

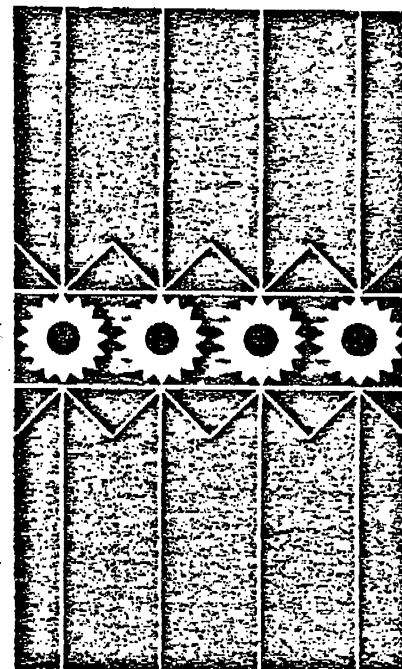
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1977 Edition

Custom Engineered
P/M PARTS
And Products
MANUFACTURERS
DIRECTORY
International



METAL POWDER INDUSTRIES FEDERATION
P.O. BOX 2054, PRINCETON, N.J. 08540
(609) 799-3300



Issued by the
Powder Metallurgy Parts Association
P/M Industries Association
Refractory Metals Association

METAL POWDER INDUSTRIES FEDERATION
P.O. BOX 2054, PRINCETON, N.J. 08540

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p/m parts

.... are products of powder metallurgy. They are made by compressing metal powders in a precision die at room temperature. Compaction pressures are in the order of 15 tons or more per square inch. The compact is ejected and then heated in a controlled atmosphere sintering furnace so that the powder particles unite metallurgically (sinter). No binder is needed. Sintering is a solid state phenomenon that results in atomic transfer (diffusion) below the melting point of the metal.

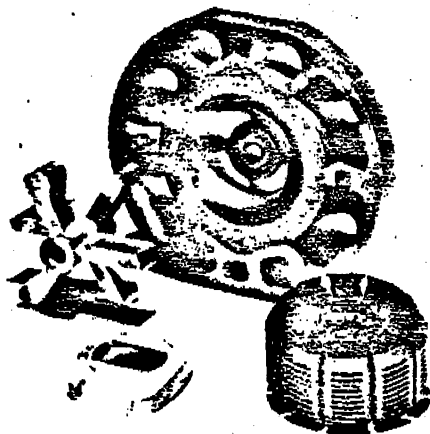
P/M parts can most often be pressed and sintered directly to their final shape, size and surface finish from practically any metal or alloy, thus eliminating many of the finishing operations usually required with other metal forming methods. They can also be sized, coined or repressed to close tolerance, impregnated with oil or plastic, infiltrated with a lower melting metal or alloy, heat treated, plated, machined, or otherwise processed.

P/M is a precision mass production process. Complex parts can be made rapidly, accurately and economically at rates of 200 to 800 parts/hour in conventional automatic presses. Some configurations can be made as fast as 3,000 parts/hour. P/M parts can be made smaller than the ball point on a pen or as large as a bearing weighing more than 100 pounds. Because forming is done under high pressure at room temperature in precision dies, the piece-to-piece reproducibility from first to last is a major asset. Economics are good because labor and energy in-put are low, little or no smoke is generated and there are no polluting effluents to clean up or dispose of.

SM-5/77-RP

1

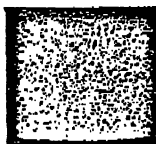
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Since the experienced powder metallurgist has a wide variety of raw materials and process techniques at his disposal, the properties of P/M parts can meet the demands of most applications. Physical properties of P/M parts can match those of machined, cast, or even forged parts. Parts can even be made hard and dense in one area and porous for self-lubrication in another. Properties range from low density, porous self-lubricating bearings, to high density structural parts with tensile strengths above 180,000 psi. The powder metallurgist can "tailor" the density and all of the properties of a given metal or alloy to suit the needs of the application - an advantage unique to P/M. For more detailed information about designing for P/M and properties available, write to the Association for a copy of the "Powder Metallurgy Design Guidebook".

Except where indicated otherwise, the companies whose products are described in this Directory are manufacturers of custom engineered P/M parts. In addition to making the parts indicated, most of them can also provide or arrange for such secondary operations as plating, machining, heat treating, steam treating, plastic impregnation, sizing or coining, grinding, or other finishing compatible with P/M. These companies often specialize in certain areas of P/M expertise including short production runs, high density parts, helical gearing, split-die forming, infiltrated parts, parts with special electrical or magnetic properties, etc. They should be contacted directly for more detail.

2



Other companies listed manufacture special products unique to powder metallurgy, employing techniques which differ from that described above and too complex to detail here. They have in common the use of metal in powder form as a starting material for the creation of products with special properties and characteristics.

All companies listed are members of the Powder Metallurgy Parts Association, the P/M Industries Association, the Refractory Metals Association, or are overseas members of MPIF. Their addresses and phone numbers are given.

Discover what P/M parts and products can do for you by reducing your costs through improved performance and properties and a more efficient use of materials.

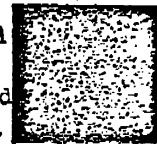
PRIMARY PRODUCTS KEY

1. Ferrous P/M Parts
2. Nonferrous P/M Parts*
3. Self-lubricating Bearings
4. P/M Preforms or Forgings
5. Stainless P/M Parts
6. P/M Filters
7. Electrical/Magnetic Parts
8. Titanium P/M Parts
9. Aluminum P/M Parts
10. Cemented Carbides
11. Electrical Contacts
12. Friction Materials
13. Iron Powder Electronic Cores
14. Roll Compacted Strip
15. Heavy Metals
16. Refractory Metal Products**

*Includes copper, brass, bronze and nickel silver.

**W, Mo, Ta, etc.

3



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M & R REFRACTORY METALS, INC.
Fleming Pike
Winslow, NJ 08095
(609) 561-7500
16

NRC INC.
45 Industrial Place
Newton, MA 02164
(617) 969-7690
16

SANDVIK INC.
1702 Nevins Road
Fair Lawn, NJ 07410
(201) 797-6200
10

SHIELDALLOY CORPORATION
25 East 39th Street
New York, NY 10016
(212) 686-4010
16

STELLITE DIVISION - CABOT CORP.
1020 West Park Avenue
Kokomo, IN 46901
(317) 457-8411
5-12

TELEDYNE
Wah Chang Huntsville
7300 Highway 20 West
Huntsville, AL 35806
(205) 837-1311
15-16

TELEDYNE/FIRTH STERLING
Four Parkway Center
Pittsburgh, PA 15220
(412) 922-9600
10-15-16

TELEDYNE POWDER ALLOYS
P.O. Box 825
Clifton, NJ 07013
(201) 773-4850
15

UNION CARBIDE CORPORATION
Metals Division
270 Park Avenue
New York, NY 10017
(212) 551-5873
16

WESTINGHOUSE ELECTRIC CORP.
Incandescent Lamp Div.
1 Westinghouse Plaza - P.O. Box 184
Bloomfield, NJ 07003
(201) 465-3324
16

OVERSEAS

ARGENTINA

INDUSTRIAS METALURGICAS LUJAN
S.A.C.I.y.F.
Piedras 383 - 3er Piso
Buenos Aires, Argentina
Tel. 33-1219-3458-8988
1-2-3

AUSTRALIA

THE ANI CORPORATION LTD.
14 Parramatta Road
P.O. Box 20 Lidcombe, N.S.W. 2141
Sydney, Australia
Tel. 648-2951
1-2-4-5

NILSEN SINTERED PRODUCTS (AUSTRALIA)
PTY. LTD.
239 Separation Street (P.O. Box 85)
Northcote, Victoria, Australia 3070
Tel. 489-1277
1-2-3-6

REPCO BEARING CO. PTY. LTD.
P.O. Box 1088
Launceston 7250, Tasmania, Australia
Tel. 002-261222
1-2-3-6-11

14

15

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W. H. WYLIE & CO. PTY. LTD.
1326-1378 South Road
Clovelly Park, Adelaide
South Australia
Tel. 76.8177
1-2-3-5

AUSTRIA

METALLWERK PLANSEE AG & CO. KG
Postfach 74, A-6600 Reutte
Austria
Tel. (05672)-2241
1-2-3-4-5-10-11-15-16

BRAZIL

BRASSINTER S.A. INDUSTRIA E COMERCIO
Caixa Postal 1234
01000- Sao Paulo - Sao Paulo - Brazil
Tel. 269-4611
1-2-3-6-10-11-12-16

**COFAP - COMPANHIA FABRICADORA
DE PECAS**

Ave. Alexandre Gusmao, 1395
Caixa Postal 366
09000 - Santo Andre' - Sao Paulo - Brazil
Tel. (011) 449-2011
1-2-3

METALPO INDUSTRIA E COMERCIO LTDA.

Estrada do Jaragua 453-A
Caixa Postal 11.966 - CEP 01.000
Sao Paulo - Sao Paulo - Brazil
Tel. (11) 260.0652
1-2-3-12-13

**PETRAC- ENGENHARIA COMERCIO
INDUSTRIA S.A.**

Rua Wandenolk 459
03040 - Sao Paulo - Sao Paulo - Brazil
Tel. (011) 279-1028
1-2-3-12

ENGLAND

M.B. SINTERINGS LTD.
Elton Park Works, P.O. Box 19
Hadleigh Road, Ipswich
Suffolk, England
Tel. (0473) 215151
1,2,3

SINTERED PRODUCTS LTD.

Hamilton Road
Sutton-In-Ashfield
Notts, England NG 17 5LL
Tel. Sutton-In-Ashfield 590.
1-2-3-5-6-7

FRANCE

LA METALLURGIE FRANCAISE DES POUDRES

56 Rue de Londres
75008 Paris, France
Tel. (16-1) 387-2600
1-2-3-4-5-6-7-8-9-10-12-15

**PECHINEY - UGINE KUHLMAN
(UGINE CARBONE)**

23 Rue Balzac
BP 787-08
75360 Paris, France
Tel. 563-1112
1-2-3-4-5-6-10-11

INDIA

FLEXICONS LTD.

Mani Mahal - 3rd Floor
11/21 Matthew Road
Bombay-4, India
Tel. 329026
1-2-3

MAHINDRA SINTERED PRODUCTS LTD.

146 Bombay-Poona Road
Pimpri Poona - 18, India
Tel. 88278
1-2-3-6-7

ITALY

F.I.P.S. S.p.A.
Via De Sanctis 27
10141 Torino, Italy
Tel. 728181
1-2-3-4-5-6-7-11

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MERISINTER S.p.A.
Casella Postale
80022 Arzano
Naples, Italy
Tel. (081) 7312866
1-2-3-5-6

ING. C. OLIVETTI & CO. S.p.A.
Via G Jervis, 77
Ivrea,
Torino, Italy
Tel. (0125) 525-2533
1-3-7-9

S.A.I.N.I. S.p.A.
Via Verdi, 82/84
Cernusco Sul Naviglio
Milano, Italy
Tel. 9041505
1-2-3-4-5-6-7-11-12

JAPAN

HITACHI POWDERED METALS CO., LTD.
13-7, 1-chome
Uchikanda, Chiyoda-ku
Tokyo, Japan
Tel. 03-295-8666
1-2-3-4-5-7-8

MITSUI MINING & SMELTING CO., LTD.
2-Chome, Nihonbashi- Muromachi
Chuo-ward,
Tokyo, Japan
Tel. 241-4101
1-2-3-5-9

RIKEN PISTON RING IND. CO., LTD.
7-13, Nishi-Shinbashi 1-chome
Minato-ku,
Tokyo, Japan
Tel. Tokyo 501-5201
1

SUMITOMO ELECTRIC INDUSTRIES LTD.
1, Miyahigashi, Koya
Itami, 664 Japan
Tel. Itami 72-5151
1-2-3-4-5-6-7-8-9-10-11-15

TOYO KOGYO CO., LTD.
3-1, Shinci Fuchu-cho
Aki-gun, Hiroshima, Japan
Tel. Hiroshima 62-1111
1-2-3-6-10

TOYOTA MOTOR COMPANY, LTD.
1, Toyota-cho, Toyota-shi
Aichi, Japan
Tel. (Toyota) 2-2121
1-3

KOREA

KOREA POWDER METALLURGIES, LTD.
97-3, Hasu-Dong, Mapo-ku
Seoul, Korea
Tel. 32-2054
1-2-3

MEXICO

SINTERMETAL, S.A.
Mateo Aleman 46, Colonia Anahuac
Mexico 17, D.F. Mexico
Tel. 531-7221
1-2-3-6-7

SINTERMEX, S.A.
Naranjos 12
Naucalpan, EDO. MEX.
Mexico
Tel. 576.84.77
1-2-3-6-7

SOUTH AFRICA

SINTERED METAL COMPONENTS (PTY) LTD.
P.O. Box 156
Bellville 7530
Cape Province, South Africa
Tel. 97-1751 Cape Town
1-2-3-5-6-7

SPAIN

AMES, S.A.
Tort 18
Barcelona, 14 Spain
Tel. 325.37.00
1-2-3-5-6-7-12

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POLVOS METALICOS, S.A. POLMETASA
Barrio San Andres
Mondragon - Guipuzcoa
Spain
Tel. 79 14 48
1-2-3-5-9-11-12-13

SINTERMETAL, S.A.
Covadonga, S/N.
Ripollet (Barcelona)
Spain
Tel. 292.16 00
1-2-3-5-6

SWEDEN

ESSEM SINTERMETALL
S-721 88 Vasteras
Sweden
Tel. 021-137120
1-2-3-5-6-7-9-12

KOHLSPA JERNVERKS AKTIEBORG
Kolsva, Sweden S-730 30
Tel. 0221-510 00
1-2-5-6-7-15

SANDVIK AB, COROMANT FACTORY
Lerkrogsvagen 15-23, Box 42 056
S-126 12 Stockholm, Sweden
Tel. 46 8 45 2620
10

WEST GERMANY

ROBERT BOSCH GmbH
Postfach 50
7000 Stuttgart 1
West Germany
Tel. 81-6592
1-2-3-7-9

RINGSDORFF-WERKE GmbH
Konigswinterer Strasse 1
Bonn - Bad Godesberg
West Germany 5300
Tel. (0711) 811-6592
1-2-3-7-9

SINTERMETALLWERK KREBSOEGE GmbH
5608 Radevormwald
West Germany
Tel. (2191) 60281
1-2-3-4-5-6-7-8-9-13-15

All listings based on membership as of April 1977.
Contact MPIF for latest listing.

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INDUSTRIES DRESSER

DRESSER INDUSTRIES, INC., EXECUTIVE OFFICES: DRESSER BUILDING " ELM AT AKARD " DALLAS, TEXAS 75221

2

LAW DEPARTMENT

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February 6, 1978

FEB 15 78

Rauer Meyer, Director
Office of Export Administration
Department of Commerce
Washington, D.C. 20230

Re: Technical Data License for Complete Oilfield Rock Bit
Manufacturing Facility for Kuibyshev, U.S.S.R.

A 297071

Dear Mr. Meyer:

Under the provisions of Section 379.5(d) of the Export Administration Act, the following information is provided:

1. The identities of all parties to the transaction:
Dresser Industries, Inc., Dallas, Texas, is the seller of the technical data and equipment to establish a rock bit manufacturing plant in Kuibyshev, U.S.S.R. The existing rock bit manufacturing facility will be the operator and end user. The buyer is Vsesojuznoe Exportno-Importno Objedinenie "Stankoimport", Moscow, U.S.S.R. Subcontract supplies of technical data are listed in Paragraph 3 below.
2. The exact project location where the technical data will be used:
The technical data will be used adjacent to the existing rock bit manufacturing facilities at Kuibyshev, U.S.S.R.
3. The type of technical data to be exported:
 - (a) Dresser will deliver to buyer the technical documentation, know-how and information, and the training of specialists in the U.S.S.R. necessary for the production of oilfield rock bits at the current level of technology, including milled tooth bits, tungsten carbide insert bits and journal bearing insert bits. Dresser will provide the technology included in certain U.S. patents and patent applications per contract, all relating to rotary rock bits, and will provide bills of material, project engineering drawings, material and heat treat specifications, and rock bit design technology. Also included will be standard time data, tool lists, tool drawings, special equipment drawings, numerical controlled programs with two axis plotters, a quality control manual, a list of standard purchased fixtures.

TELEPHONE 214/745-8000 • TELEX 73-2499 • TWX 910-861-4136 • CABLE: DRESSERIND

Page Two

- (b) Dresser, in participation with Soviet specialists and through its subcontract with Pullman-Kellogg, will develop a plant project for the additional manufacture of 100,000 drilling rock bits per year at the Kuibyshev facilities. The project will include two stages, a technical and an executive. On the technical side it will include a general plan, including engineering and building with specifications and designs for sanitary systems, electrical, thermal, layouts of production, auxillary and transportation equipment, material flow, pipeline networks, and the like, drawings of building arrangements, loads, layouts of utility service lines, construction assignments, static and dynamic loads, recommendations on internal decoration, data on noise level volumes from installed equipment and recommendations for protection against noise. Also to be included are specifications for electrical equipment, information for thermal power layout requirements and layouts for outside heat and for a compressor station. Also to be included will be technical data on each machine tool, equipment or stand, including assembly, setting up and starting instructions, assembly drawings of lining for heat treating, furnaces and other heating equipment, required layout assignment, foundation column displacement networks, arrangements for working drawings of piping and recommended equipment arrangements.

(c) Rubber Plant:

Dresser will supply the technology to operate that portion of the plant devoted to manufacturing the rubber components for rock bit production, consisting of diaphragms, seals and "O" rings. No formulations will be provided. Only specifications calling for nitrile rubber citing ASTM standards will be included.

- (d) Dresser will supply technology through the Stood Company of 16425 Gale Avenue, Industry, California 91749, with respect to the application of hard facing required in the production of rock bits.

(e) Tungsten Carbide Inserts:

Dresser, through its supplier, General Electric Company, will provide the technology for the manufacture of tungsten carbide inserts to be pressed into the working surfaces of drilling bits.

The technology for which the license is requested embodies the conversion of tungsten powder to tungsten carbide, combining the tungsten carbide with cobalt and paraffin, and then pressing, presintering, forming, sintering, grinding, and tumbling to achieve a cylindrical shape with various end configurations.

These configurations are approximately 0.5" diameter and 0.75" long and weigh about 40 grams each. They are pressed into drilled holes in the working surfaces of a tri-cone drilling bit.

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Page Three

The use of tungsten carbide inserts in tri-cone rock bits was first introduced on a commercial scale in the middle 1950's. Since that time the percentage of rock bits using tungsten carbide inserts has steadily increased to over 30%.

Different combinations of tungsten carbide and cobalt are formulated with the requirements of the application. For increased toughness, higher percentages of cobalt are used; for increased wear resistance, lower percentages of cobalt are used. The particle size of the tungsten carbide is also varied to achieve various levels of fracture toughness.

Carburization of tungsten to form the WC structure occurs by diffusion of carbon at high temperatures (1700-1800°C) and is both time and temperature dependent. The reaction is well known and phase diagrams are available in general publications.

Pressing the formulated powders is accomplished with a Dorst press which is a standard in the industry. The technology at this point of the process is oriented toward design of tooling that shapes the part being pressed and allows it to be ejected without flaws (i.e., chips, scratches, pull-out, etc.).

The parts are then presintered at approximately 500-600°C to drive off the paraffin in the powder and to impart a slight consolidation to the part to allow the part to be machine formed.

The forming operation is done by a General Electric designed machine which diamond grinds a small (usually 15°) angle on the base of the presintered part.

Sintering of the part is done in General Electric designed furnaces of the stoking type with a 10" muffle. The part is heated to temperature (1400-1500°C) in a hydrogen atmosphere for several hours and then cooled in the hydrogen atmosphere. This completely consolidates the parts and achieves 100% density. Full metallurgical properties are developed at this point of the process. Vacuum furnaces may also be used for this operation.

The final operations of grinding and tumbling use common equipment in the industry. The grinding operation is for achieving an O.D. of the finished part to $\pm .0002$ ". Cincinnati centerless grinders are used exclusively. The tumbling operation consists of barrel tumbling the carbide parts either by themselves or with a rock addition to achieve the desired surface finish.

The request for license is for the transfer of process instructions, equipment operating instructions, drawings, and training of personnel both in the United States and the U.S.S.R. to accomplish the above process.

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Page Four

Carbide compositions and formulations used in the oil and gas drilling and mining industries are different from those carbides used in metalworking and thus different technology is used — particularly where alloying additions such as TiC and TaC are included for metalworking applications. Additional description is provided in Exhibit 1.

- (f) Dresser, through a supplier, Ceromet, Inc., of 17059 East Green Drive, Industry, California, will provide the technology for the manufacture of powdered metal bushings for use in rock bits.
- (g) Two types of equipment to be sold by Dresser will be manufactured in Europe from U.S. technology. These are Items Nos. 8 and 54 in Appendix VII of the Kuibyshev rock bit plant contract, which will now be sourced from a West German subsidiary of Ingersoll Milling Machine Co. The machine will have two axis contouring, three positioning, N/C hard wired. Item 47, Appendix VII, indicated machines to be sources from Motch & Merriwether, will now be sourced from a licensee of Motch, Minganti of Bologna, Italy. This is for a twin spindle N/C vertical chuck lathe, two axis contouring hard wired control. Detailed descriptions are provided for the Ingersoll type and Motch, Minganti machines in Exhibits 2 and 3, respectively, attached. The Kuibyshev rock bit plant contract is attached as Exhibit 4.

4. The form in which the export will be made:

The technical data described in Paragraphs 3.(a) - 3.(f) will be supplied in the form of drawings, manuals, directives and training for specialists in the Soviet Union. The technology incorporated in Paragraph 3.(g) consists of the machines themselves.

5. The uses for which the data will be employed:

The data is intended to provide an additional capacity at Kuibyshev in the Soviet Union for the manufacture of 100,000 rock bits per year on a two-shift basis.

6. An explanation of the process, product size and output capacity of the plant or equipment:

The rated capacity of the Kuibyshev addition is expected to be 100,000 oilfield rock bits per year on a two-shift basis.

7. The availability abroad of comparable foreign technical data:

- (a) With respect to the technical data for the manufacture and production of oilfield rock bits referred to in Paragraph 3.(a) above, the principal sources outside Eastern European countries are Hughes Tool Company, Smith, Reed and Dresser in the United States, and Creusot-Loire in France.

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Rauer Meyer, Director
February 6, 1978

DRESSER INDUSTRIES, INC.

Page Five

- hanna* (b) With respect to the industrial design involved in the plant layout described in Paragraph 3.(b) above, the concepts, technology and principles are widely available in industrialized countries.
- hanna* (c) With respect to the technology for manufacture of rubber components referred to in Paragraph 3.(c) above, the technology is widely available in industrialized countries.
- γ* (d) With respect to the technology for the application of hard facing consumables required in the production of rock bits referred to in Paragraph 3.(d) above, the technology is available in Western Europe, Japan and South America, including Sandvik and ESAB in Sweden and British Oxygen in the United Kingdom.
- x* (e) With respect to the technical data for the production of tungsten carbide inserts referred to in Paragraph 3.(e) above, to the best of our knowledge, the U.S.S.R. is now producing tungsten carbide inserts for the metalworking industry in a town near Moscow. This plant was constructed during the past year in cooperation with the Sandvik Company of Sandvik, Sweden.

At the present time the major carbide part producers using basically the above process are:

United States:

General Electric
Kennametal
Atrax
Firth-Sterling
Valenite
Wendt-Sonis
Other small companies

Foreign:

Sandvik - Sweden
Fagersta - Sweden
Widia - Germany
Small specialized producers in Japan,
England and France

- hanna* *γ* (f) With respect to the technology for the production of powder metal bushings referred to in Paragraph 3.(f), this is conventional level powder metal technology widely available in industrialized countries.
- hanna* (g) With respect to the technical data incorporated in the machine tools referred to in Paragraph 3.(g) above, it is our understanding that machine tools of comparable levels of sophistication are available in Eastern European countries, including East Germany and the U.S.S.R.

We request this validated license to export technical data be issued to expire April 1, 1982, the anticipated start-up date for the contracted rock bit plant addition.

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Respectfully submitted,

V. Rock Grundman Jr.
V. ROCK GRUNDMAN, JR.
Government/Business Affairs Counsel

FEB 15 78

A 297071