

**RECORDATION FORM COVER SHEET
PATENTS ONLY**

To the Honorable Commissioner of Patents and Trademarks: Please record the attached original documents or copy thereof.

1. Name of conveying party(ies):

Battelle Development Corp.
505 King Avenue
Columbus, OH 43201

2. Name and address of receiving party(ies):

Globe Metallurgical, Inc.
32 County Road
Beverly, OH 45715

Additional name(s) of conveying party(ies) attached? ☐ Yes ☒ No

Additional name(s) and address(es) attached? ☐ Yes ☒ No

3. Nature of conveyance:

- ☐ Assignment ☐ Merger
☐ Security Agreement ☐ Change of Name
☒ Other: License Agreement between Battelle Development Corp.
and Globe Metallurgical, Inc.

Execution Date: May 8, 1991

4. Application number(s) or patent number(s):

If this document is being filed together with a new application, the execution date of the application is:

A. Patent Application No.(s) B. Patent No.(s) 4,646,812

Additional numbers attached? ☐ Yes ☒ No

5. Name and address of party to whom correspondence concerning document should be mailed:

IP Department
Piper Rudnick LLP
One Liberty Place, Suite 4900
1650 Market Street
Philadelphia, PA 19103

6. Total number of applications and patents involved: 1

7. Total fee (37 CFR 3.41) \$40.00

- ☐ Enclosed
☒ Authorized to be charged to deposit account

8. Deposit Account No. 50-2719
(Attach duplicate copy of this page if paying by deposit account)

DO NOT USE THIS SPACE

9. Statement and signature.

To the best of my knowledge and belief, the foregoing information is true and correct and any attached copy is a true copy of the original document

JAMES E. BAUERSMITH

Name of Person Signing

Signature

Date

Total number of pages including one cover sheet, attachments and document: 25

CH \$40.00 502719 4646812

LICENSE AGREEMENT

THIS AGREEMENT made and entered into at Columbus, Ohio, and effective as of the first day of June, 1990, by and between Globe Metallurgical, Inc., having its principal place of business in Cleveland, Ohio, herein called "LICENSEE", and Battelle Development Corporation, having its principal place of business in Columbus, Ohio, herein called "BDC",

WITNESSETH THAT:

WHEREAS, BDC is the owner of certain inventions and technical information relating to flow (float) casting techniques for forming metal sheet,

WHEREAS, LICENSEE wishes to acquire the right to use such technical information, and inventions,

WHEREAS, BDC has agreed to provide LICENSEE with certain exclusive rights to practice its inventions and technical information in return for LICENSEE's sponsorship of a research program on direct casting of ferro alloys and silicon metal at the Columbus Laboratories of Battelle Memorial Institute (BCI).

NOW, THEREFORE, in consideration of the mutual covenants herein contained and intending to be legally bound hereby, the parties agree as follows:

1. DEFINITIONS

As used herein, the following terms shall have the meanings set forth below:

A. INVENTION(S) means a method and apparatus for producing metal sheet or strip by a flow (float) casting process including at least the delivery of molten metal to a chilled surface which may be comprised of a heat conducting material and where either the tundish or the chilled surface is moved relative to the other as disclosed and claimed by the PATENT(S), and improvements of the INVENTION(S) which are owned by BDC and/or may be licensed by BDC during the term of this Agreement.

B. PATENT(S) means United States Patent Number 4,646,812 issued March 3, 1987, entitled "Flow Casting" and any corresponding foreign patent applications or patents hereafter acquired by BDC and all divisions, continuations, reissues, substitutes, and extensions thereof and any improvements or additional patents. Attachment 1 provides a summary of such patents and applications as of April 26, 1991.

C. TECHNICAL INFORMATION means any concepts, ideas, research and development information, know-how and trade secrets for use in practicing an INVENTION which is presently under control of BDC or hereafter comes under control of BDC.

D. LICENSED TERRITORY means the entire world.

E. LICENSED FIELD means, and is limited to, the practice of the PATENTS and TECHNICAL INFORMATION to make alloys for melt additives which contain one or more of the following elements:

3

silicon, iron, manganese, chromium, and magnesium [in no case will an alloy contain more than fifty percent (50%) by weight of iron] and to make unalloyed silicon or silicon-based materials for use as chemical feedstock, semiconductor feedstock and for ceramic materials.

F. LICENSEE shall mean Globe Metallurgical, Inc., and any subsidiary thereof in which Globe Metallurgical, Inc., owns at least forty percent (40%) direct or indirect equity interest.

2. PATENT LICENSE

A. BDC hereby grants to LICENSEE, to the extent of the LICENSED FIELD and LICENSED TERRITORY, an exclusive license to make, have made, use or sell the products of the INVENTIONS under the PATENTS with the exclusive right to sublicense (as provided in Article 7 of this Agreement) subject to provisions of Paragraphs B and C below. In the event the patent applications do not mature into patents, there will be a license under Article 3.

B. No government participation within the LICENSED FIELD shall be permitted during the term of this Agreement without the prior approval of LICENSEE.

C. BDC reserves for itself and Battelle Memorial Institute (BMI) the right to practice the INVENTIONS for research purposes.

3. TECHNICAL INFORMATION LICENSE

A. BDC hereby grants to LICENSEE, to the extent of the LICENSED FIELD and LICENSED TERRITORY, an exclusive license to make, have made, use or sell products resulting from the use of the TECHNICAL INFORMATION with the right to sublicense (as provided in Article 7 of this Agreement). Such TECHNICAL INFORMATION license is subject to the same reservations as provided for the PATENT license in Articles 2B and 2C in addition such license shall not cover or embrace TECHNICAL INFORMATION which: (1) was known to LICENSEE at the time of disclosure to LICENSEE by BDC; (2) is lawfully acquired by LICENSEE from a third party; (3) was generally known to the public at the time of disclosure to LICENSEE by BDC; or (4) becomes generally known to the public through no fault of LICENSEE.

B. During the term of this Agreement neither party may disclose to third parties any unpublished TECHNICAL INFORMATION furnished by BDC except any part thereof which may be of public knowledge, or published, or on sale, or independently disclosed to LICENSEE by third parties, or which may already be in the possession of LICENSEE, its affiliates, or any of its employees, or which otherwise may come within the exceptions in A above. Disclosures may be made of any such TECHNICAL INFORMATION at any time: (1) with the prior written consent of the other party, or (2) to the extent necessary to other licensees of BDC outside the LICENSED FIELD (unless this Agreement becomes nonexclusive at

5

which time BDC may disclose such TECHNICAL INFORMATION to all licensees of the LICENSED FIELD), sublicensees of LICENSEE and purchasers of LICENSEE's products or services, or (3) after the same shall have become public through no fault of the parties. To the extent that any such TECHNICAL INFORMATION is disclosed to other licensees of BDC, sublicensees of LICENSEE and purchasers of LICENSEE's products or services, the agreements contained in this Article shall be made to apply to and be made binding upon all such parties.

4. LICENSE FEE

A. Prior to the date of this LICENSE AGREEMENT, LICENSEE has paid all license fees required by the option-letter agreement of February 27, 1986 between the parties.

B. In the event that BCO conducts further research sponsored by LICENSEE during the term of this LICENSE AGREEMENT within the LICENSED FIELD, all INVENTIONS, TECHNICAL INFORMATION, know-how, and other intellectual property conceived or reduced to practice by BCO as a result of such research shall be owned by BDC.

All intellectual property developed as a result of such further research within the LICENSED FIELD will be included in this Agreement. If not in the LICENSED FIELD, an appropriate license agreement, with reasonable terms, will be negotiated between the parties subject to the availability of such rights.

6

BDC shall promptly disclose to LICENSEE all such intellectual property developed by BCO under the terms of this Article 4.

5. ROYALTIES

A. Beginning January 1, 1991, in consideration for the PATENT license granted under Article 2 and the TECHNICAL INFORMATION license granted under Article 3:

1. LICENSEE shall pay to BDC the following stated earned royalty based on the sales per annum or equivalent of the sales per annum of product made, used or sold under the PATENT license granted under Article 2. The royalty rate based on sales per annum will be:

<u>Annual Sales</u>	<u>Royalty Percent of Sales</u>
0 - \$1,000,000	1.0%
\$1,000,001 - \$10,000,000	0.5%
\$10,000,001 - \$25,000,000	0.2%
\$25,000,001 - \$50,000,000	0.1%
\$50,000,001 and above	0.05%

2. LICENSEE shall pay to BDC a continuing earned royalty on the sales per annum of all product sold or used under the TECHNICAL INFORMATION license granted in Article

3. The royalty rate based on sales per annum will be:

<u>Annual Sales</u>	<u>Royalty Percent of Sales</u>
0 - \$1,000,000	0.75%
\$1,000,001 - \$10,000,000	0.2%
\$10,000,001 - \$25,000,000	0.075%
\$25,000,001 - \$50,000,000	0.05%
\$50,000,001 and above	0.02%

7

3. LICENSEE shall pay to BDC a continuing royalty on the sales per annum of all product sold or used if both the PATENT license of Article 2 and the TECHNICAL INFORMATION license of Article 3 are in effect. In such event, the royalties listed in Paragraphs 1 and 2, above, shall not be payable and the following royalty rate based on sales per annum will be in effect:

<u>Annual Sales</u>	<u>Royalty Percent of Sales</u>
0 - \$1,000,000	1.25%
\$1,000,001 - \$10,000,000	0.625%
\$10,000,001 - \$25,000,000	0.250%
\$25,000,001 - \$50,000,000	0.125%
\$50,000,001 and above	0.0625%

The figures put forth in Items 1, 2 and 3 above are annual figures, therefore, as of January 1, of each year, there will be zero sales.

B. Should this license become nonexclusive for any reason, LICENSEE shall pay the royalty at the rates set forth in this Article 5, however, such royalty rates shall not be greater than any royalty rate charged by BDC to other nonexclusive licensees in the LICENSED FIELD.

C. BDC will waive one-third (1/3) of the earned royalties required in this Article until the amount spent in research and development at the Battelle Columbus Laboratories, as required, has been recovered, without interest. In no event shall this amount exceed Five Hundred Thousand Dollars (\$500,000).

8

D. The term "sales per annum" as used herein shall mean the actual dollar sales amount in a calendar year FOB LICENSEE's plant, excluding packaging, which LICENSEE receives from its customers for products made by practicing the INVENTIONS.

6. MINIMUM ROYALTIES

A. LICENSEE shall pay to BDC royalties as stated in Articles 5 and 7, but in no event shall royalties due BDC for a calendar year for commercial use of the PATENT license and the TECHNICAL INFORMATION license in the LICENSED TERRITORY be less than the following minimum royalties during each of the calendar years indicated except that after ten (10) years from first commercial sale minimum royalties will be due only if PATENT is being practiced:

<u>Calendar Year</u>	<u>Minimum Royalty</u> <u>U.S. \$/Calendar Year*</u>
	<u>Exclusive License</u>
1990	5,000
1991	15,000
1992 and each calendar year thereafter during the term of this Agreement	20,000

* Net to BDC, after taxes, if any, withheld at the source.

B. BDC may, by written notice to LICENSEE, convert the licenses granted under Articles 2 and 3 of this Agreement to nonexclusive during any April subsequent to the year 1994, if LICENSEE has not practiced the INVENTIONS and/or TECHNICAL

INFORMATION during each calendar year that precedes such April to the extent of generating earned royalties in the amount of Ten Thousand Dollars (\$10,000) each year.

C. Should the licenses granted under Articles 2 and 3 of this Agreement be converted to nonexclusive, there will be no minimum royalties, however, exclusive minimum royalties shall be applied for any year during which this license is converted to nonexclusive.

7. SUBLICENSING

A. Sublicensing shall be the responsibility of LICENSEE so long as and to the extent this license remains exclusive and it is the intent of the parties that sublicenses shall be available to qualified third parties on fair and reasonable terms. Sublicenses shall be nonexclusive licenses that are transferable only from LICENSEE to BDC under terms and conditions set forth herein.

B. The royalty rates for sublicensees shall be no less than the royalty rates set out in Article 5 of this Agreement, unless otherwise agreed to by the parties.

C. LICENSEE shall pay to BDC fifty percent (50%) of all income received from sublicensing, and LICENSEE shall retain the remaining fifty percent (50%) of all income received from sublicensing.

D. Should this Agreement become nonexclusive or terminated for any reason, LICENSEE shall immediately assign all of its

10

right, title, and interest to all sublicenses to BDC including the right to receive income.

8. PAYMENTS

A. For the year 1990 within thirty (30) days of execution of this Agreement by LICENSEE, and for all later years, not later than the last day of each January, LICENSEE shall furnish to BDC a written statement in such detail as BDC may reasonably require of all amounts due pursuant to Articles 5 and 7 for the annual periods ended the last day of the preceding December and shall pay to BDC all amounts due to BDC. In the event that the amounts due and payable at the end of any calendar year do not equal the minimum royalties specified in Article 6 for said calendar year, LICENSEE shall pay to BDC on the last day of the following January the amount required to satisfy the minimum royalty obligation for the preceding calendar year. Such amounts are due at the dates the statements are due. If no amount is accrued during any annual period, a written statement to that effect shall be furnished. A format for such annual report is provided in Attachment 2.

B. Payments provided for in this Agreement, shall, when overdue, bear interest at a rate per annum equal to one percent (1%) in excess of the interest rate charged by Citibank NA of New York to prime commercial borrowers for ninety (90) day unsecured loans, as in effect at the time such payment is due until payment is received by BDC.

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11

C. If this Agreement is for any reason, other than by default by BDC, terminated before all of the payments provided have been made, LICENSEE shall immediately pay to BDC any remaining unpaid balance even though the due date as above provided has not been reached. If LICENSEE has not paid royalties equal to the minimum royalties specified in Article 6 for the year in which termination takes place, LICENSEE shall immediately pay BDC the amount required to satisfy the minimum royalty obligation for that year.

9. REPRESENTATIONS

A. Nothing in this Agreement shall be deemed to be a representation or warranty by BDC of the validity of any of the PATENTS or the accuracy, safety or usefulness for any purpose, of any TECHNICAL INFORMATION, techniques, or practices at any time made available by BDC. BDC shall have no liability whatsoever to LICENSEE or any other person for or on account of any injury, loss, or damage, of any kind or nature, sustained by, or any damage assessed or asserted against, or any other liability incurred by or imposed upon LICENSEE or any other person, arising out of or in connection with or resulting from (i) the production, use, or sale of any apparatus or product, or the practice of the INVENTIONS; (ii) the use of any TECHNICAL INFORMATION, techniques, or practices disclosed by BDC; or (iii) any advertising or other promotional activities with respect to any of the foregoing, and LICENSEE shall hold BDC, and any

PATENT

12

affiliated company of BDC, harmless in the event BDC, or any affiliated company of BDC, is held liable for loss or damage stemming from LICENSEE's use of the licensed intellectual property or from the sale of product resulting from the use of the licensed intellectual property.

B. BDC holds LICENSEE harmless from liability to third party licensees for infringement of intellectual property rights of BDC outside the LICENSED FIELD. Such indemnity and/or hold harmless shall not apply to the results of such research and development or to LICENSEE's use of such results.

C. BDC represents that it has the right to grant all of the rights granted herein.

D. While BCO is undertaking research with LICENSEE's funds and for as long as this Agreement is exclusive, BDC represents that BCO will not undertake research using the INVENTIONS in the LICENSED FIELD for others without the permission of LICENSEE.

10. TERMINATION

A. (i) LICENSEE's obligations under this Agreement relating to the PATENTS including the obligation to pay royalties for the practice of the INVENTIONS under any of the patents licensed herein as specified in Article 5A.1 shall end upon the expiration of the last to expire of any of the patents included herein, except that any licensee and/or sublicensee to TECHNICAL INFORMATION then outstanding in accordance with Article 7 shall continue.

13

(ii) LICENSEE's obligations under this Agreement to pay royalties for the use of the TECHNICAL INFORMATION as specified in Article 5A.2 shall terminate ten (10) years from the date on which LICENSEE incurs earned royalties payable to BDC for commercial use or sale of products or services utilizing the TECHNICAL INFORMATION.

B. LICENSEE may terminate this entire Agreement at any time upon sixty (60) days written notice in advance to BDC. Should LICENSEE terminate the license under this Paragraph B, LICENSEE will be obligated to pay any royalty payments (including minimum royalties) that might be due at the time of termination.

C. If either party shall be in default of any obligation hereunder, or shall be adjudged bankrupt, or become insolvent, or make an assignment for the benefit of creditors, or be placed in the hands of a receiver, the other party may terminate this Agreement by giving sixty (60) days' notice by Registered Mail to the party at fault, specifying the basis for termination. If within sixty (60) days after the receipt of such notice, the party at fault shall remedy the condition forming the basis for termination, such notice shall cease to be operative, and this Agreement shall continue in full force; provided that if notice is given by BDC to LICENSEE for the third time then this grace period shall not be available unless permitted in such third notice, and this Agreement shall be finally terminated.

D. In the event this Agreement becomes terminated for any reason other than BDC's fault prior to ten (10) years from the

14

date of the first commercial sale or use of products or services utilizing the TECHNICAL INFORMATION, LICENSEE agrees not to use the TECHNICAL INFORMATION or sell products made by use of the TECHNICAL INFORMATION and shall continue to observe the provisions of Article 3, Paragraph B, until ten (10) years from effective date of this Agreement.

11. LITIGATION

A. Each party shall notify the other in writing of any suspected infringement(s) of the PATENTS in the LICENSED FIELD, and the LICENSED TERRITORY and shall inform the other of any evidence of such infringement(s).

B. So long as the license of Article 2 is exclusive, BDC shall have the first right to institute suit for infringement(s) in the LICENSED FIELD and the LICENSED TERRITORY. However, if BDC does not institute suit for infringement(s) within ninety (90) days of receipt of written notice from LICENSEE of LICENSEE's desire to bring suit for infringement in its own name and on its own behalf, then LICENSEE may, at its own expense, bring suit or take any other appropriate action. Any recovery received pursuant to such suit shall be retained by the party bringing suit.

C. In the event this license becomes nonexclusive, BDC shall have the sole right to institute suit for infringement.

D. In the event this license becomes nonexclusive and LICENSEE gives BDC a written notice of an infringement of a

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Globe Metallurgical Inc

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15

PATENT together with evidence of such infringement and BDC does not file suit against the infringer or abates the infringement within one hundred twenty (120) days after the date of the written notice, LICENSEE's obligation to pay royalties shall cease and, thereafter, LICENSEE shall have no obligation to pay royalties unless BDC files suit against the infringer or BDC abates the infringement. Should BDC file suit against the infringer and prosecute the suite with due diligence or should BDC abate the infringement all royalties due after suit is filed or abatement is accomplished will be paid to BDC.

E. During the term of this Agreement, each party shall promptly bring to the attention of the other party any prior art or other information known to it which is relevant to the patentability or validity of any of the PATENTS and which might cause a court to deem any of the PATENTS wholly or partly inoperative or invalid.

F. LICENSEE shall have the right to challenge the PATENTS in an appropriate court of law. If LICENSEE should institute such a suit, BDC shall not have the right to cancel this License Agreement or to take other preventive action against the LICENSEE during the pendency of the lawsuit or thereafter so long as LICENSEE is otherwise in compliance with the terms of this Agreement.

PATENT

12. PATENTS

A. BDC shall have the first right to file, prosecute, and maintain all of the PATENTS covering the INVENTIONS that are the property of BDC and shall have the first right to determine whether or not, and where, to file a patent application, to abandon the prosecution of any patent or patent applications, or to discontinue the maintenance of any patent or patent applications. Such patent applications and patents will be included in this Agreement.

B. INVENTIONS made by LICENSEE shall be the exclusive property of LICENSEE.

C. BDC shall notify LICENSEE in respect to INVENTIONS in writing of its intent: (i) to abandon the prosecution or maintenance of any such patent applications; or (ii) to discontinue the maintenance of any patent resulting from such patent applications at least forty-five (45) days prior to the last day on which action is required to preserve such INVENTIONS, applications or patents from abandonment or prior to the convention date of the international treaties relating to the filing of patent applications so that LICENSEE may, at its option and its own expense, take the required action.

D. Upon written request from LICENSEE, BDC shall promptly furnish to LICENSEE all papers pertaining to INVENTIONS BDC has elected not to pursue in accordance with the provisions of this Article or Article 4B so that LICENSEE may take the required

17

action at LICENSEE's expense to maintain the inventions, patents, and patent applications and, at LICENSEE's option, to file corresponding patent applications in countries in which BDC has not and elects not to file. So long as this license is exclusive, such patents filed and prosecuted by the LICENSEE shall be the property of the LICENSEE providing that LICENSEE grants to BDC an irrevocable, royalty free nonexclusive license, with the right to sublicense, to all fields except the LICENSED FIELD. Should this license become nonexclusive this license granted by the LICENSEE to BDC will include an irrevocable royalty free nonexclusive license with the right to sublicense to the LICENSED FIELD. In the case this license is terminated for any reason other than stated in Article 10, Paragraph A or by reason of default by BDC the title to such patents will be assigned by LICENSEE to BDC.

E. In the event that a third party claims by instituting legal proceedings that the LICENSEE or its sublicensees are infringing paramount rights of that third party, LICENSEE shall notify BDC forthwith of such claims. In the event such third party prevails in such proceedings and LICENSEE is required to take a license and to pay a royalty to such third parties in order to practice the INVENTIONS under the patents in one or more countries covered by the LICENSED TERRITORY to settle such litigation or there is a BDC approved settlement between the parties, LICENSEE may thereafter credit one-half (50%) the amount of the royalty due BDC from that country as set forth in Article

19

given effect without the invalid provision; providing the parties shall promptly negotiate in good faith as to modifications in the Agreement as may be necessary to make it fair and equitable to both parties.

16. PUBLICITY

In publicizing anything made, used or sold under this Agreement, neither party to this Agreement shall use the name of the other party or otherwise refer to it or to any organization related to the other party, except with the prior written approval of the other party.

17. WAIVER AND ALTERATION

A. The waiver of a breach hereunder may be effected only by a writing signed by the waiving party and shall not constitute a waiver of any other breach.

B. A provision of this Agreement may be altered or amended only by a writing signed by both parties stating an intention to alter or amend the Agreement.

18. IMPLEMENTATION

Each party shall execute instruments necessary to implement the provisions of this Agreement.

PATENT

19. CONSTRUCTION

This Agreement shall be construed in accordance with the laws of the State of Ohio and The United States of America and in the English language.

20. EXPORTATION OF TECHNICAL INFORMATION

BDC and LICENSEE agrees to comply with the laws and rules of The United States Government regarding the exportation of reports and TECHNICAL INFORMATION furnished to LICENSEE either directly or indirectly by BDC.

21. ENTIRE UNDERSTANDING

All the terms and conditions of this Agreement are embodied herein and no other terms and conditions shall be considered a part hereof unless expressly agreed upon in writing.

22. ADDRESSES

For the purpose of all written communications between the parties, their addresses shall be:

Globe Metallurgical, Inc.
6450 Rockside Woods
Boulevard South, Suite 390
Cleveland, Ohio 44131

Battelle
505 King Avenue
Columbus, Ohio 43201-2693

or any other addresses of which either party shall notify the other party in writing.

23. AFFILIATES

BDC agrees that BMI and any other affiliate of either BDC or BMI (including Battelle Columbus Laboratories) which may have any relationship to the subject matter of this Agreement shall be bound by it.

IN WITNESS WHEREOF the parties have caused this Agreement to be executed by their duly authorized officers on the respective dates and at the respective places hereinafter set forth.

GLOBE METALLURGICAL, INC.

ATTEST:

By *Marcia Taylor*Signed at Cleveland, OhioBy *[Signature]*Date May 8, 1991

BATTELLE DEVELOPMENT CORPORATION

ATTEST:

By *Shirley Russell*Signed at Columbus, OhioBy *Richard Razgaitis*Date April 26, 1991

Attachments-2

Patent Summary

Sample Royalties/Fees Report

PATENT

ATTACHMENT 2**SAMPLE ROYALTIES/FEES REPORT**

(Name of Licensee)
(Technology/Intellectual Property Licensed)
Royalty and Sales Report
(period covered by report)

Sales

(This should be a description of what was sold, i.e. gross weights, number of production items, constructed processes, etc.)

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Receipts/Monies Received/Income, etc.

\$\$\$

Royalties

(This should be a description of the basis of the royalties computed, reported, and paid by the licensee, including the royalty rate and any minimum royalties due.)

Royalties Due Battelle

\$\$\$

Fees

(In the event any fees are due and payable by the licensee, a description of such fees should be included here.)

License Fees Due Battelle

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This report is certified to be true and correct.

(Licensee Name)

By: _____
(Signature)
(Printed Name)

Title: _____

Date: _____
(Signature Date)

PATENT

BREVETED CENTRAL INTELLECTUAL PROPERTY DATABASE LISTING 04/26/91 PAGE 1

27620 TID: DMF/FLOW CASTING

TID SCOPE:

PROCESS FOR FLOW CASTING METALLIC STRIP THICKER THAN ACHIEVABLE BY MELT-DRAW PROCESSES, BUT THINNER THAN BY NORMAL CASTING METHODS, BY WHICH MOLTEN METAL ISSUES, WITHOUT DECONTAMINATION, FROM THE BOTTOM ORIFICE OF A TUNDISH ONTO A FLAT MOVING CHILL SURFACE AND WITHIN A CHANNEL-SHAPED CROSS-SECTIONAL CONFINING SPACE, THE MOLTEN METAL BEING CARRIED, WITHOUT ACCELERATION, UNDER A CHILLED SQUEEGE ROLL TO DISTRIBUTE METAL UNIFORMLY AND SOLIDIFY TOP SURFACE.

* CASE: 1 COMPONENT: BCD

TID: 27620 SOURCE: ECL

INVENTOR(S): MARINDER RE

CASE SCOPE:

PROCESS FOR FLOW CASTING METALLIC STRIP THICKER THAN ACHIEVABLE BY MELT-DRAW PROCESSES, BUT THINNER THAN BY NORMAL CASTING METHODS, BY WHICH MOLTEN METAL ISSUES, WITHOUT DECONTAMINATION, FROM THE BOTTOM ORIFICE OF A TUNDISH ONTO A FLAT MOVING CHILL SURFACE AND WITHIN A CHANNEL-SHAPED CROSS-SECTIONAL CONFINING SPACE, THE MOLTEN METAL BEING CARRIED, WITHOUT ACCELERATION, UNDER A CHILLED SQUEEGE ROLL TO DISTRIBUTE METAL UNIFORMLY AND SOLIDIFY TOP SURFACE.

TITLE: FLOW CASTING

PATENT COUNTRY	PATENT REFERENCE NUMBER	PATENT APPLICATION NUMBER	PATENT FILING DATE	PATENT STATUS	PATENT NUMBER	PATENT ISSUE DATE	PATENT EXPIRE DATE
AUSTRIA		86906089.7	19860915	ISSUED	233283	19890712	20060915
BELGIUM		86906089.7	19860915	ISSUED	233283	19890712	20060915
BRAZIL		PI 8606878	19860915	ISSUED		20010915	
CANADA		518,365	19860917	ISSUED	1268315	19900501	20070501
EUROPEAN		86906089.7	19860915	ISSUED	233283	19890712	20060915
DESIGNATED ARE: AUS, BEL, SMO, WA, FR, UK, IT, JPN, AEN, SMC.							
FEDERAL REPUBLIC OF GERMANY		86906089.7	19860915	ISSUED	233283	19890712	20060915
FRANCE		86906089.7	19860915	ISSUED	233283	19890712	20060915
ITALY		86906089.7	19860915	ISSUED	233283	19890712	20060915
JAPAN		505090/86	19860915	UNKNOWN			
LUXEMBOURG		86906089.7	19860915	ISSUED	233283	19890712	20060915
MEXICO		3776	19860919	UNKNOWN			
NETHERLANDS		86906089.7	19860915	ISSUED	233283	19890712	20060915
NORWAY		872107	19860915	UNKNOWN			
PCT		ECT/US86/01921	19860915	EXPIRED			19870520
DESIGNATED: BRZ, EPC, JA, NOR							
PORTUGAL		83,399	19860918	UNKNOWN			
SOUTH AFRICA		86/7045	19860916	ISSUED	86/7045		20060916
SPAIN		86/02057	19860919	ISSUED	2001977	19880530	20060919
SWEDEN		86906089.7	19860915	ISSUED	233283	19890712	20060915
SWITZERLAND		86906089.7	19860915	ISSUED	233283	19890712	20060915
UNITED KINGDOM		86906089.7	19860915	ISSUED	233283	19890712	20060915
UNITED STATES		778,633	19850920	ISSUED	4,646,812	19870303	20040303
VENEZUELA		1,627/86	19860919	UNKNOWN			

BUSINESS SENSITIVE