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Investment Castings (Lost Wax) From Canada

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[Canada. Dept. of Industry, Trade and Commerce. Non-ferrous Metals Division.]

Directory of the Investment Casting (Lost Wax) Industry In Canada

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INTRODUCTION

PURPOSE OF THE BOOKLET

This booklet was designed, in co-operation with the Government of Canada and the Investment Casting Association of Canada, to make the expertise, products and services of the Association's members more widely known to current and potential users of investment castings.

WHAT IS THE INVESTMENT CASTING PROCESS?

Investment casting is defined as casting metal into a ceramic mold formed around a heat expendable pattern. The most common pattern material is wax. The patterns are made in metal dies. Single or multiple patterns are assembled by their gates onto runners. The wax assembly is surrounded by a refractory material to form a ceramic mold. When the refractory material is hardened the wax is melted out to leave a clean mold cavity to receive the molten metal. After solidification the ceramic mold is destroyed and the casting is ready for further processing.

WHY BUY INVESTMENT CASTINGS?

1. **Design Flexibility:** Because of the few process limitations, designers are free to consider the functional aspect of the components rather than the manufacturing method.

2. **Close Tolerances:** The general tolerance level is ±0.005 inch per inch (approximately ±0.13 mm per 25 mm) although closer limits are obtainable depending on material and configuration. These close dimensional tolerances, in many instances, provide the user with castings which do not require further machining.

3. **Metallurgical Integrity:** Present-day technology in the industry meets the unusual demands of casting quality through the use of equipment providing measures of X-ray soundness, penetrant inspection, magnetic particle and ultrasonic testing.

4. **Mechanical Properties:** The high degree of metallurgy integrity and the use of heat treatable alloys, result in high mechanical properties.

5. **Surface Finish:** 65–125 RMS are usual "as cast" surfaces.

Additional Advantages

1. Machining may be eliminated by careful design of tolerances resulting in a more economical component.

2. Investment castings are economical from prototype quantities to large production runs.

3. In many instances one-piece investment castings have replaced multi-pieced costly fabricated components whether they are soldered, brazed, welded or mechanically joined, etc.

MARKETS

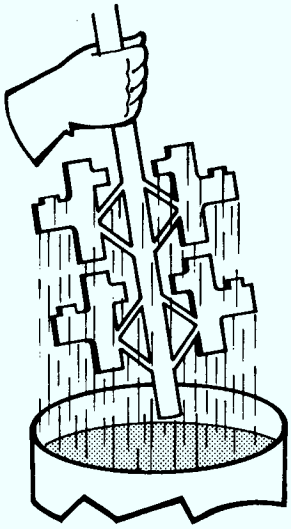
Members of the Investment Casting Association of Canada are suppliers of castings for the following industrial applications:

aircraft jet engines
frames
turbines
aerospace
satellite
navigational
naval ordnance
missile
military hardware
nuclear
electronic/computer hardware and packaging
optical
instrumentation
fuel control
valves
business machines
medical
food and drug processing
chemical
pulp and paper
agriculture
textile
printing
glass and packaging
mining
steel mills
oil processing
transportation
machine tools
power

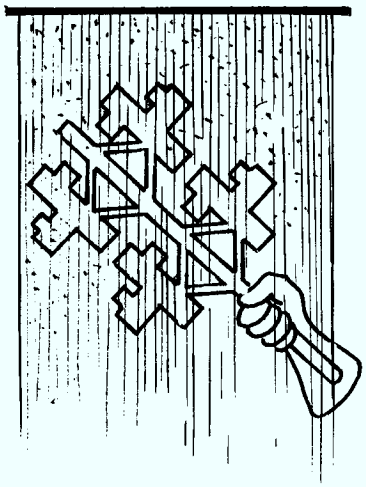
Specialty equipment where such considerations as close tolerances, metal alloys and precision are prerequisites.

These are representative industrial applications only. Uses for investment castings may be found in most, if not all industries.

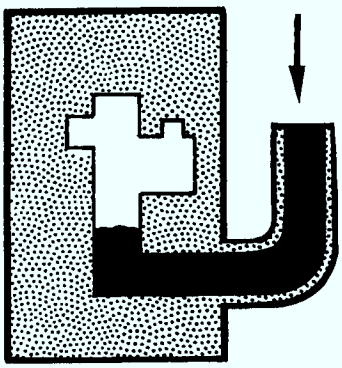
INVESTMENT SHELL CASTING



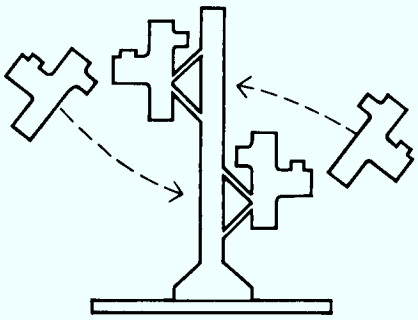
③ PATTERN CLUSTERS ARE DIPPED IN CERAMIC SLURRY



④ REFRACTORY GRAIN IS SIFTED ONTO COATED PATTERNS. STEPS 3 AND 4 ARE REPEATED SEVERAL TIMES TO OBTAIN DESIRED SHELL THICKNESS



① WAX OR PLASTIC IS INJECTED INTO DIE TO MAKE A PATTERN



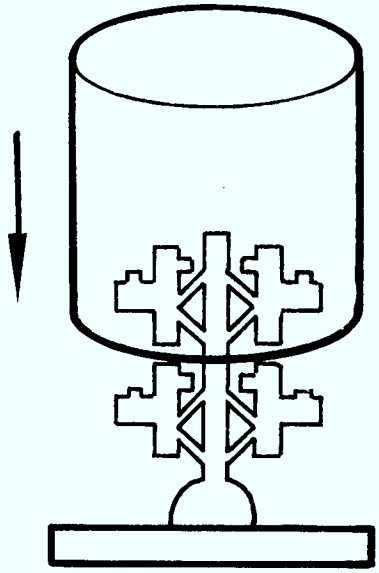
② PATTERNS ARE GATED TO A CENTRAL SPRUE

A BRIEF HISTORY

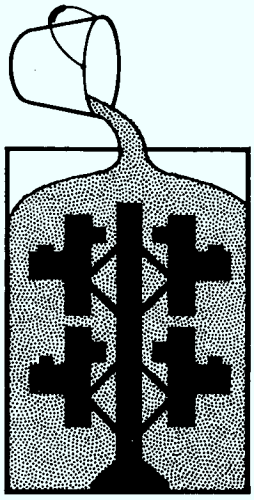
The "Lost Wax Process" is an ancient art.

Its history reaches back beyond Egypt's pyramids and in the museums of today there are to be found exquisite castings created in bronze by the artisans of the Shang Dynasty in China (1766 to 1122 B.C.). Long before Christopher Columbus arrived on the scene the aboriginal goldsmiths of Colombia and the gold-workers of Aztec Mexico were turning out works of art which showed complete mastery of a difficult and involved technique. In later years the Italian Renaissance was instrumental in producing magnificent statues created through the use of the lost wax process.

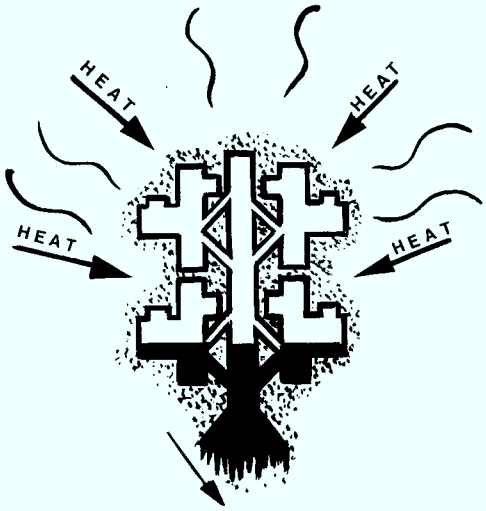
INVESTMENT FLASK CASTING



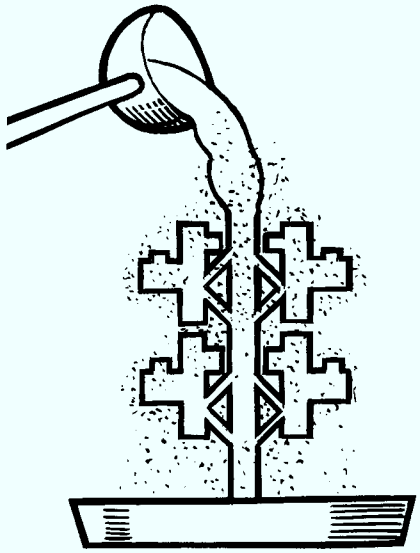
③ A METAL FLASK IS PLACED AROUND THE PATTERN CLUSTER



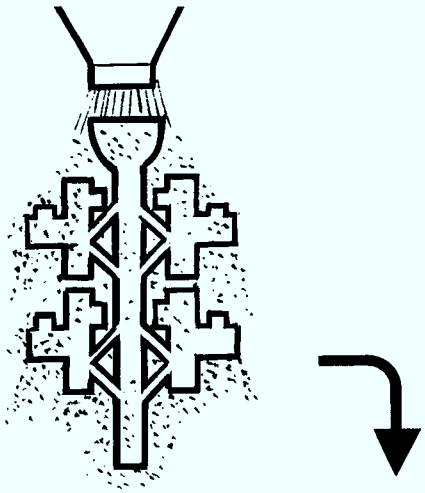
④ FLASK IS FILLED WITH INVESTMENT MOLD SLURRY



⑤ AFTER MOLD MATERIAL HAS SET AND DRIED, PATTERNS ARE MELTED OUT OF MOLD



⑥ HOT MOLDS ARE FILLED WITH METAL BY GRAVITY, PRESSURE, VACUUM, OR CENTRIFUGAL FORCE

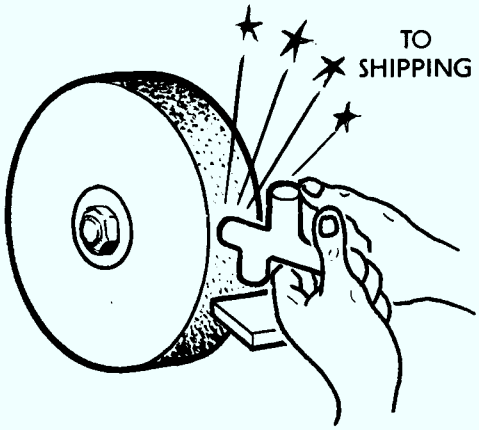


⑦ MOLD MATERIAL IS BROKEN AWAY FROM CASTINGS

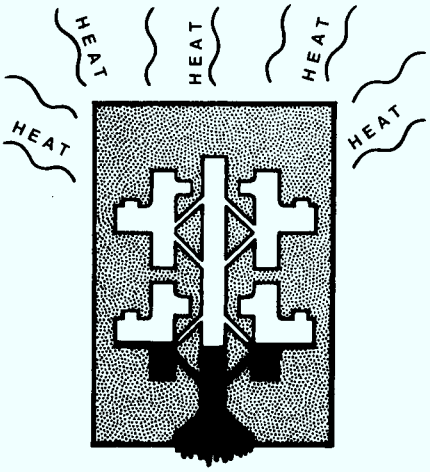
It is a tried and true method of casting.

The "Lost Wax Process" is a modern technology.

Today's modern investment (lost wax) casting industry had its beginning in the dental and jewellery industries. The urgent military demands of World War II overtaxed the capabilities of the machine tool industry. A shortcut was needed to provide finished precision parts for arms and aircraft quickly and in large volume. Knowhow from the dental industry was combined with the permanent die techniques used by jewellers to produce investment castings in prodigious amounts. During the post-war years this "new" method of casting spread rapidly in the United States and the growth was paralleled in Canada. Starting with one company in the 1940s the industry expanded to two well before 1950. The following decade saw the establishment of three enterprises followed by four more in the 1960s. Since 1970 two more companies have been established. Continued steady growth is not only evidenced by the increasing number of entries into the field but also by the expanded services provided to more and more industries within and outside of Canada.



⑧ CASTINGS ARE REMOVED FROM SPRUE, AND GATE STUBS GROUND OFF



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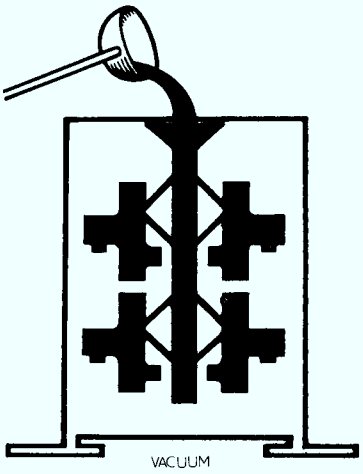

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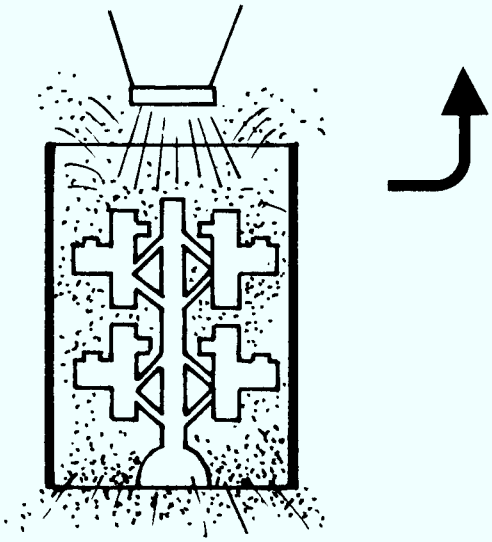

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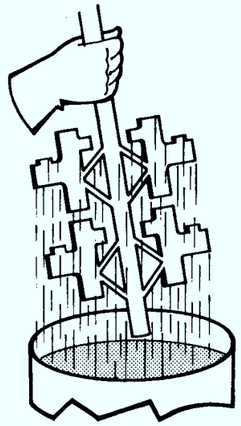
INVESTMENT SHELL CASTING



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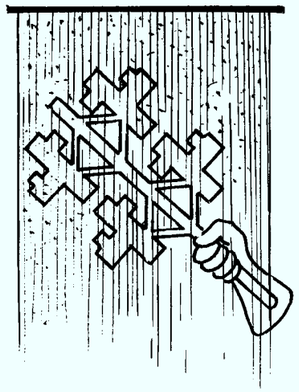

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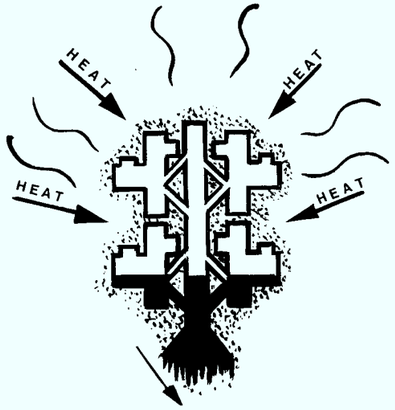

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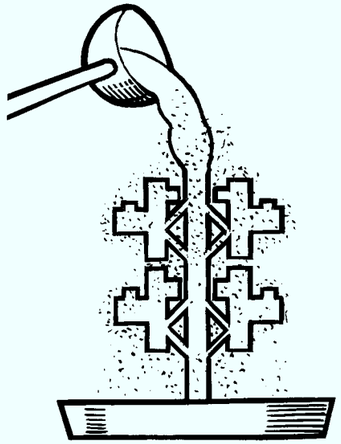

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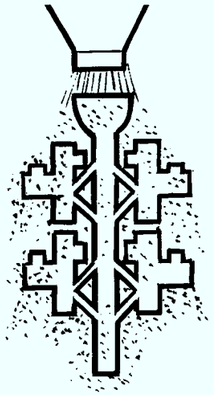

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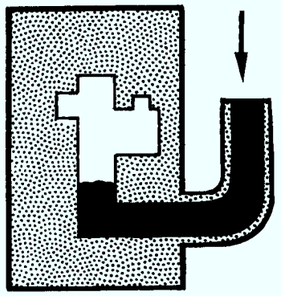

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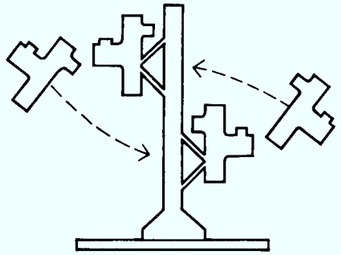

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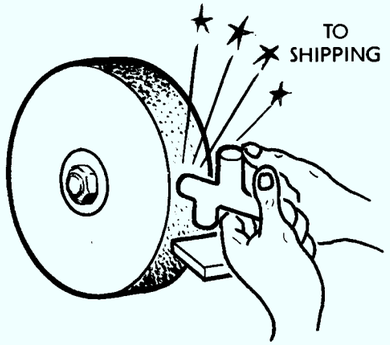

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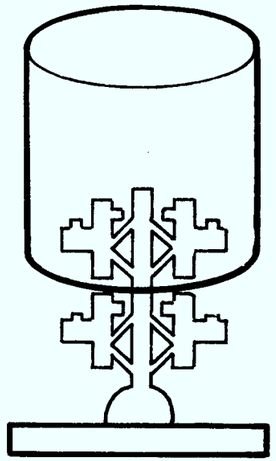
INVESTMENT FLASK CASTING



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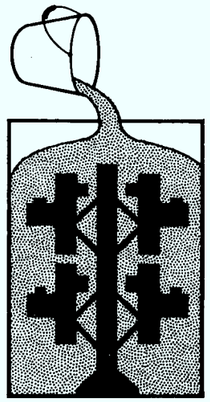
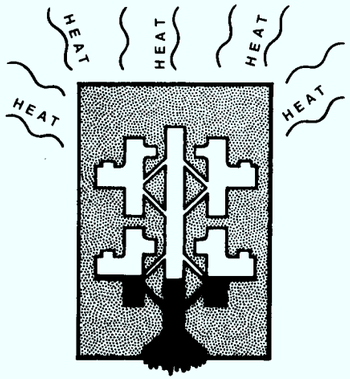


④ FLASK IS FILLED WITH INVESTMENT MOLD SLURRY



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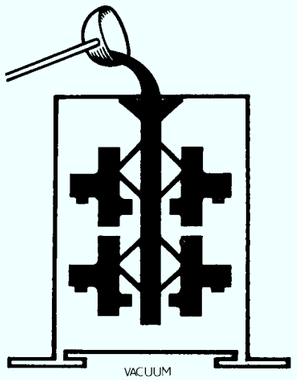

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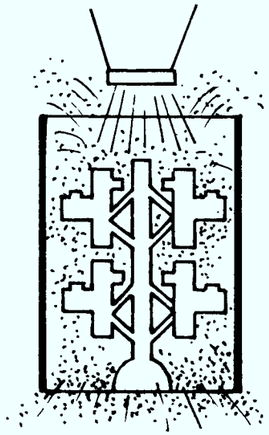


⑦ MOLD MATERIAL IS BROKEN AWAY FROM CASTINGS

METALS CAST

	Ferrous Alloys							Non-Ferrous Alloys	
	Stainless Steels	Low Alloy Steels	Carbon Steels	High Alloy Steels	Tool Steels	Cobalt Based Alloys	Nickel Based Alloys	Aluminum Based Alloys	Copper Based Alloys
Cer-A-Met Manufacturing Limited	●	●	●	●	●	●	●		
Cercast Industries								●	●
Cercor Inc								●	●
Deloro Stellite	●	●	●	●	●	●	●		
Designed Precision Castings	●	●	●	●	●	●	●	●	●
Industrial Fine Castings	●	●	●	●	●	●	●	●	●
Shellcast Foundries Inc.								●	●
Supreme Precision Castings (1963) Ltd.	●	●	●	●	●	●	●	●	●
Vestshell Inc. ①	●	●	●	●	●	●	●		
Welkin Manufacturing Co. Ltd.	●	●	●		●	●	●	●	●

① Also casts soft magnets.

FACILITIES

	Testing					Heat Treating		Other Facilities	
	Non Destructive			Other					
	Radiographic Inspection	Penetrant Inspection	Magnetic Particle Inspection	Mechanical	Chemical	Ferrous	Non-Ferrous	Tooling	Machining
Cer-A-Met Manufacturing Limited	○	●	○	○	○	●		●	●
Cercast Industries	●	●		●	●		●	●	○
Cercor Inc.	●	●		●	●		●	○	○
Deloro Stellite	●	●	●	●	●	●	●	○	●
Designed Precision Castings	●	●	●	●	●	○	●	●	○
Industrial Fine Castings	○	○	○	○	○	○	○	○	○
Shellcast Foundries Inc.	●	●		●	●		●	●	●
Supreme Precision Castings (1963) Ltd.	●	○	○	○	○	○	●	○	○
Vestshell Inc.	●	●	●	●	●	●		●	●
Welkin Manufacturing Co. Ltd.	●	●	○	●	○	○	●	●	●

● In-house ○ Outside government approved sources

DIMENSIONS

	Weight of Castings								Size of Castings		
	Ferrous				Non-Ferrous						
	Up to 25 lbs.	25-50 lbs.	51-100 lbs.	Over 100 lbs.	Up to 25 lbs.	25-50 lbs.	51-100 lbs.	Over 100 lbs.	12 x 8 x 6	20 x 12 x 10	Larger
Cer-A-Met Manufacturing Limited ①	●	●	●		●	●	●	●	●	●	●
Cercast Industries					●	●			●	●	●
Cercor Inc.					●				●		
Deloro Stellite ①	●	●	●		●	●	●		●	●	
Designed Precision Castings	●	●	●		●	●			●	●	●
Industrial Fine Castings	●	●			●	●			●	●	
Shellcast Foundries Inc. ②									●	●	●
Supreme Precision Castings (1963) Ltd.	●				●				●		
Vestshell Inc.	●	●	●	●							
Welkin Manufacturing Co. Ltd.	●	●			●	●			●	●	

① Non-ferrous in cobalt and nickel based alloys. ② Aluminum only.

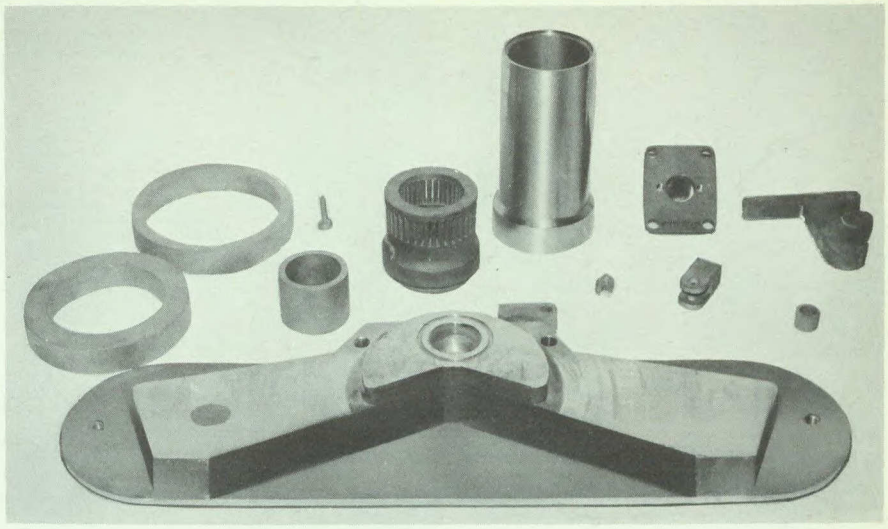
CER-A-MET MANUFACTURING LIMITED (D)

P.O. Box 1365
Picton, Ontario, Canada
K0K 2T0

Tel: (614) 476-3269

Cer-A-Met Manufacturing Limited provides a design service, production of tooling, machining where required and a special prototype service. Also available is an export service including documentation.

Cer-A-Met's production capacity is constantly expanding ahead of sales growth to ensure earliest deliveries and allow rush orders.



CERCAST INDUSTRIES (D)

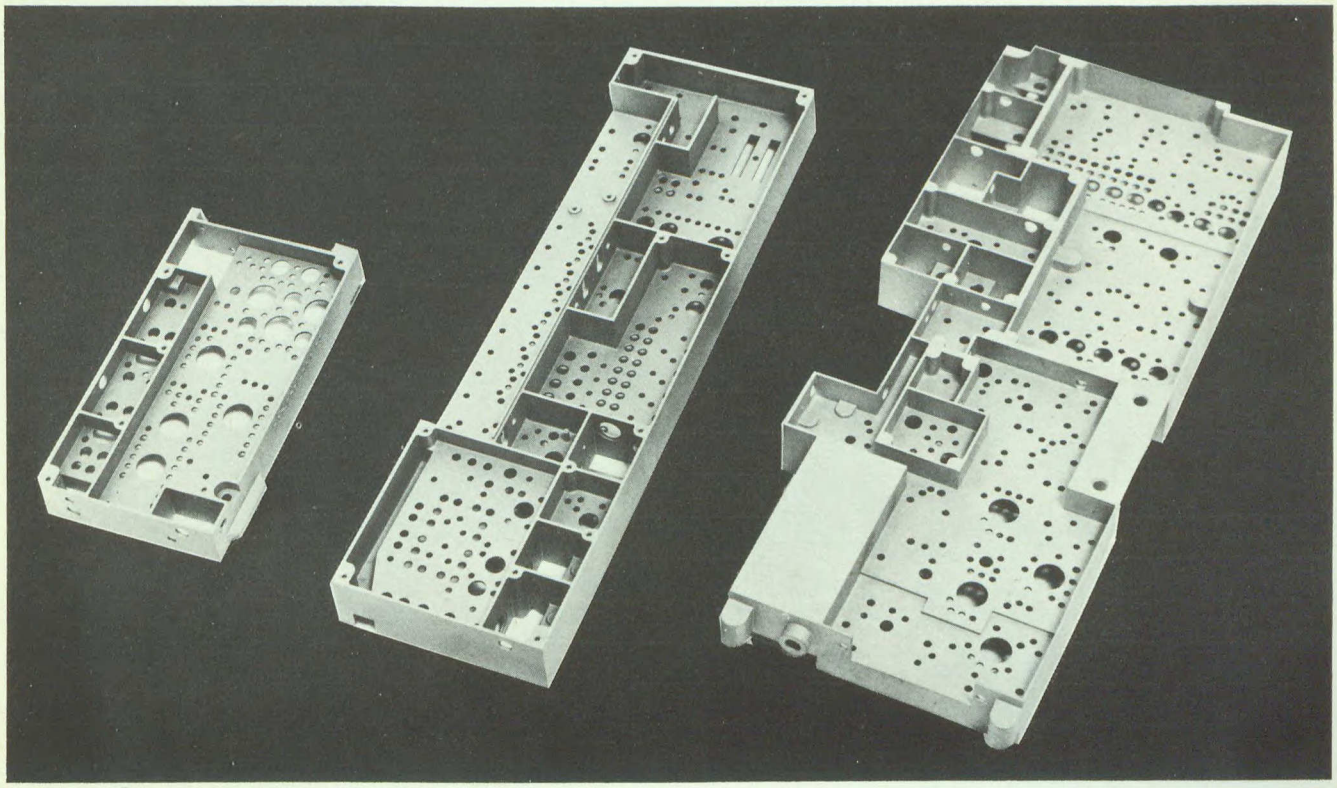
3905, boulevard Industrial
Montréal (Québec) Canada
H1H 2Z2

Tel: (514) 322-2371

Cercast is one of today's leading manufacturers of high quality non-ferrous investment castings. Founded in 1959, it has since developed into a group of four manufacturing plants. Along with the plant located in Montreal, there is Cercor Inc. in Georgetown, Ontario. For further information concerning the two plants in United States, please contact the Montreal office.

Castings are produced to military specifications. Non-destructive testing laboratories and heat treating are government-approved to American and European standards.

Cercast markets its products through representatives and agents in the United States and Europe.

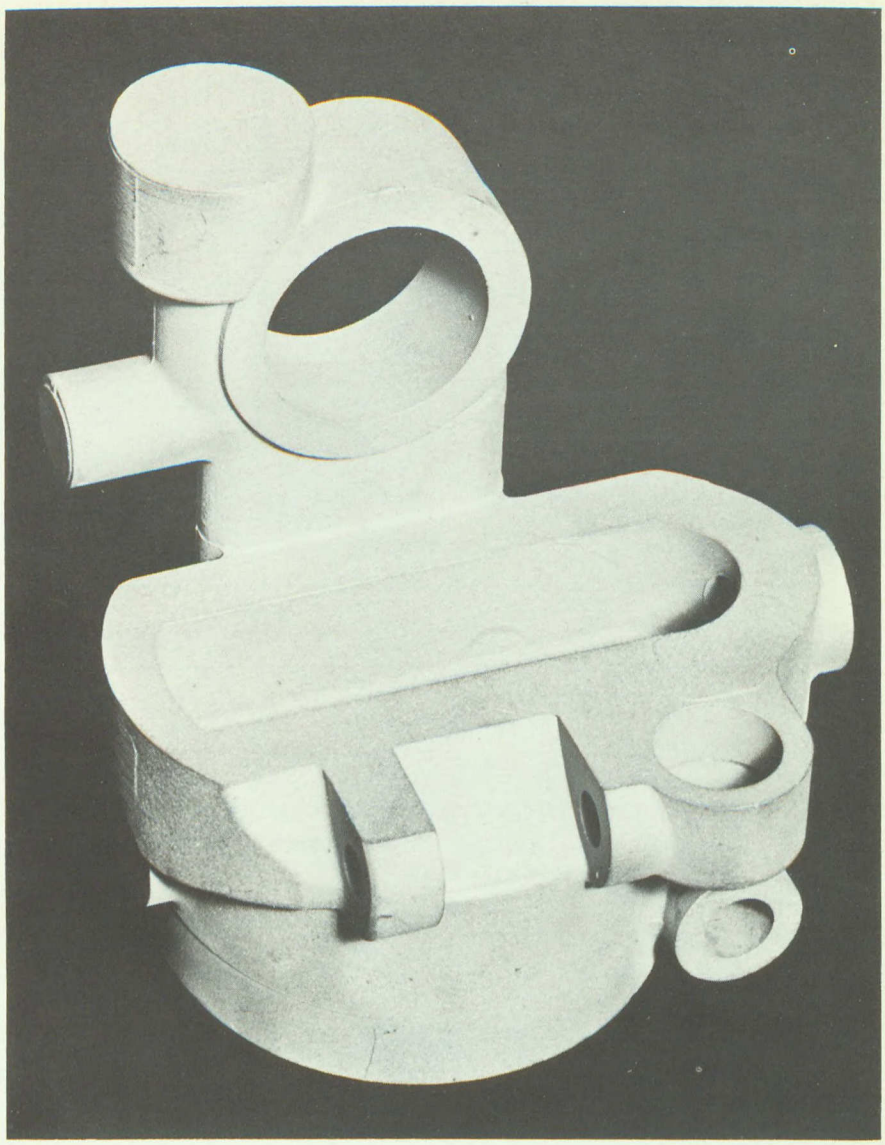


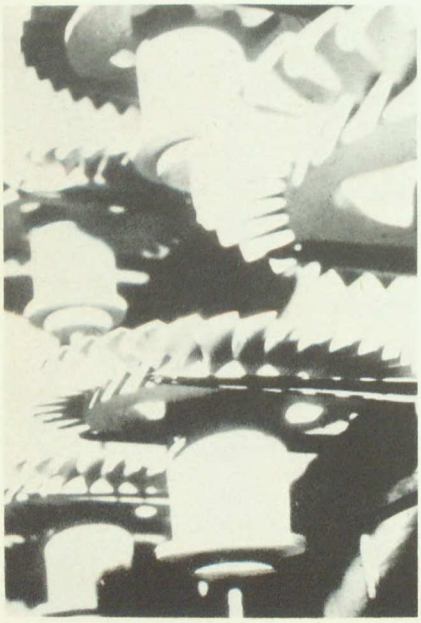
CERCOR INC. (D)
P.O. Box 129
Georgetown, Ontario, Canada
L7G 4T1

Tel: (416) 877-9661
877-2233
Telex: 0697752

Cercor Inc., formerly known as Mid Canadian Investment Castings, was founded in 1963 and became a member of Cercast Industries in 1972. The company is a custom producer of high precision investment castings *specializing* strictly in *non-ferrous* alloys. The latest techniques for producing investment castings as developed by the Cercast research group are used to assure the ultimate product is delivered.

Export is carried out on a continual basis at Cercor and a complete customs service is available.





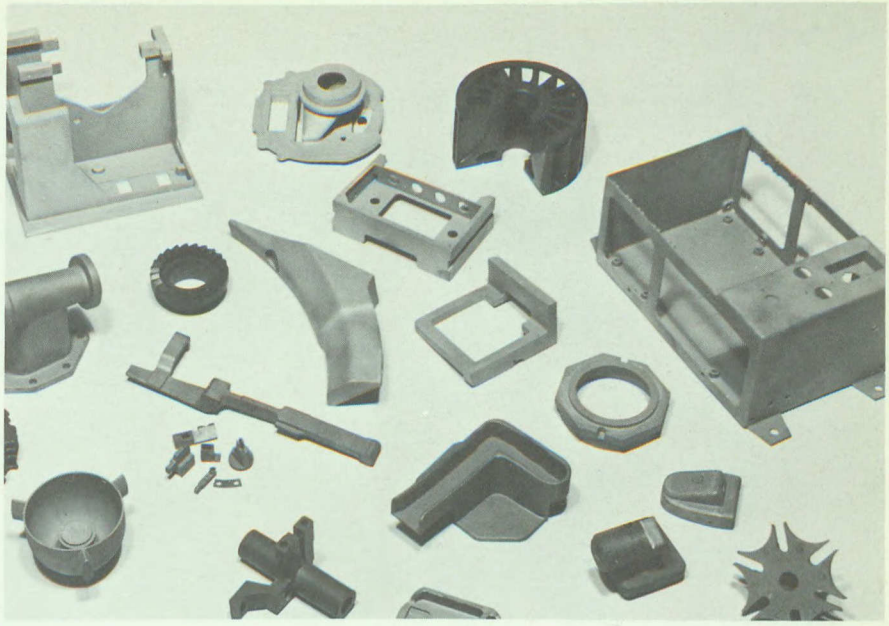
DELORO STELLITE (D)
Division of Canadian Oxygen Limited
P.O. Box 5300
Belleville, Ontario, Canada
K8N 5C4

Tel: (613) 968-3481
Telex: 06-62218

Deloro Stellite's 10,780-m^2 (116,000-sq.-ft.) plant incorporates a fully equipped investment foundry. Facilities also include a versatile machine shop with precision grinders.

The company specializes in high alloy complex castings, including nickel and stainless steels, with emphasis on Stellite (cobalt base alloys). Deloro engineers also work closely with surgeons and orthopaedic specialists in the design and production of surgical implants.

Doloro Stellite has sales representatives in Europe and the United States.



DESIGNED PRECISION CASTINGS (D)

75 Eastern Avenue
Brampton, Ontario, Canada
L6W 1X9

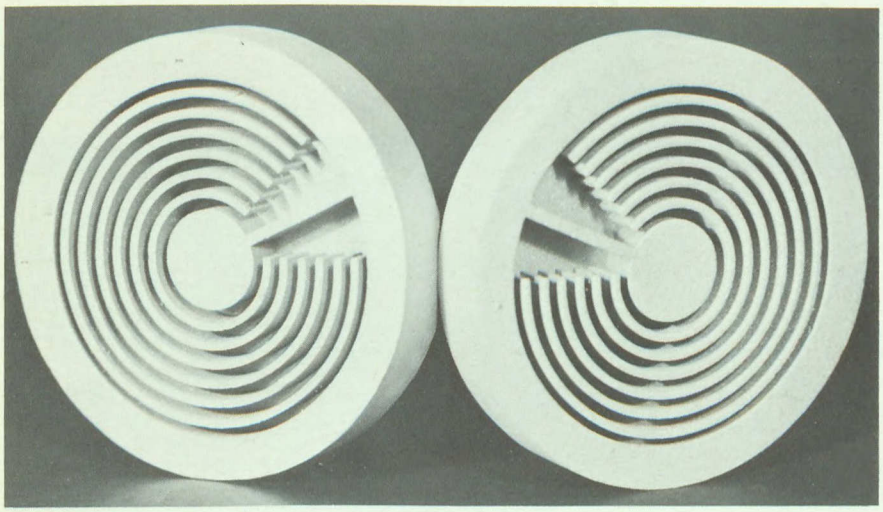
Tel: (416) 453-0421

Designed Precision Castings was incorporated in 1958 with its head office, administration and manufacturing plant located in Brampton. The company was initially formed to satisfy the investment casting needs of the aircraft and military industries in Southern Ontario but has since diversified to supply other industries such as aerospace, nuclear and electronic.

With the completion, in 1974, of one phase of expansion and modernization, the company now offers product controls that will satisfy the specific requirements of its customers.

Servicing needs are fulfilled by sales representatives who report directly to the plant.

Designed Precision Castings offers complete customs clearance service together with delivery to all parts of the North American Continent.



INDUSTRIAL FINE CASTINGS LTD. (D)

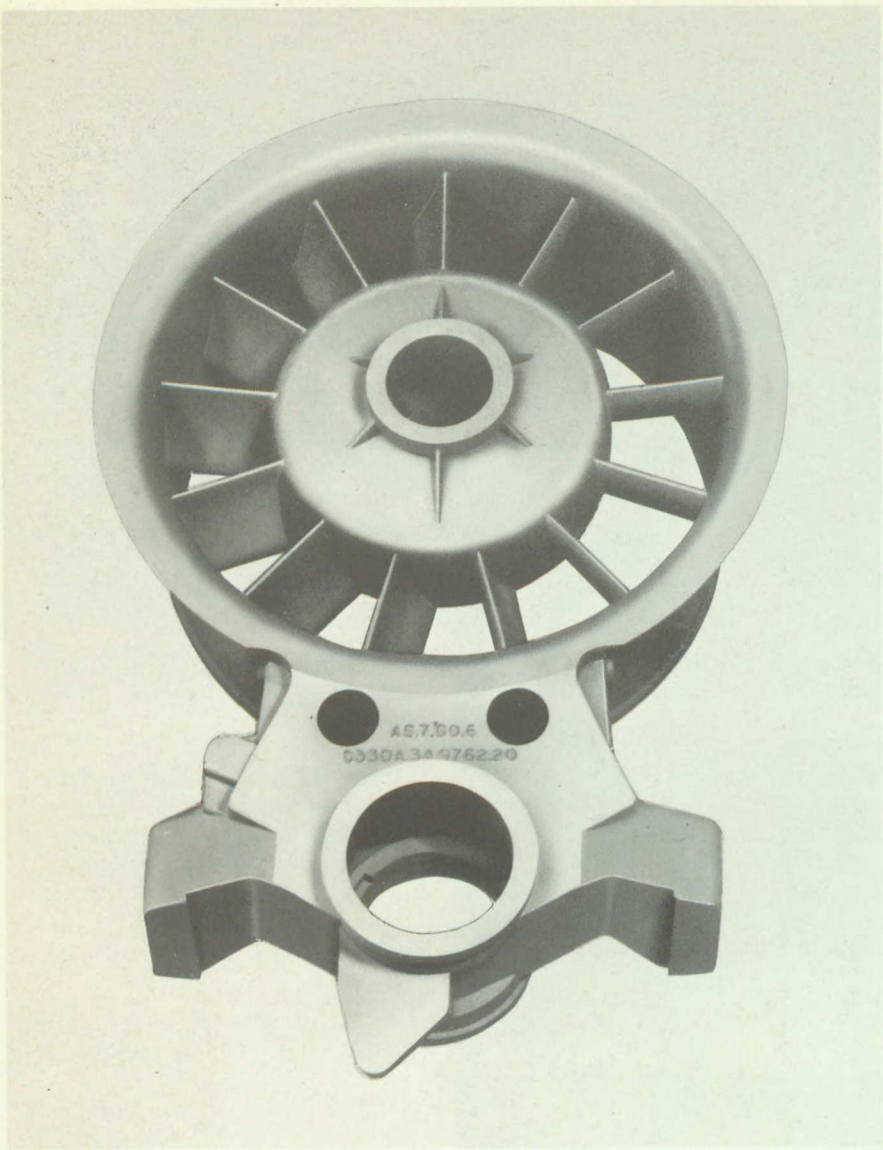
272 Geary Avenue
Toronto, Ontario, Canada
M6H 2C5

Tel: (416) 534-9281

Industrial Fine Castings Ltd. (IFC) has been supplying the Canadian industry with quality castings for 35 years and was one of the first companies in Canada to produce castings by the investment process.

The company offers design and technical services that provide customers with optimum use of their casting application.

IFC provides export services and has representation in the United States.



SHELLCAST FOUNDRIES INC. (D)

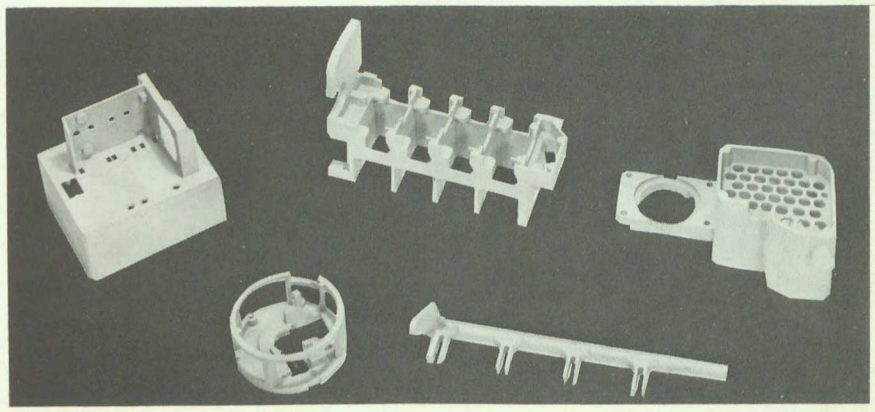
10645, avenue Lamoureux
Montréal (Québec) Canada
H1G 5L4

Tel: (514) 322-3760/61
327-1501/02
Telex: 05-828787

Shellcast Foundries Inc. offers casting design advice as well as conversions from other manufacturing processes to more economical investment castings, free of charge. Free consulting and engineering services are given, and present or prospective customers are encouraged to make use of this service at an early design change. Technical sales representatives are stationed throughout North America and Europe to implement this customer service.

A telecopy system is available for sketches and drawings so that design changes or modifications can be transmitted quickly and efficiently by telephone.

In-house tooling facilities at Shellcast include tooling and die manufacturing and design.



SUPREME PRECISION CASTINGS (1963) LTD. (D)

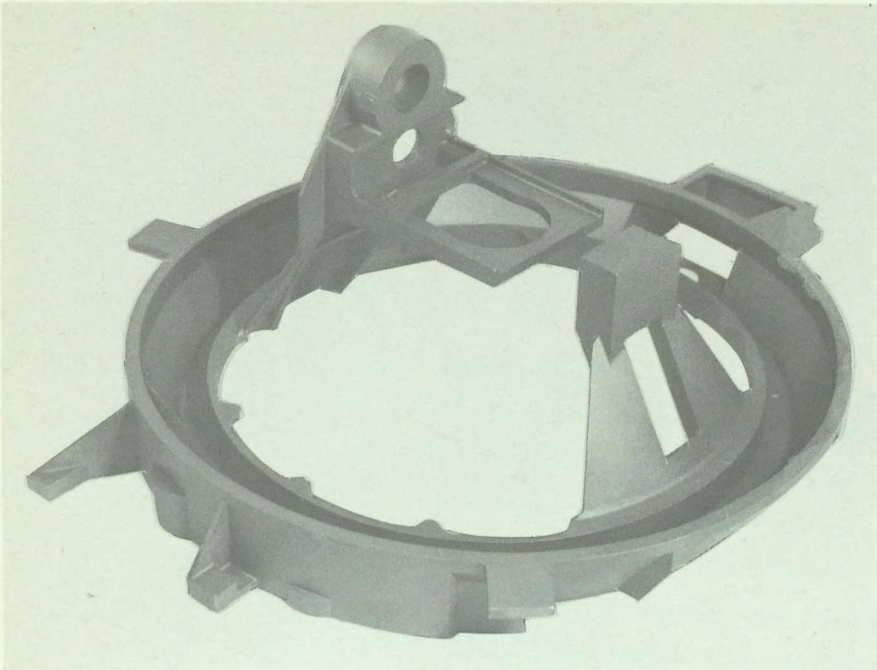
1050, St-Amour
Montréal (Québec) Canada
H4S 1J2

Tel: (514) 341-3520
Telex: 05-827804

Operated by professional engineers since 1953, Supreme Precision Castings and its 50 employees were relocated in 1976. The new and larger premises contain modernized, sophisticated, environmental, process and quality control equipment that permits the supply of investment castings under the U.S./Canada Defence Sharing Agreement (duty free) and meets the approval of all major aircraft manufacturers.

The company carries out a continuing and successful program of freely-given consultation for customers in the fields of mechanical and metallurgical engineering and non-destructive testing.

Supreme Precision Castings has representation in the United States.



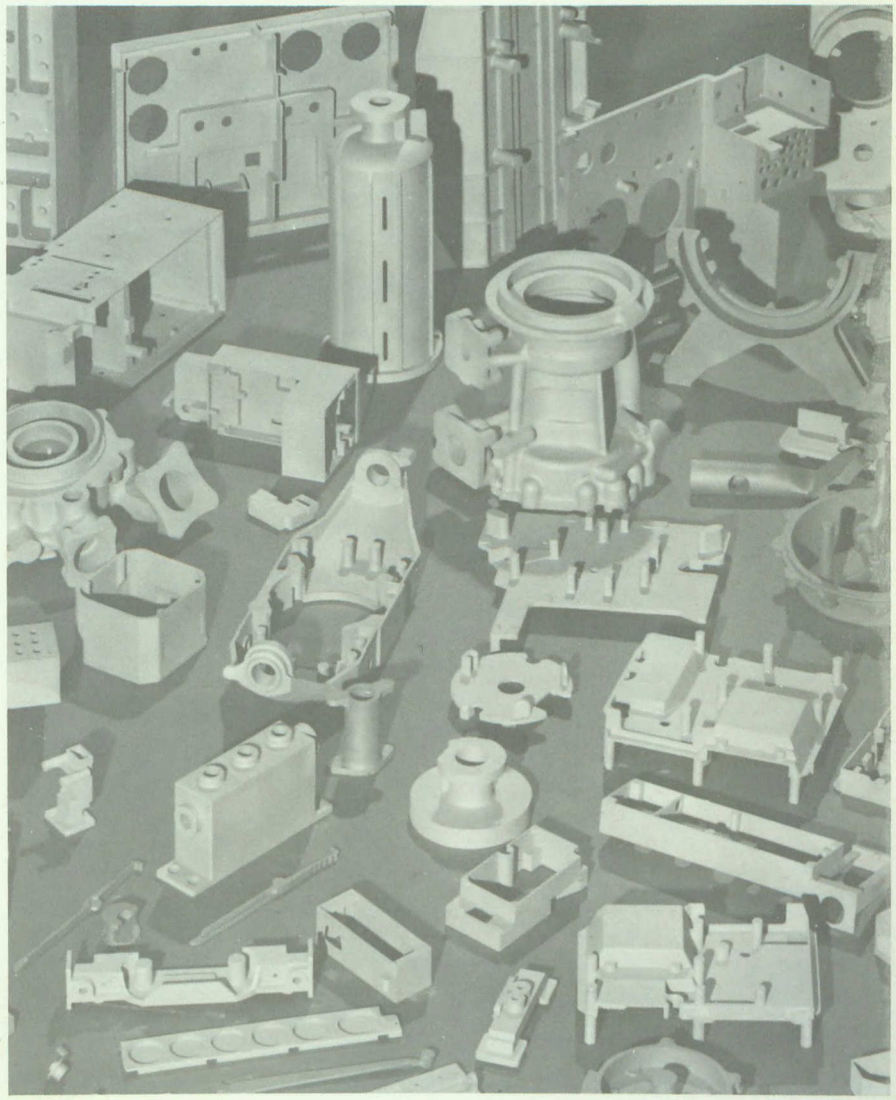
VESTSHELL INC. (D)
10351, rue Pelletier
Montréal (Québec) Canada
H1H 3R2

Tel: (514) 326-1280

Vestshell Inc. began operations in 1959 and became incorporated in 1964. The company has consistently pioneered new techniques and methods in the investment casting process.

Vestshell casts a wide range of complex configurations and offers all foreign clients a complete customs clearance service.

Names of U.S. representatives will be supplied on request.



WELKIN MANUFACTURING CO. LTD. (D)
824, rue Deslauriers
Montréal (Québec) Canada
H4N 1X1

Tel: (514) 336-8311
Telex: 05-825544

Welkin Manufacturing Co. Ltd. was incorporated in 1964. It entered the investment casting field in 1971 by purchasing the investment foundry of Canadian Marconi and continuing its policy of serving the quality casting market.

Welkin now supplies ferrous and non-ferrous castings to international markets. The foundry is approved by many leading aerospace companies.

Recently, Welkin purchased the Aerospace Division from Central Dynamics Company for the purpose of machining investment castings and assembling them in sub-assemblies.

Welkin maintains representatives in the United States and abroad.

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INDUSTRY CANADA/INDUSTRIE CANADA
69549

For further information about Canada's investment casting industry, please contact:

Non-Ferrous Metals Division
Metals and Minerals Group
Resource Industries and Construction Branch (52)
Department of Industry, Trade and Commerce
112 Kent Street
Ottawa, Ontario, Canada
K1A 0H5

or the nearest Canadian Trade Office.

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