusting fabric webs were made for Dick Jackson utilizing various types and sizes of polypropylene fibers. He needs larger quantities of material to work with, so would like to schedule a trial production run at Fairmont.

AWB:dw