number:

title: Vocabulary

subtitle:

editor:

* first\_name: Jane

last\_name: Bassett

bio: Jane Bassett (Head of Decorative Arts and Sculpture Conservation, J. Paul Getty Museum, Los Angeles) completed her graduate studies in conservation at New York State College at Buffalo. A conservator at the Getty Museum since 1991, she has co-curated many exhibitions focused on sculptural processes, including *La Roldana’s St. Ginés: The Making of a Polychrome Sculpture*; *Bernini and Marble* and *Foundry to Finish* on the direct lost wax casting process. She authored *The Artist Revealed: Adriaen de Vries, Sculptor in Bronze* (2008) and coedited *French Bronze Sculpture: Materials and Techniques 16th–18th Century* (2014).

* first\_name: David

last\_name: Bourgarit

bio: David Bourgarit (Archaeometallurgist, Centre de Recherche et de Restauration des Musées de France [C2RMF], Paris, and Laboratory TEMPS-CNRS-Nanterre University) has a background in physics, with a PhD on the physical metallurgy of a specific titanium alloy. Since 1996 he has been a researcher at the C2RMF, where he has been investigating metallic artifacts from almost all periods and regions. His primary research interests are in the technological approach to copper metallurgy, with a focus on the provenance of copper and fabrication techniques. He coedited *French Bronze Sculpture: Materials and Techniques 16th–18th Century* (2014).

contributor:

* first\_name: Jane

last\_name: Bassett

bio: Jane Bassett (Head of Decorative Arts and Sculpture Conservation, J. Paul Getty Museum, Los Angeles) completed her graduate studies in conservation at New York State College at Buffalo. A conservator at the Getty Museum since 1991, she has co-curated many exhibitions focused on sculptural processes, including *La Roldana’s St. Ginés: The Making of a Polychrome Sculpture*; *Bernini and Marble* and *Foundry to Finish* on the direct lost wax casting process. She authored *The Artist Revealed: Adriaen de Vries, Sculptor in Bronze* (2008) and coedited *French Bronze Sculpture: Materials and Techniques 16th–18th Century* (2014).

* first\_name: Francesca

last\_name: Bewer

bio: Francesca G. Bewer (Research Curator for Conservation and Technical Studies Programs, Harvard Art Museums, Cambridge, Massachusetts), undertook her graduate theses at the Warburg Institute, University of London (MPhil 1986) and the Institute of Archaeology, University College London (PhD 1996), focusing on Renaissance bronze technology. She has published widely on art technology and conservation history. She authored *A Laboratory for Art: Harvard’s Fogg Museum and the Emergence of Conservation in America (ca. 1900–1950)* (2010) and coedited *French Bronze Sculpture: Materials and Techniques 16th–18th Century* (2014) and *The Explicit Material: Inquiries on the Intersection of Curatorial and Conservation Cultures* (2019).

* first\_name: David

last\_name: Bourgarit

bio: David Bourgarit (Archaeometallurgist, Centre de Recherche et de Restauration des Musées de France [C2RMF], Paris, and Laboratory TEMPS-CNRS-Nanterre University) has a background in physics, with a PhD on the physical metallurgy of a specific titanium alloy. Since 1996 he has been a researcher at the C2RMF, where he has been investigating metallic artifacts from almost all periods and regions. His primary research interests are in the technological approach to copper metallurgy, with a focus on the provenance of copper and fabrication techniques. He coedited *French Bronze Sculpture: Materials and Techniques 16th–18th Century* (2014).

* first\_name: Yi

last\_name: Chen

bio: Yi Chen received her PhD in Chinese archaeology from the University of Oxford. She is a former curator of early Chinese collections and now a visiting researcher at the British Museum. In addition, she is an academic advisor of the Dresden Porcelain Project of the Staatliche Kunstsammlungen Dresden and a consultant on Chinese art for Bonhams. Before she joined the British Museum in 2015, she was the Christensen Fellow in Chinese Painting at the Ashmolean Museum of Art and Archaeology in Oxford.

* first\_name: Joachim

last\_name: Kreutner

bio: Joachim Kreutner (Metals Conservator, Bavarian Nationalmuseum, Munich) received his degree in conservation, restoration, and art technology at the Technische Universität, Munich. Since 2016 he has been supervisor to the metals conservation team at the Bavarian Nationalmuseum. His research interests are focused on preventative conservational conditions of museum silver collections and the technique of bronze casting. He is deputy spokesperson for the conservation working group at Deutscher Museumsbund.

* first\_name: Elisabeth

last\_name: Lebon

bio: Elisabeth Lebon holds a doctorate in art history from Paris I Panthéon-Sorbonne. She is an independent researcher in nineteenth- and twentieth-century French sculpture and the author of the catalogues raisonnés of Antoine Pevsner (in collaboration with Pierre Brullé), Charles Despiau, and Jean Joire. She specializes in the history of art foundries and casting processes in France, and is the author of *Dictionnaire des fondeurs de bronze d’art. France 1890–1950* (2003), *Le Fondeur et le sculpteur: Technique du bronze et histoire de l’art* (2012), and *Fonte au sable – fonte à cire perdue: histoire d’une rivalité* (2012). She has been brought to work on a wide range of artists through this specialty.

* first\_name: Linda Y.

last\_name: Lin

bio: Linda Y. Lin (Conservator, Shangri La, Museum of Islamic Arts, Culture and Design, Honolulu) received her MA in conservation of archaeological and ethnographic materials from UCLA / Getty Conservation Program in 2010. She was formerly the conservator for arts of Asia at the Newark Museum, New Jersey. She has translated articles in the areas of archaeology, conservation, and technical research published in both Chinese and English journals. Her most recent translation projects include ancient Chinese bronze-casting technology and Chinese lacquer, in collaboration with the Smithsonian Institution’s National Museum of Asian Art.

* first\_name: Lorenzo

last\_name: Morigi

bio: Lorenzo Morigi (Independent Restorer) joined the company owned by his father in 1990, specializing in the restoration of outdoor bronze sculptures and metal objects. He studied chemistry for conservators at ICCROM in Rome. He has been responsible for planning, direct restoration, and technological study of many Italian bronze sculptures from ancient Rome to the modern era, and specializes in the conservation of contemporary sculptures, also with thorough experience in consolidation and restoration of waterlogged wood. He has reproduced medieval bronze doors and sculptures in art foundries. He collaborates with art handling companies in conceiving, designing, and building special art crating with reverse engineering. He works with 3D scanners and digital fabrication systems.

* first\_name: Ruven

last\_name: Pillay

bio: Ruven Pillay (Research Scientist, Centre de Recherche et de Restauration des Musées de France [C2RMF], Paris) holds an MPhys in physics from the University of Manchester, an MSc in computer science from the University of Edinburgh, and a PhD in hyperspectral imaging from NTNU, Norway. His research interests include the application of advanced imaging, data processing and visualization, and other techniques to the study of art. In addition to his work at the C2RMF he has more than twenty-five years of experience working in major art galleries, and has also worked at the National Gallery in London, the National Museum in Stockholm, and as an invited scholar at the J. Paul Getty Museum in Los Angeles.

* first\_name: Jean-Marie

last\_name: Welter

bio: Jean-Marie Welter (Independent Scholar, Luxembourg) holds an engineering diploma from Ecole Polytechnique, Paris (1966) and graduated as a Dr. rer. nat. from the Technische Hochschule, Munich (1969). He started his professional career in academia, producing and studying metallic materials. In 1985 he joined the copper industry and became corporate director of research and development of a major European group (KME) fabricating semi-products of copper and copper alloys. In those days he started investigating historical copper artifacts, which he presently continues to do within the context of the history of the copper industry, its products, and their applications.

additional contributors: Ann Boulton, Anne-Lise Desmas, Jean Dubos, Sharon Hecker, Andrew Lacey, Marjee Levine, Jeffrey Maish, Benoît Mille, Peta Motture, Uve Peltz, David Reid, Dominique Robcis, Lise Saussus, Harold Schulze,Jeffrey Springer, Nicolas Thomas, Quanyu Wang, Jeremy Warren, Frank Willer, Dimitrios Zikos

abstract:

short\_title: Vocabulary

term: after-cast

language: en

images: **figs. 1, 284**

definition: A bronze cast that has been created from a reusable mold taken directly from an existing bronze. After-casts are therefore made using the indirect lost-wax process, or in some instances by sand casting.

Note: An after-cast will usually replicate surface traces of alterations on its precursor model, including damage and repairs. It will also tend to be smaller and potentially less crisp than the bronze from which it was derived (see [II.3](#II.3)).

## To Be Distinguished From

**copy**

**replica**

## Sources

### *Cultural Heritage Publications*

{Dillon 2002}

{Motture 2019}

{Penny 1993}

## Synonyms

**aftercast**

**surmoulage**

The French term *surmoulage* is often used in English texts.

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Nachguss |  |  |
| French | [surmoulé](file:////vocabularies/surmoule) |  |  |
| Italian | calco | rifusione (less common, related to the process of obtaining a new bronze from already-existing sculpture)  fusione successiva (usually has smaller dimensions due to the shrinkage of the metal while cooling)  multiplo  sovracalco (closest translation to *surmoulage*; could refer to the process as well as to the product of surmoulage; not specifically used for metal in these sources) | [Treccani](https://www.treccani.it/vocabolario/calco/)  Alternate translations:  rifusione: {Battaglia 1961}, here  rifusione: [Treccani](http://www.treccani.it/vocabolario/rifusione/)  sovracalco: {Cuomo di Caprio 2007}, 224  sovracalco: {Panazza 2011}, 30 |
| Chinese | 翻铸 |  |  |

term: armature

language: en

images: **figs. 8, 31, 32, 34, 79, 221**

definition: Assemblage of joined metal rods, tubes, and/or wires (and/or other materials such as wood) that provides a structural framework for a sculpture and usually attaches to a base. Though generally internal, it may also include external supporting components that are eventually removed. In a lost-wax bronze, the armature is created to support the model, whether it is hollow or solid. In the case of a hollow cast, it will further help support the refractory mass of the core during the pour (see [GI](#GI)). Armatures may also be used in the assembly of a sculpture that was cast in parts, and in the repair of sculptures that have been structurally damaged (e.g., large archaeological bronzes).

## Sources

### *Cultural Heritage Publications*

{Mattusch 1996}

{Boulton 2006}

{Dillon 2002}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/armature>

## Synonyms

**core rod**

### *Copper Industry*

{Brunhuber 1988}

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Kerneisen | Stütz-konstruktion  Armierung | {Brunhuber 1988}  Alternate translations:  Armierung: {Maaz 2010}, 695 |
| French | [armature](file:////vocabularies/armature--fr) |  |  |
| Italian | armatura | armadura (early italian spelling of *armatura*)  ferramenta (relates more specifically to the ferrous materials used for the armature)  rinforzo per anime | {Giuffredi 2006}, 19–21  [Treccani](http://www.treccani.it/vocabolario/armatura)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI01/GDLI_01_ocr_676.pdf&parola=armatura)  Alternate translations:  armadura: {Leonardo 1490}, fols. 155, 157v, 144v  ferramenta: {Biringuccio [1540] 1990}, fol. 80v  rinforzo per anime: {Brunhuber 1988} |
| Chinese | 塑像內部支架 | 雕塑骨架 | {Ming 2010}, 1783 |

term: as-cast surface

language: en

images: **figs. 5, 62, 104, 277**

definition: Refers to the surface immediately after removal from the mold, before fettling and chasing.

Note: The quality of the as-cast surface varies depending on the characteristics of the refractory mold. It may include oxidized metal, refractory mold remains, flashes, or casting flaws and imperfections. An artist or foundry may choose to preserve the surface as-cast without much further refinishing.

## To Be Distinguished From

**fire scale**

**fire-skin**

## Sources

### *Cultural Heritage Publications*

{Kienlin, Bischoff, and Opielka 2006}

### *Other*

{Burd and Greene 1948}

{Mödlinger and Sabatini 2016}

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Gusshaut | gussrauhe Oberfläche | {Maaz 2010}, 696  {Alscher 1987}, 555 |
| French | [surface brute de coulée](file:////vocabularies/surface-brute-de-coulee) |  |  |
| Italian | superficie al grezzo (used as part of expression “superfiecie al grezzo di fusione”) | grezzo | {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI07/GDLI_07_ocr_46.pdf&parola=grezzoni) |
| Chinese | 毛坯铸件表面 |  | {Ming 2010}, 998 |

term: brass

language: en

images: **fig. 133**

definition: A copper alloy with zinc as the primary added element. As with bronzes, there are a wide variety of brass alloys.

## Sources

### *Cultural Heritage Publications*

{Bayley 1991}

{Dillon 2002}, 299

{Penny 1993}, 297

### *Copper Industry*

{Brunhuber 1988}

{Campbell 2015}, 270

{Koch and Newell 1963}

### *Historical Sources*

{Buchanan 1903}, 23

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/brass>

### *Other*

{Turner 1982}

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Messing |  | {Maaz 2010}, 708  {Gesamtverband Deutscher Metallgiessereien 1982}  {Brunhuber 1988}  {Koch and Newell 1963} |
| French | [laiton](file:////vocabularies/laiton) |  |  |
| Italian | ottone |  | [Treccani](http://www.treccani.it/vocabolario/ottone/)  [Treccani](https://www.treccani.it/enciclopedia/fusione_%28Enciclopedia-Italiana%29/) [under “Bronzi e ottoni”]  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI12/GDLI_12_ocr_295.pdf&parola=ottone) |
| Chinese | 铜锌合金 (literally “copper-zinc alloy”) | 黃铜 (this is a broad, colloquial term for brass) | {Ming 2010}, 1440 |

term: brazing

language: en

images: **figs. 188, 206, 229**

definition: In bronze sculpture, a technique for joining separately cast parts or repairs or filling casting defects by localized addition of a molten copper alloy of slightly lower melting temperature than that of the cast. Unlike in welding, the contact zones of the sections to be joined are not brought to a molten stage.

Note: In industry, brazing is often defined as a joining method using a filler metal with a melting point above 450°C, which includes both copper-based and silver-based (hard solder) alloys. In cultural heritage settings, it may be impractical to identify the alloy and melting point of the filler metal. To avoid confusion, we suggest that white filler metal be referred to as solder.

## To Be Distinguished From

**flow fusion welding**

**flow welding**

**fusion welding**

**repair**

**soldering**

**welding**

## Sources

### *Historical Sources*

{Buchanan 1903}, 23, 60

{Bolland 1894}, 72)

### *Copper Industry*

{Schwartz and Aircraft 1951}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/brazing>

### *Other*

{Scott 1991}, 138

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Hartlöten |  |  |
| French | [brasage](file:////vocabularies/brasage) |  |  |
| Italian | brasatura (a subset of *saldatura*) |  | [Treccani](http://www.treccani.it/vocabolario/brasatura/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI02/GDLI_02_ocr_364.pdf&parola=brasatura) |
| Chinese | 硬焊 | 钎接  钎焊  铜焊 | {Ming 2010}, 1684  [TNATD](https://terms.naer.edu.tw/detail/637816/?index=1)  Alternate translations:  钎焊: {Ming 2010}, 1137–38  铜焊: {Ming 2010}, 1436  铜焊: [TNATD](https://terms.naer.edu.tw/detail/637816/?index=1) |

term: bronze

language: en

images: **figs. 133, 134**

definition: Depending on the user, “bronze” may designate a copper alloy that has tin as the primary added element or any other copper-based alloy. We recommend using the term “bronze” specifically for copper-tin alloys unless qualified by another term (e.g., “silicon bronze”). See [I.2§1](#I.2§1).

Note: In common parlance, most copper alloy sculptures are referred to as “bronzes” regardless of the alloy’s actual elemental composition.

## Sources

### *Cultural Heritage Publications*

{Bayley 1991}

{Bassett 2008}, 274

{Dillon 2002}, 299

{Penny 1993}, 297

{Welter 2018}

### *Historical Sources*

{Buchanan 1903}, 24

### *Art and Craft Textbooks*

{Rome and Young 2003}, 302

### *Copper Industry*

{Brunhuber 1988}

{Campbell 2015}, 270

{Koch and Newell 1963}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/bronze>

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Bronze |  | {Weihrauch 1944}  {Maaz 2010}, 677  {Brunhuber 1988}  {Koch and Newell 1963} |
| French | [bronze](file:////vocabularies/bronze--fr) |  |  |
| Italian | bronzo |  | [Treccani](http://www.treccani.it/vocabolario/bronzo/)  [Treccani](https://www.treccani.it/enciclopedia/fusione_%28Enciclopedia-Italiana%29/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI02/GDLI_02_ocr_400.pdf&parola)  {Biringuccio [1540] 1990}, fols. 80v–81  {Brunhuber 1988} |
| Chinese | 铜锡合金 (literally “copper-tin alloy”) | 青铜 (this is a broad, colloquial term used for bronze) | {Ming 2010}, 1440 |

term: cast (n.)

language: en

images:

definition: A sculpture or more generally an object that is shaped by pouring a molten material or a slurry into a mold in which it will solidify. Plaster of paris, metal, and wax are among the cast-forming sculptural materials routinely involved in bronze production. The term may also refer to the amount of homogenous molten metal resulting from a single pour.

Note: Both “cast” and “casting” can be correctly used as nouns, but the former is more common.

## Synonyms

**casting**

### *Copper Industry*

{Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Guss | Gussstück | Alternate translations:  Gussstück: {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979} |
| French | [fonte](file:////vocabularies/fonte) |  |  |
| Italian | getto (foundry-specific term) | colata (a more general term that can be used to specify the pouring of plaster, wax, or molten metal)  gitto (early Italian form of *getto* that can refer to the cast object as well as the act of pouring) | [Treccani](http://www.treccani.it/vocabolario/getto/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI06/GDLI_06_ocr_730.pdf&parola=Getto)  {Baglione 1642}, 324–25  Alternate translations:  colata: [Treccani](https://www.treccani.it/enciclopedia/colata/)  colata: [Treccani](https://www.treccani.it/enciclopedia/fusione_%28Enciclopedia-Italiana%29)  colata: {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI03/GDLI_03_ocr_279.pdf&parola=Colata)  gitto: {Biringuccio [1540] 1990}, fol. 81 |
| Chinese | 铸件 | 铸品 | {Ming 2010}, 1828 |

term: cast (v.)

language: en

images: **fig. 549**

definition: In the sculptural context, the verb refers to pouring a slurry or liquefied material (e.g., plaster, wax, metal) into a hollow matrix or mold that will determine the shape of the material in order to produce a cast (n.).

## Sources

### *Cultural Heritage Publications*

{Boulton 2006}

### *Historical Sources*

{Buchanan 1903}

{Bolland 1894}

### *Copper Industry*

{Brunhuber 1988}

{Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/cast>

## Synonyms

**pour**

### *Copper Industry*

{Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | gießen |  | {Brunhuber 1988}  {Gesamtverband Deutscher Metallgiessereien 1982}  {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979} |
| French | [couler](file:////vocabularies/couler) |  |  |
| Italian | gettare (foundry-specific term that relates to the pouring of metal) | buttare (literally “to throw”)  colare (a more general term that can be used to specify the pouring of plaster, wax, or molten metal)  fondere (used in reference to the melting of the metal)  gittare  (early Italian spelling of *gettare*) | [Treccani](http://www.treccani.it/vocabolario/gettare/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI06/GDLI_06_ocr_726.pdf&parola=gettare)  Alternate translations:  buttare: {Battaglia 1961}, [here](http://www.gdli.it/JPG/GDLI02/00000472.jpg)  colare: [Treccani](https://www.treccani.it/vocabolario/colare1/)  fondere: [Treccani](http://www.treccani.it/vocabolario/fondere/)  fondere: {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI06/GDLI_06_ocr_137.pdf&parola=fondere)  fondere: {Leonardo 1490}, fol. 150r  gittare: {Leonardo 1490}, fol. 143  gittare: {Biringuccio [1540] 1990}, fols. 89v–90 |
| Chinese | 铸造 |  | {Ming 2010}, 1831  [TNATD](https://terms.naer.edu.tw/detail/11563468/?index=2) |

term: casting defect

language: en

images: **figs. 73, 150, 151, 153, 154, 155, 158, 159, 161**

definition: An unintended imperfection on a bronze that occurs during casting and appears as a more or less subtle discontinuity in the desired form and is associated with either a lack or an excess of metal. See [I.3](#I.3).

Note: Casting defects should not be confused with other defects generated before casting (e.g., imperfection in the model) or after casting (e.g., intentional alteration, wear due to use, or damage). Some authors separate casting defects into categories as either negative or positive ({Rome and Young 2003}).

## Sources

### *Art and Craft Textbooks*

{Rome and Young 2003}

### *Copper Industry*

{Ammen 1980}

{Campbell 2015}

{Neff 2011}

## Synonyms

**casting flaw**

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Gussfehler |  |  |
| French | [défaut de fonderie](file:////vocabularies/defaut-de-fonderie) |  |  |
| Italian | difetto di fusione | difetto di fonderia  manchevolezza (general term for describing defects) | {Pecchioli 1999}, 193  [Treccani](http://www.treccani.it/vocabolario/sbollitura/)  Alternate translations:  difetto di fonderia: {Carruba 2006}, 24  difetto di fonderia: {Pecchioli 1999}, 192  manchevolezza: [Treccani](https://www.treccani.it/enciclopedia/fusione_%28Enciclopedia-Italiana%29/) |
| Chinese | 铸瑕 | 铸疵  铸造缺陷 | [TNATD](https://terms.naer.edu.tw/detail/1009176/?index=1)  Alternate translations:  铸疵: [TNATD](https://terms.naer.edu.tw/detail/628170/?index=2)  铸造缺陷: {Ming 2010}, 1832 |

term: cast-on repair

language: en

images: **figs. 65, 123, 169, 177, 179, 180, 181, 182, 184, 196**

definition: A type of repair consisting of a localized cast of molten copper alloy to fill cavities or other %%casting defects**%%**. Cast-on repairs may fill a void in the sculpture or secure a separately formed %%patch%% or element to the cast. See [I.4](#I.4).

## To Be Distinguished From

**cast-on**

Note: The shortened term “cast-on” refers to a type of joint in which molten metal is used to join parts that were intentionally cast in sections.

## Sources

### *Cultural Heritage Publications*

{Dillon 2002}

{Salter and Gilmour n.d.}

{Motture and Martin 2001}, 222

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Überfangguss (literally “cast-on.” Generally used in reference to an ancient process. In German, the term describes everything related to casting-on: it designates indiscriminately a cast-on repair or a cast-on joint. *Überfanggussreparatur* might be invented to avoid confusion.) | Anguss  Angussverfahren  Angießverfahren (used in reference to modern processes) | {Drescher 1958}  {Willer 2016}  Alternate translations:  Angießverfahren: {Brunhuber 2001} |
| French | [réparation par coulée secondaire](file:////vocabularies/reparation-par-coulee-secondaire) |  |  |
| Italian | getto a incastro (more general term to denote casting on, could apply to joints and repairs; see German *Überfangguss*) | rifusione  rigetto | {Rohnstock 1999}  Alternate translations:  rifusione: {Morigi and Morigi 2008}  rigetto: {Morigi and Morigi 2008} |
| Chinese | 修补浇铸 | 浇补  补铸 | {Ming 2010}, 1585  Alternate translations:  浇补: {Ming 2010}, 740  浇补: [TNATD](https://terms.naer.edu.tw/detail/3457911/?index=3)  补铸: [TNATD](https://terms.naer.edu.tw/detail/3457911/?index=3) |

term: casting plan

language: en

images: **fig. 367**

definition: A methodological tool that has been developed by researchers to reverse engineer the casting sequence of a bronze sculpture and visually represent the separately cast parts. It is based on the evidence presented in the object and attempts to map the decisions made by a foundry regarding the number and position of separately cast pieces.

Note: %%Founders%% do not work with such charts or maps, although strategizing occurs at every stage (e.g., where joints in the wax or metal will occur).

## Sources

### *Cultural Heritage Publications*

{Mille and Descamps-Lequime 2017}

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Teilungsplan |  |  |
| French | [plan de coulée](file:////vocabularies/plan-de-coulee) |  |  |
| Italian | schema di fusione |  |  |
| Chinese | 分铸计划 |  |  |

term: chaplet

language: en

images: **figs. 38, 39, 40, 122**

definition: A type of metal insertion placed in the gap between the %%core%% and the outer mold as a spacer to hold the core in place during the casting operation. A number of these are placed strategically throughout the mold. They are most often made of an alloy similar to that of the surrounding metal, as they will become embedded in the cast. In modern foundries, chaplets are mainly used in %%sand casting%%, but they have been encountered in historic lost-wax castings as well.

Note: The term “chaplet” has occasionally been used in the context of technical studies to refer to nails or pins that extend from the core to the mold and serve to hold the core in place ({Beale 1975}, {Mattusch 1996}). More commonly these are referred to as %%core pins%%.

## To Be Distinguished From

**core nail**

**core pin**

**core rod**

**core support**

## Sources

### *Cultural Heritage Publications*

{Beale 1975}, 40

{Mattusch 1996}, 24

{Penny 1993}, 298

{Salter and Gilmour n.d.}

### *Art and Craft Textbooks*

{McCreight 1996}

### *Copper Industry*

{Brunhuber 1988}

{Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}

## Synonyms

**core plate**

### *Copper Industry*

{Brunhuber 1988}

**spacer**

### *Cultural Heritage Publications*

{Strahan 2010}

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Kernhalteplatte | Kernhalter | {Brunhuber 1988}  Alternate translations:  Kernhalter: {Willer 1994} |
| French | [cale à noyau](file:////vocabularies/cale-a-noyau) |  |  |
| Italian | chiodo distanziatore |  |  |
| Chinese | 墊片(this term has several translations, including “chaplet,” “shim,” “spacer,” “gasket,” etc.) | 撑头  芯撐  金属撑子 | {Ming 2010}, 272  {Zhang 2010}, 85  {Liu 2015}, 97  Alternate translations:  撑头: {Ming 2010}, 141  芯撐: [TNATD](https://terms.naer.edu.tw/detail/1262400/?index=4)  金属撑子: {Ming 2010}, 141 |

term: chasing

language: en

images: **figs. 105, 248, 249, 252, 253, 255, 511, 550**

definition: The process of fine detailed “cold work” after casting and %%fettling%% that serves to correct or enhance the cast surface by removing and/or compressing metal using hand tools by punching, %%engraving%%, and/or %%chiseling%%, and in modern times also with power and pneumatic tools.

Note: In common art historical usage, the term “chasing,” when used for bronze sculpture, refers specifically to all of the steps taken to embellish the surface of the cast after fettling. Modern founders include the detailed process of removing and repairing %%casting defects%%. In decorative arts, on the other hand, chasing of gilt bronze refers to the steps taken after filing to embellish the surface by compressing the metal (using punches), as opposed to %%engraving%%.

## To Be Distinguished From

**chiseling**

**engraving**

**fettling**

**punching**

Note: In modern foundries, fettling may be carried out by the founder using power tools, whereas “chasing” refers to finer work carried out by a specialized person—the chaser—preferentially with hand tools.

## Sources

### *Cultural Heritage Publications*

{Beale 1975}

{Penny 1993}, 298

{Dillon 2002}, 299

{Bassett 2008}, 274

### *Art and Craft Textbooks*

{Rome and Young 2003}, 273

{Untracht 1982}, 122

### *Other*

{Van Langh 2012}

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | ziselieren |  | {Maaz 2010}, 744  {Alscher 1987}, 555 |
| French | [ciselure](file:////vocabularies/ciselure) |  |  |
| Italian | rifinitura (not reserved specifically for metals) | rinettare (v.)  cesellare  ritocco a freddo (ritocco a freddo di dettagli) | [Treccani](https://www.treccani.it/enciclopedia/fusione_%28Enciclopedia-Italiana%29/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI16/GDLI_16_ocr_264.pdf&parola=rifinitura)  Alternate translations:  rinettare (v.): {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI16/GDLI_16_ocr_526.pdf&parola=rinettare)  cesellare: {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI03/GDLI_03_ocr_19.pdf&parola=cesellare)  ritocco a freddo: {Formigli 2010}, 20–21 |
| Chinese | 铸件表面加工 |  |  |

term: chiseling

language: en

images: **figs. 226, 249, 254, 278, 281, 550**

definition: Act of using a chisel and hammer to remove metal. With each strike of the hammer the tool jumps, often leaving a visible “step.” Chiseling may be part of either fettling or chasing.

Note: This term is sometimes incorrectly used to define all steps to remove metal as well as to compress it (actions that should be referred to as “chasing”). This is an inaccuracy possibly stemming from the French term *ciselure* (which translates to “chaser,” not “chiseler”).

## To Be Distinguished From

**chasing**

## Sources

### *Cultural Heritage Publications*

{Frel 1982}, 13

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/chiseling>

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | meißeln |  | {Bol 1985}, 139 |
| French | [travail au ciseau](file:////vocabularies/travail-au-ciseau) |  |  |
| Italian | scalpellatura | rifinitura a cesello  incisione a bulino  (note: *cesello* in Italian is used to refer to a punch, which is seldom a cutting tool, but rather a pushing tool with a rounded tip that exploits the malleability of some metals and displaces the worked area. *Bulino* is an engraver, which is a cutting tool used for engraving copper plates for printmaking, for instance.) | [Treccani](https://www.treccani.it/vocabolario/scalpellatura/)  Alternate translations:  incisione a bulino: {Battaglia 1961}, [here](file:///C:\Users\sherm\Desktop\Casting%20TO%20FINALIZE\:\www.gdli.it\pdf_viewer\Scripts\pdf.js\web\viewer.asp%3ffile=\PDF\GDLI07\GDLI_07_ocr_693.pdf&parola=incisione) |
| Chinese | 凿 (v., n.) | 錾 (v., n.)  镌 (v.)  雕 (v.) | {Ming 2010}, 1735  Alternate translations:  錾: {Ming 2010}, 1735 |

term: coating

language: en

images: **figs. 322, 323, 324, 326, 330**

definition: Purposefully applied surface deposits or films on bronze sculpture that consist of materials chemically different from the metal substrate. Their composition can vary widely, ranging from natural substances such as lacquer, resin, oil, and wax to synthetic resins. Coatings may be decorative and/or protective. In the study of Renaissance bronzes, for example, applied lacquer-like coatings are often referred to as “organic patinas.”

Note: Not to be confused with corrosion products or mineral compounds bonded to the metal surface, which fall under %%patina%%. Though metals are also used to coat surfaces, they are referred to here as %%plating%%.

## Sources

### *Art and Craft Textbooks*

{Hughes and Rowe 1989}, 45–46

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/coat>

### *Other*

{Weil 1977}

{Considine et al. 2010}, 94–95

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Überzug |  | {Koller and Baumer 2000} |
| French | [revêtement](file:////vocabularies/revetement) |  |  |
| Italian | rivestimento |  | [Treccani](https://www.treccani.it/vocabolario/rivestimento)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI16/GDLI_16_ocr_1065.pdf&parola=rivestimento)  {Giuffredi 2006}, 221 |
| Chinese | 涂层 | 涂料 | {Ming 2010}, 1448  [TNATD](https://terms.naer.edu.tw/detail/207700/?index=8)  Alternate translations:  涂料: {Ming 2010}, 1449  涂料: [TNATD](https://terms.naer.edu.tw/detail/627946/?index=6) |

term: cold shut

language: en

images: **figs. 6, 159**

definition: The interface where two streams of metal come together in the mold but do not fuse properly, often due to premature cooling of the metal in the mold. A cold shut may also describe a hole or void in a cast caused by premature cooling ({Rome and Young 2003}, 303). The cooled metal edges will be rounded in profile.

## To Be Distinguished From

**cold tearing**

Note: Cold tearing is generated by the same phenomenon as a cold shut, but leading to a crack.

## Sources

### *Cultural Heritage Publications*

{Bassett 2008}

### *Historical Sources*

{Bolland 1894}

{Buchanan 1903}

### *Copper Industry*

{Ammen 1980}

{American Foundry Society (AFS). n.d.}

{Palmer 1929}

### *Art and Craft Textbooks*

{Rome and Young 2003}, 303

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/cold%20shut>

## Synonyms

**cold-shot (alternate spelling)**

**cold-shut (alternate spelling)**

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Kaltguss | Kaltschweisse | {Brunhuber 1986} |
| French | [reprise](file:////vocabularies/reprise) |  |  |
| Italian | accostatura | giunzione fredda  solidificazione prematura |  |
| Chinese | 冷界 | 冷结  冷隔  流界 | [TNATD](http://terms.naer.edu.tw/detail/627912/?index=1)  Alternate translations:  冷结: {Ming 2010}, 883  冷隔: {Ming 2010}, 883  流界: [TNATD](http://terms.naer.edu.tw/detail/627912/?index=1) |

term: core

language: en

images: **figs. 8, 10, 57, 61, 69, 112, 428, 431, 473, 475**

definition: The portion of the %%refractory mold%% that defines the internal space in a hollow bronze sculpture. It may be formed in a variety of ways and is usually (but not always) made of similar material as that used for the outer portion of the mold. The term is also used as shorthand to refer to the material it is made of. A core is generally solid but may be hollow (see [GI§2.1.1](#GI§2.1.1)).

## Sources

### *Cultural Heritage Publications*

{Bassett and Fogelman 1997}

### *Historical Sources*

{Bolland 1894}

### *Copper Industry*

{Brunhuber 1988}

{Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}

{Palmer 1929}

### *Art and Craft Textbooks*

{Rome and Young 2003}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/core>

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Kern |  | {Brunhuber 1988}  {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}  {Willer 2016} |
| French | [noyau](file:////vocabularies/noyau) |  |  |
| Italian | anima (literally “soul”) | anima di fusione  maschio (early Italian term for core that literally translates as “male”)  nocciolo (early Italian term for core that means “nut”) | [Treccani](http://www.treccani.it/vocabolario/anima/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI01/GDLI_01_ocr_489.pdf&parola=anima)  {Giuffredi 2006}, 219  {Biringuccio [1540] 1990}, fols. 77–78  {Bruni 1994}, 81–82  {Brunhuber 1988}  Alternate translations:  anima di fusione: {Bruni 1994}, 81–82  maschio: {Leonardo 1490}, fols 156, 157v  maschio: {Biringuccio [1540] 1990}, fols. 77v and 84  nocciolo: {Cellini [1568] 1967}, fols. 48, 49 |
| Chinese | 芯型 | 芯范 | {Ming 2010}, 1573  Alternate translations:  芯范: {Zhang 2010}, 82 |

term: core support

language: en

images: **figs. 9, 16, 25, 42, 122, 195**

definition: A general term for a variety of metal or other features that reinforce or support the core during the casting process. This term is used in different ways depending on the context. In industry, it is applied to metal inserts or spacers that hold the core in place during the pour; therefore, %%core pins%%, %%chaplets%%, and %%mold extensions%% are examples of core supports. In cultural contexts, the term is applied to internal wires or rods that help strengthen the core during assembly of the casting model and/or during the pour. Generally reserved for smaller wires in projecting limbs, or wires and rods used to strengthen joints between separately molded wax sections in the indirect lost-wax process. For clarity, when the second definition is intended, the term “internal core support” should be used.

## Sources

### *Cultural Heritage Publications*

{Dillon 2002}

{Bassett 2008}

{Sturman 2004}

{Stone 2008}

### *Copper Industry*

{American Foundrymen’s Society 1984}

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Kernstütze |  | {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}  {Brunhuber 1988} |
| French | [support de noyau](file:////vocabularies/support-de-noyau) |  |  |
| Italian | chiodo di sostegno (same as “core pin”) | armatura interna  sopporto reggi anime  sostegno di bronzo (also found with alternative spelling: *sustegno*)  supporto dell’anima di fusione | [Treccani](https://www.treccani.it/enciclopedia/fusione_%28Enciclopedia-Italiana%29/)  Alternate translations:  sopporto reggi anime: {Brunhuber 1988}  sostegno di bronzo: {Biringuccio [1540] 1990}, fol. 82 |
| Chinese | 芯骨 |  | {Ming 2010}, 1572 |

term: core pin

language: en

images: **figs. 35, 36, 37, 122, 547**

definition: A metal rod, nail, or wire that is embedded in both the **core** and the outer mold and serves to secure the core in place during the pour. Core pins have traditionally been made of copper alloys, iron, or steel, and today are generally made of stainless steel.

Note: The term “transverse core pin” (or “transfixing core pin”) is used to describe long core pins that extend through both sides of the core (e.g., straight through a limb) (**figs. 35, 64, 122**).

## To Be Distinguished From

**chaplet**

**core plate**

**spacer**

Note: However, note that “spacer” has been used as a synonym for “core pin” in some technical studies in reference to ancient bronzes ({Mattusch 1996}, 22–24).

## Sources

### *Cultural Heritage Publications*

{Penny 1993}

{Lie and Bewer 2014}

{Mattusch 1996}, 22–24

### *Copper Industry*

{Brunhuber 1988}

{Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}

### *Art and Craft Textbooks*

{Rome and Young 2003}

### *General Dictionaries*

## Synonyms

**core nail**

**core rod**

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Kernstift |  | {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979} |
| French | [fer à noyau](file:////vocabularies/fer-a-noyau) |  |  |
| Italian | chiodo di sostegno (same as “core support”) | chiodo distanziatore  distanziatore | Alternate translations:  chiodo distanziatore: {Giumlia-Mair 1999}, 257  chiodo distanziatore: {Pecchioli 1999}, 193  distanziatore: {Bruni 1994}, 72 |
| Chinese | 支釘 | 銷釘 | Alternate translations:  銷釘: {Ming 2010}, 1559  銷釘: [TNATD](https://terms.naer.edu.tw/detail/625481/?index=3) |

term: corrosion

language: en

images: **figs. 310, 311, 312, 314, 315, 318, 334, 348, 503**

definition: A chemical process that causes a metal such as bronze to change from a metallic state into a chemically more stable mineral compound known as a corrosion product.

Note: Most metals undergo natural corrosion, except for pure so-called noble metals such as gold and platinum-group metals. A chemical patina refers to corrosion of the surface by either natural causes (e.g., burial) or the intentional application of chemicals. The minerals formed during the process may be similar to ones from which the metal was smelted or refined prior to manufacture. Sometimes artificially induced chemical patinas intentionally mimic natural corrosion products.

## Sources

### *Cultural Heritage Publications*

{Gettens 1970}

{Scott 2002}

{Chase 1994}

{Selwyn and Canadian Conservation Institute 2004}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/corrosion>

### *Other*

{Scott 1991}, 43–47, 81

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Korrosion |  |  |
| French | [corrosion](file:////vocabularies/corrosion--fr) |  |  |
| Italian | corrosione |  | [Treccani](http://www.treccani.it/vocabolario/corrosione)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI03/GDLI_03_ocr_845.pdf&parola=corrosione) |
| Chinese | 腐蚀 | 锈蚀 | {Ming 2010}, 452  [TNATD](https://terms.naer.edu.tw/detail/655779/?index=2)  Alternate translations:  锈蚀: {Ming 2010}, 1586  锈蚀: [TNATD](https://terms.naer.edu.tw/detail/175745/?index=10) |

term: edition

language: en

images: **figs. 1, 261, 551**

definition: The intentional production of a sculpture in several virtually identical casts, usually from the same set of molds derived from the original model. In modern castings, item number and total number of multiples produced is often reported somewhere on the surface, as it has legal value.

Note: Casts from any given edition will be essentially identical in form and size (understanding that within an edition, different bases may be used, and there may be variations in how the edition is mounted), yet may vary owing to casting flaws or differences in chasing, patination, or deterioration of the molds/chef-modèle over time. Whereas before the nineteenth century it was rare for replicas to be made without small variations (hence the use of the term “versions”), modern bronze casting practice is more consistent, and generally predicated on the notion of editions. Starting in the early twentieth century, it became common practice to mark casts with their individual number within an edition.

## To Be Distinguished From

**copy**

**replica**

**version**

**variant**

## Sources

### *Cultural Heritage Publications*

{Bassett and Fogelman 1997}, 32

{Beale 1975}

{Dillon 2002}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/edition>

## Synonyms

**editioned replica**

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Auflagenguss | Edition | {Maaz 2010}, 671, 683  Alternate translations:  Edition: {Mietzsch 2009}, 103 |
| French | [édition](file:////vocabularies/edition--fr) |  |  |
| Italian | edizione | multiplo (in the arts, specifies that the cast is not a one-off but part of a group of essentially identical sculptures)  serie (correctly describes the presence of a number of issued sculptures; less used in artwork because production “in serie” has a less valuable industrial production meaning) | [Treccani](http://www.treccani.it/vocabolario/edizione)  Alternate translations:  multiplo: [Treccani](https://www.treccani.it/enciclopedia/multiplo/) |
| Chinese | 版本 | 翻版 | {Ming 2010}, 310  [TNATD](https://terms.naer.edu.tw/detail/7644588/?index=2) |

term: engraving

language: en

images: **figs. 241, 243, 254, 276, 279, 280, 495**

definition: In relation to bronzes, the process of decorating the surface by removing material with a chisel, burin, or graver that creates a V-shaped groove.

Note: Engraving may be undertaken in the chasing process, and/or to form or enhance signatures. See [I.6§2.3](#I.6§2.3).

## To Be Distinguished From

**chasing**

## Sources

### *Cultural Heritage Publications*

{Beale 1975}, 43

### *Copper Industry*

{Brunhuber 1988}

{Maskinaktiebolaget Karlebo 1982}

### *Art and Craft Textbooks*

{Untracht 1982}, 283

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/engraving>

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | gravieren | Gravur | {Brunhuber 1988}  Alternate translations:  Gravur: {Weihrauch 1944}  Gravur: {Brunhuber 1988}  Gravur: {Maskinaktiebolaget Karlebo 1982} |
| French | [gravure](file:////vocabularies/gravure) |  |  |
| Italian | incisione |  | [Treccani](http://www.treccani.it/vocabolario/incisione/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI07/GDLI_07_ocr_693.pdf&parola=incisione)  {Brunhuber 1988}  {Maskinaktiebolaget Karlebo 1982} |
| Chinese | 阴刻 | 雕刻 | [TNATD](https://terms.naer.edu.tw/detail/3608499/?index=3)  Alternate translations:  雕刻: {Ming 2010}, 310  雕刻: [TNATD](https://terms.naer.edu.tw/detail/14191105/?index=9) |

term: fettling

language: en

images: **figs. 104, 552**

definition: Steps carried out directly after casting to remove unwanted features, including oxidized metal, %%sprues%%, %%core pins%%, %%flashing%%, etc. Fettling may entail the use of power tools and/or hand tools such as saws, chisels, hammers, coarse files, and abrasives.

## To Be Distinguished From

**chasing**

## Sources

### *Cultural Heritage Publications*

{Salter and Gilmour n.d.}, 23

{Penny 1993}

### *Copper Industry*

{Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}

### *Art and Craft Textbooks*

{Untracht 1982}

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Abgraten | Entgraten  Fertigputzen  Putzen (this term is used primarily in the modern casting industry and for mass production; in an art foundry it is not always distinguished as a separate step from chasing [*Ziselieren*] and is generally not used) | {Association Technique de {Fonderie, Commission Ingénieurs et Techniciens 1979}  Alternate translations:  Entgraten: {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}  Fertigputzen: {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}  Putzen: {Brunhuber 1986}, 747 |
| French | [réparure](file:////vocabularies/reparure) |  |  |
| Italian | rifinitura (similar word used for chasing) | sbavatura (removal of flashing or traces of sprues)  sgrossatura (designates more specifically the quick removal prior to chasing; see **chiseling**) | [Treccani](https://www.treccani.it/enciclopedia/fusione_%28Enciclopedia-Italiana%29/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI16/GDLI_16_ocr_264.pdf&parola=rifinitura)  Alternate translations:  sbavatura: [Treccani](http://www.treccani.it/vocabolario/sbavatura1/)  sbavatura: {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI17/GDLI_17_ocr_671.pdf&parola=sbavatura)  sgrossatura: {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI10/GDLI_10_ocr_700.pdf&parola=sgrossatura) |
| Chinese | 清砂 | 修整  清理  精整 | {Ming 2010}, 1164  Alternate translations:  修整: [TNATD](https://terms.naer.edu.tw/detail/634620/?index=3)  清理: {Ming 2010}, 1828  清理: [TNATD](https://terms.naer.edu.tw/detail/627107/?index=2)  精整: [TNATD](https://terms.naer.edu.tw/detail/14194174/?index=5) |

term: flashing

language: en

images: **figs. 6, 59, 61, 77, 90, 249, 545**

definition: A ridge of excess metal that can occur when molten metal enters cracks in the refractory mold (both outer and core). Flashing most often rises perpendicularly to the inner or outer wall of bronze, although a gap in consecutive layers of the mold material may result in thin flanges of excess bronze that spread parallel to the metal wall. This type of feature can appear on the cast’s internal or external surfaces (respectively called “core flashing” and “mold flashing”), and in the latter case is often removed during fettling. Flashing may also occur along seam lines of an ill-fitted piece mold.

## To Be Distinguished From

**seam line**

Note: The term “flashing” is also used to describe a seam line, but to avoid confusion, we recommend that it be used specifically in connection with casting defects.

## Sources

### *Cultural Heritage Publications*

{Beale 1975}, 41

### *Copper Industry*

{Ammen 1980}

{Brunhuber 1988}

{Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}

### *Art and Craft Textbooks*

{McCreight 1996}

## Synonyms

**finning**

### *Copper Industry*

{Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}

**veining**

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Grat | Gussgrat |  |
| French | [gerce](file:////vocabularies/gerce) |  |  |
| Italian | bava | cresta di fusione | [Treccani](https://www.treccani.it/enciclopedia/sbavatura/)  {Biringuccio [1540] 1990}, fol. 78  Alternate translations:  cresta di fusione: {Carruba 2006}, 24  cresta di fusione: {Pecchioli 1999}, 192 |
| Chinese | 毛边 | 溢料  溢边  飞边 | {Ming 2010}, 997  Alternate translations:  溢料: [TNATD](https://terms.naer.edu.tw/detail/11553389/)  溢边: [TNATD](https://terms.naer.edu.tw/detail/11553389/)  飞边: {Ming 2010}, 409  飞边: [TNATD](https://terms.naer.edu.tw/detail/11553389/) |

term: founder

language: en

images: **fig. 546**

definition: Expert head of the foundry or the person who pours the metal. Person(s) responsible for the translation of the artist’s sculptural model into cast metal sculptures. This may entail a variety of specialized operations, from mold making to wax chasing, alloying, casting, fettling, assembling, chasing, and patination. The artist may in some cases also take on one or more of these roles.

## Sources

### *Cultural Heritage Publications*

{Boulton 2006}

### *Historical Sources*

{Buchanan 1903}

### *Copper Industry*

{Brunhuber 1988}

{Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}

### *Art and Craft Textbooks*

{Wikipedia n.d.}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/founder>

## Synonyms

**foundryman**

### *Copper Industry*

{Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}

**foundrywoman**

**foundryworker**

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Giesser | Giessereieinhaber  Giessereifachman  Giessereileiter  Giessereiunternehmer  Schmelzmeister (this designates the operator standing next to the furnace and deciding when to pour the molten metal in the mold) | {Brunhuber 1988}  {Gesamtverband Deutscher Metallgiessereien 1982}  Alternate translations:  Giessereieinhaber: {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}  Giessereifachman: {Brunhuber 1988}  Giessereifachman: {Gesamtverband Deutscher Metallgiessereien 1982}  Giessereileiter: {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979} |
| French | [fondeur](file:////vocabularies/fondeur) |  |  |
| Italian | artefice (many sources used the general terms *artefice* or *maestro* to refer to founders) | fonditore  fusore  gettatore  maestro  tragettatore | {Biringuccio [1540] 1990}, fols. 75–76  Alternate translations:  fonditore: [Treccani](https://www.treccani.it/vocabolario/ricerca/fonditore/)  fonditore: {Morigi and Morigi 2008}  fonditore: {Bruni 1994}  gettatore: {Cellini [1568] 1967}, fols. 51v, 55  maestro: {Cellini 1996}, 668  maestro: {Biringuccio [1540] 1990}, fols. 75–76  tragettatore: {Baglione 1642}, 327  tragettatore: {Marconi 2004}, 71n71 |
| Chinese | 铸工 | 铸造工 | [TNATD](https://terms.naer.edu.tw/detail/626946/?index=3)  Alternate translations:  铸造工: {Ming 2010}, 1831 |

term: foundry model

language: en

images: **figs. 210, 531, 544, 553, 554**

definition: A general term for any model or replica of the artist’s model that is used to make a mold. It is made by the foundry in order to preserve the artist’s model. A foundry model may also be used as a reference for the finishing of a bronze for the purpose of quality control.

Note: In sand casting, a foundry model is referred to as a “pattern” or “%%chef-modèle%%.”

## Sources

### *Cultural Heritage Publications*

{Boulton 2006}

{Beale 1975}

{Beentjes 2019}

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Ausführungsmodell |  | {Maaz 2010}, 671 |
| French | [modèle de fonderie](file:////vocabularies/modele-de-fonderie) |  |  |
| Italian | forma da gittar di bronzo | modello di fonderia | {Biringuccio [1540] 1990}, fol. 82v |
| Chinese | 铸型 |  |  |

term: gilding

language: en

images: **figs. 287, 290, 293, 294, 295, 296, 297, 299, 301, 555**

definition: The application of gold to the surface of a bronze sculpture. This can be achieved by a variety of methods. Traditionally gilding was mainly undertaken using leaf gilding or mercury gilding. Starting in the nineteenth century, electrochemical plating or deposition began to be used, as well as gold powder paint or wax. See [I.7](#I.7).

## Sources

### *Cultural Heritage Publications*

{Drayman-Weisser 2000}

{Oddy 1993}

{Salter and Gilmour n.d.}

{Motture 2019}, 39

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Vergoldung |  | {Lein 2004}, 58 |
| French | [dorure](file:////vocabularies/dorure) |  |  |
| Italian | doratura |  | [Treccani](http://www.treccani.it/vocabolario/doratura/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI04/GDLI_04_ocr_970.pdf&parola=doratura)  {Cellini [1568] 1967}, fol. 41 |
| Chinese | 镀金 | 鎏金 (although literally translates to “fire-gilding,” it is widely used as a general term for gilding of ancient works) | {Ming 2010}, 328  [TNATD](https://terms.naer.edu.tw/detail/633619/?index=1) |

term: inlay

language: en

images: **figs. 309, 340, 342, 343, 345, 346, 349, 351, 365**

definition: Decorative element on a sculpture usually added for visual contrast through color and/or texture. The top surface of an inlay is generally flush with the surrounding metal. A wide range of attachment methods may be used, including solder, adhesives, cements, burrs, undercuts, and/or rivets, but the basic technique involves shaping the inlay and incising the ground metal to produce a cavity of the inlay shape. Inlay materials may include metals, glass, stone, or bone, among others.

Note: The terms “inlay” and “%%overlay%%” are often used indiscriminately, but they differ in one main regard: inlays are inserted into the bronze surface, whereas overlays are set on top of the surface.

## To Be Distinguished From

**encrustation**

**foil**

**incrustation**

**overlay**

## Sources

### *Cultural Heritage Publications*

{Hemingway and Abramitis 2017}

### *Art and Craft Textbooks*

{Untracht 1982}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/inlay>

## Synonyms

**damascene**

This term is often used interchangeably to describe inlays and/or overlays, especially in iron or steel arms and armor and decorative metalwork. As the term is imprecise and more applicable to those types of materials, we recommend it not be used in the context of bronze casting. The term “false damascening” is somewhat of a misnomer, as it is a different technique that renders a similar visual result: instead of cutting recesses, the metal is superficially scored and thin metal foil or wire is hammered onto the surface. Since this joint may be weak, the surface is heated to further fuse the two metals. Visually the two techniques appear similar. On this topic see also the [Philadelphia Museum of Art website](http://www.philamuseum.org/booklets/7_43_81_1.html).

### *Art and Craft Textbooks*

{Untracht 1982}

**incrustation**

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Einlage (in principle more general [actually a direct translation of “inlay”]) | Tauschierung (only if the inlay is of linear character, e.g., wires; you wouldn´t speak of a *Tauschierung* in the case of inlaid silver eyes) | {Cüppers 1994}, 1013–16  Alternate translations:  Tauschierung: {Lein 2004}, 63 |
| French | [damasquinure](file:////vocabularies/damasquinure) |  |  |
| Italian | agemina (a decorative process usually performed on steel and copper alloys, with thin silver wires in an undercut groove on the surface) | damaschinatura (more specifically referring to inlaid decoration on bronze, brass, or iron with contrasting colored metals)  inserto  intarsio (general term referring to the insertion of different materials on a decorated surface)  lavori di tanccia (as in “Damascho fanno gli azzimini che commetteno in quei loro vasi pezzetti d’oro...”; see {Biringuccio [1540] 1990}, 373; note that translators Smith and Gnudi assume this is a misprint) | [Treccani](https://www.treccani.it/vocabolario/ricerca/agemina/)  Alternate translations:  intarsio: [Treccani](http://www.treccani.it/vocabolario/intarsio/)  intarsio: {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI08/GDLI_08_ocr_176.pdf&parola=intarsio)  lavori di tanccia: {Biringuccio [1540] 1990}, fol. 373 |
| Chinese | 镶嵌 |  | {Ming 2010}, 1554  [TNATD](https://terms.naer.edu.tw/detail/11566239/?index=5) |

term: inter-model

language: en

images: **figs. 1, 16, 41, 55, 72, 556**

definition: Replica in wax obtained from the reusable %%mold**%%** of an original %%model%%. Inter-models are used in indirect %%lost-wax casting%%. Inter-models are often slush molded (**fig. 16**, [Case Study 7](#CaseStudy7)). One inter-model may vary from another through additions or changes made in the wax before the %%investment%% is applied.

Note: The term is subject to dispute among the CAST:ING members. Depending on discipline and expertise, some initially preferred “wax working model,” “wax intermediary model,” or simply “wax.” The current term was finally agreed upon. An inter-model is a type of casting model or foundry wax, but the latter two refer to any wax model that is destroyed during casting, including those used in direct or indirect lost-wax casting processes.

## Sources

### *Cultural Heritage Publications*

{Motture 2019}

{Dillon 2002}

{Beentjes 2019}

## Synonyms

**intermediary model**

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Wachsmodell |  | {Alscher 1987}, 554  {Mietzsch 2009}, 6 |
| French | [modèle intermédiaire](file:////vocabularies/modele-intermediaire) |  |  |
| Italian | modello intermedio |  |  |
| Chinese | 范制蜡型 |  |  |

term: investment

language: en

images: **figs. 5, 13, 16, 557, 558**

definition: The term can refer to the %%refractory mold%% used in the %%lost-wax casting%% process or to the material used to make that mold. It also denotes the process of coating or embedding the wax model in this material and is applicable to clay-based, plaster-based, and ceramic shell molds. In all of these, the first layers have a special, fine consistency that is designed to pick up the detail and avoid problems during casting; the later layers are coarser. Clay-based investment may also be referred to as “loam.” The investment is destroyed to free the cast bronze.

## Sources

### *Cultural Heritage Publications*

{Motture 2019}, 35

{Salter and Gilmour n.d.}

### *Art and Craft Textbooks*

{Untracht 1982}

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Formmantel | Gussmantel | {Alscher 1987}, 554  Alternate translations:  Gussmantel: {Maaz 2010}, 706 |
| French | [moule de potée](file:////vocabularies/moule-de-potee) |  |  |
| Italian | forma (the variety of terms is due to regional differences in foundry terminology. *Forma* is the total of all layers of investments ready to cast. *Camicia* or *tunica* are the first fine refractory clay layer applied directly on the wax. *Mantello* or *cappa* are the second, coarser layer, often made of refractory clay, thick cloths, or iron belts to help contain the pressure developing during the pour. See **refractory mold**.) | camicia (literally “shirt”)  cappa (layer of the investment mold)  chappa (early Tuscan spelling of *cappa*)  mantello (di fusione) (used in the way defined here under the long entry “fusione” for the casting of bells under the paragraph “formatura” in Treccani)  refrattario (refers to the investment material and investment mold)  terra da forme (refers to the investment material)  tunica (*tonaca di terra*, and even more often: *involucro*) | {Morigi 1990}, quaderni di restauro, 3  {Pecchioli 1999}, 193  {Leonardo 1490}, fols. 154v, 142v  {Biringuccio [1540] 1990}, fols. 77v–78  Alternate translations:  camicia: {Biringuccio [1540] 1990}, fol. 95  chappa: {Leonardo 1490}, fol. 156v  mantello (di fusione): [Treccani](https://www.treccani.it/enciclopedia/fusione_%28Enciclopedia-Italiana%29/)  mantello (di fusione): {Carruba 2006}, 24  mantello (di fusione): {Formigli and Hackländer 1999}, 301  refrattario: {Bruni 1994}, 75  terra da forme: {Biringuccio [1540] 1990}, fols. 76v, 80v  tunica: [Treccani](https://www.treccani.it/enciclopedia/fusione_%28Enciclopedia-Italiana%29/) |
| Chinese | 熔模 | 熔模材料  耐火材料 | Alternate translations:  熔模材料: {Ming 2010}, 1214  耐火材料: {Ming 2010}, 1036  耐火材料: {Hua 2013}, 347 |

term: lost-wax casting

language: en

images: **figs. 13, 16, 18, 23, 25, 28**

definition: A technique in which a model made of wax is embedded in a %%refractory mold%% that is heated, thereby melting out the wax and creating a void to be filled with molten metal. Two primary variations of the technique are referred to as “direct” or “indirect” lost-wax casting, depending on whether the original model is the one sacrificed in the process. See [GI§2](#GI§2).

Note: The French term “cire perdue” is often adopted in English as well. The wax model can be supplemented by other materials that can be burned out, such as cloth.

## Sources

### *Cultural Heritage Publications*

{Penny 1993}

{Beale 1975}

{Mattusch 1996}

{Motture 2019}

### *Other*

{Untracht 1968}

## Synonyms

**investment casting**

**lost wax casting (alternate spelling)**

**lost-wax molding**

### *Copper Industry*

{Koch and Newell 1963}

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Wachsausschmelzverfahren | Modellausschmelzverfahren | {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}  {Müller 2014}, 167  Alternate translations:  Modellausschmelzverfahren: {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979} |
| French | [fonte à la cire perdue](file:///C:\vocabularies\fonte-a-la-cire-perdue) |  |  |
| Italian | fusione a cera persa | fusione a cera perduta | [Treccani](http://www.treccani.it/vocabolario/cera1/)  {Giuffredi 2006}, 61–62  Alternate translations:  fusione a cera perduta: [Treccani](http://www.treccani.it/vocabolario/cera1/) |
| Chinese | 失蜡法 | 失蜡铸造 | [TNATD](https://terms.naer.edu.tw/detail/3610078/?index=4)  Alternate translations:  失蜡铸造: {Ming 2010}, 1286  失蜡铸造: [TNATD](https://terms.naer.edu.tw/detail/3610078/?index=4) |

term: model

language: en

images: **figs. 1, 52, 75, 130, 472, 559**

definition: The creation of a bronze may involve a series of models and %%molds%% that can differ in size and material depending on the artist’s design process, and ultimately also on the casting process chosen to create the bronze version. The model is a positive version of the sculpture (as opposed to the negative mold); the word may refer to any work made as a step in the preparation of a finished sculpture, at any stage. An existing artwork or a live subject may also serve as model for a bronze. See [I.1](#I.1).

Note: When used in reference to general sculptural practice, the term may refer to a rough sketch made in order to work out the composition (*bozzetto*, *modello*, *esquisse*, or *maquette*) or to a more complete model (“presentation model”), sometimes used to obtain approval from a patron or as a record or reference. Because a cast may be the outcome of numerous steps of models and molds, it may be best to refer to the closest model of a cast as “precursor model” (e.g., the wax model melted out of the investment to create a particular lost-wax cast) since it can be difficult to identify the relationship of a bronze cast to the earliest model in its genealogy. “Precursor model” is a term newly proposed here.

## Sources

### *Cultural Heritage Publications*

{Dillon 2002}

{Motture 2019}

### *Art and Craft Textbooks*

{McCreight 1996}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/model>

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Modell |  | {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}  {Fleming and Tilch 1993}, 127 |
| French | [modèle](file:////vocabularies/modele) |  |  |
| Italian | modello | forma (can refer to both the model and the mold, which leads to potential confusion)  forma da gittar di bronzo (this is the wax model that is used for casting, thus also possibly referring to the inter-model) | [Treccani](http://www.treccani.it/vocabolario/modello/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI10/GDLI_10_ocr_653.pdf&parola=modello)  {Cellini [1568] 1967}, fol. 46  Alternate translations:  forma da gittar di bronzo: {Biringuccio [1540] 1990}, fols. 82v |
| Chinese | 模 |  | {Hua 2013} |

term: refractory mold

language: en

images: **figs. 7, 27, 542, 549, 557**

definition: A temporary, heat-resistant, cohesive, porous mass that captures the fine impression of the model to be reproduced and forms the void into which the molten metal will be cast. Investment, green sand, and ceramic shell are examples of refractory molds.

Note: When present, the core is considered part of the refractory mold. It may be designated as the inner refractory mold as opposed to the outer refractory mold. The material used for the refractory mold tends to be similar to—if not the same as—that of the core. To avoid confusion between types of refractory molds, spelling out the nature of the mold is recommended. An %%investment%% is a type of refractory mold used specifically for lost-wax casting.

## Sources

### *Cultural Heritage Publications*

{Bourgarit et al. 2003}, 119

{Lie and Bewer 2014}

### *Copper Industry*

{Brunhuber 1988}

{Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}

## Synonyms

**fire-resistant mold**

**heat-resistant mold**

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Form | Giessform | {Wallack 1840}  {Müller 1902}  {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}  Alternate translations:  Giessform: {Brunhuber 1988}  Giessform: {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979} |
| French | [moule réfractaire](file:////vocabularies/moule-refractaire) |  |  |
| Italian | camicia (also refers to the refractory investment material) | cappa (also refers to investment)  chappa (refers to outer investment/refractory mold)  forma (also refers to investment)  mantello (refers to outer investment/refractory mold)  refrattario (also refers to the refractory investment material)  stampo refrattario | {Biringuccio [1540] 1990}, fol. 95  Alternate translations:  cappa: {Bruni 1994}, 750  chappa: {Leonardo 1490}, fol. 156v  forma: {Morigi 1990}, quaderni di restauro, 1  forma: {Biringuccio [1540] 1990}, fols. 80v, 82  forma: {Leonardo 1490}, fols. 54v, 142v  forma: {Brunhuber 1988}  mantello: {Formigli and Hackländer 1999}, 301  refrattario: {Bruni 1994}, 75 |
| Chinese | 耐火模具 |  | {Ming 2010}, 1037 |

term: overlay

language: en

images: **figs. 223, 340, 346, 347**

definition: Decorative element resting on the surface of a sculpture via any of a variety of attachment methods, including solder, adhesives, cements, and/or rivets. Overlay materials may include a range of materials, among them metals, glass, stone, or bone.

Note: The terms “%%inlay%%” and “overlay” are often used indiscriminately, but they differ in one main regard: inlays are inserted into the bronze surface, whereas overlays are set on top of the surface.

## To Be Distinguished From

**coating**

**damascene**

**incrustation**

**inlay**

## Sources

### *Cultural Heritage Publications*

{Hemingway and Abramitis 2017}

### *Art and Craft Textbooks*

{Untracht 1982}, 315

## Synonyms

**encrustation**

### *Art and Craft Textbooks*

{Untracht 1982}, 315

**foil**

**incrustation**

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Auflage | Überzug (German has no noun for the technique of overlaying by mechanical attached sheet metal; there is just an adjective: *goldbeschlagen*, *silberbeschlagen*) | Alternate translations:  Überzug: {Lein 2004}, 51 |
| French | [placage](file:////vocabularies/placage) |  |  |
| Italian | incrostazione | riporto (rare and not very specific) | Alternate translations:  riporto: [Treccani](http://www.treccani.it/vocabolario/riporto/)  riporto: {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI16/GDLI_16_ocr_696.pdf&parola=riporto) |
| Chinese | 包覆 | 覆盖 | {Ming 2010}, 36  Synonynms:  覆盖: [TNATD](https://terms.naer.edu.tw/detail/643624/?index=2) |

term: patch

language: en

images: **figs. 35, 65, 125, 166, 168, 170, 172, 173, 187, 194, 198**

definition: A type of repair most often mechanically set into the bronze surface, but which may also be soldered, welded, or cast into place (see [I.4](#I.4)). Patches are most often made of cut-out pieces of copper alloy that are the same as that of the cast metal, but they may be of a different alloy or metal (e.g., lead).

## To Be Distinguished From

plug

## Sources

### *Cultural Heritage Publications*

{Bassett 2008}, 280, 283

{Dillon 2002}, 301–2

{Mattusch 1996}, 169–70

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/patch>

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Flicken |  | {Meissner, Haber, and Mach 2000}, 102  {Maaz 2010}, 688 |
| French | [plaquette de réparation](file:////vocabularies/plaquette-de-reparation) |  |  |
| Italian | laminetta ad incastro | tassellatura  tassello | {Pecchioli 1999}, 192–93  Alternate translations:  tassellatura: {Pecchioli 1999}, 193  tassellatura: [Treccani](https://www.treccani.it/vocabolario/tassellatura/)  tassello: [Treccani](https://www.treccani.it/vocabolario/tassello1/)  tassello: {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI20/GDLI_20_ocr_765.pdf&parola=tassello) |
| Chinese | 补修 (v., n.) | 补修料 (literally “material used as a patch”)  补片  补缀 (v., n.) | [TNATD](https://terms.naer.edu.tw/detail/625599/?index=1)  Alternate translations:  补修料: [TNATD](https://terms.naer.edu.tw/detail/625599/?index=1)  补片: [TNATD](https://terms.naer.edu.tw/detail/643120/)  补缀: [TNATD](https://terms.naer.edu.tw/detail/625599/?index=1) |

term: patina

language: en

images: **figs. 293, 306, 307, 308, 309, 313, 314, 323, 326, 328, 332, 338, 503**

definition: The term has at least three different meanings: 1) a pleasing surface alteration acquired over time—whether on a bronze or marble sculpture, furniture, or a painting—that may add aesthetic value; 2) the chemical transformation of a metal surface to a mineral layer (sometimes referred to as chemical patina, see %%corrosion%%) that usually has a different color from and reduces the bright metallic reflectance of the polished original cast surface; or 3) (as opposed to chemically induced patinas) organic %%coatings%% such as resin, lacquer, oil, wax, or synthetic resins applied to the surface of metals that can change the color, texture, saturation, and/or reflectance.

Note: Some researchers do not consider applied organic coatings part of the patina layer.

## Sources

### *Cultural Heritage Publications*

{Weil 1996}, 394–414

{Ward 2008}

### *Historical Sources*

{Hiorns 1907}, 62–63

{Littre 1873}

### *Copper Industry*

{Brunhuber 1988}

{Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}

### *Art and Craft Textbooks*

{Fishlock 1962}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/patina>

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Patina |  | {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979} |
| French | [patine](file:////vocabularies/patine) |  |  |
| Italian | patina |  | {Giuffredi 2006}, 144, 220  [Treccani](http://www.treccani.it/vocabolario/patina/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI12/GDLI_12_ocr_829.pdf&parola=patina)  {Bruni 1994}, 126–28  {Brunhuber 1988} |
| Chinese | 古色 (this term is more commonly used in art historical references and means “an aged surface accumulated over time”) | 铜绿 (there is no general term in Chinese for patina as defined here; this term can be translated as “green corrosion on copper” and is used specifically for ancient works)  铜锈 (there is no general term in Chinese for patina as defined here; this term can be translated as “corrosion on copper” and is used specifically for ancient works)  陈年色泽 (more commonly used in art historical references, meaning “an aged surface accumulated over time”) | Alternate translations:  铜绿: [TNATD](file:///C:\Users\sherm\Desktop\Casting%20TO%20FINALIZE\F6QU2HHA(p.%20https:\terms.naer.edu.tw\detail\643113\%3findex=3)  铜锈: [TNATD](file:///C:\Users\sherm\Desktop\Casting%20TO%20FINALIZE\F6QU2HHA(p.%20https:\terms.naer.edu.tw\detail\643113\%3findex=3)  陈年色泽: [TNATD](https://terms.naer.edu.tw/detail/3610266/?index=6) |

term: peening

language: en

images: **fig. 246**

definition: The act of embellishing/texturing the metal surface by repeatedly using a peen (*pein*) hammer (which has one rounded end and one flat end) to disguise porosity or other surface flaws and create a faceted effect. The term also refers to the type of tightly textured effect created by this process.

Note: The surface markings can be similar to those made by a punch and thus easily misidentified. In sand casting, the term refers to compressing the sand with the peen end of a rammer.

## Sources

### *Cultural Heritage Publications*

{Smith 2015}

### *Historical Sources*

{Bolland 1894}, 298

### *Copper Industry*

{Palmer 1929}, 294

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Hämmern |  | {Bol 1985}, 142 |
| French | [matage au marteau](file:////vocabularies/matage-au-marteau) |  |  |
| Italian | martellatura |  | [Treccani](http://www.treccani.it/vocabolario/martellatura/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI09/GDLI_09_ocr_847.pdf&parola=martellatura) |
| Chinese | 轻敲 | 锤平 | [TNATD](https://terms.naer.edu.tw/detail/625557/?index=1)  Alternate translations:  锤平: [TNATD](https://terms.naer.edu.tw/detail/625557/?index=1) |

term: piece mold

language: en

images: **figs. 9, 15, 18, 25, 26, 62, 74, 111, 116, 536, 556**

definition: A type of %%mold%% comprised of two or more individually formed, interlocking sections designed to circumvent undercuts and/or be disassembled without damage to the model or to the mold sections. Most often refers to molds made of a rigid material such as plaster. Smaller piece-mold sections are generally held together by a rigid outer mother mold. Starting in the nineteenth century, flexible piece molds (at first gelatin, later replaced by rubber, alginate, and silicone molds) were used instead of plaster, reducing the overall number of sections required to make a wax cast.

Note: Sometimes very large sculptures—both reliefs and in the round—need to be broken into smaller sections simply to avoid excessive suction or vacuum when removing the mold from the model. In the context of bronze sculpture, the term may denote molds used to cast %%inter-models%% in the indirect lost-wax process. Sand casting molds are also piece molds formed by compacting the sand in discrete portions around a rigid pattern. In the piece-mold casting process (aka “section-mold process”), baked %%refractory mold%% clay and loess—a fine-grained refractory soil found throughout northern China—are used to make piece molds into which bronze is poured (see [Case Study 3](#CaseStudy3)).

## Sources

### *Cultural Heritage Publications*

{Beale 1975}

{Boulton 2006}

### *Art and Craft Textbooks*

{Rich 1988}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/piece%20mold>

## Synonyms

**piece-mold (alternate spelling)**

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Stückform | mehrteilige Form |  |
| French | [moule à pièces](file:////vocabularies/moule-a-pieces) |  |  |
| Italian | forma a tasselli (*tassello* is a piece of a mold. In Treccani, the description refers uniquely to sand casting. Biringuccio describes forming a clay mold in pieces with locking parts he calls *incastrature*.) | calco a tasselli (this process and phrase are mentioned in the Treccani entry for *fusione* under *fusione a cera persa*) | [Treccani](https://www.treccani.it/vocabolario/tassello1/)  {Biringuccio [1540] 1990}, fols. 80v–81  {Bruni 1994}, 53–55  Alternate translations:  calco a tasselli: [Treccani](https://www.treccani.it/enciclopedia/fusione_%28Enciclopedia-Italiana%29/)  calco a tasselli: {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI02/GDLI_02_ocr_534.pdf&parola=calco) |
| Chinese | 块范 | 范块 | Alternate translations:  范块: {Zhang 2010}, 80 |

term: plug

language: en

images: **figs. 177, 178, 193, 195, 197, 478**

definition: A type of repair that fills a flaw that extends through the full thickness of the metal wall, for example those that occur with the removal of core pins and armature rods. Circular plugs are often threaded in order to mechanically lock them in place. See [I.4](#I.4).

Note: It is not always easy to distinguish a plug from a %%patch%%. Radiography is often necessary.

## To Be Distinguished From

**patch**

## Sources

### *Cultural Heritage Publications*

{Dillon 2002}

{Penny 1993}

{Sturman 2004}

### *Art and Craft Textbooks*

{Rome and Young 2003}, 311

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/plug>

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Dübel (used primarily in speech) | Flicken  Plombe (used primarily in speech)  Stift (used primarily in speech) | Alternate translations:  Flicken: {Meissner, Haber, and Mach 2000}, 102  Flicken: {Maaz 2010}, 688  Plombe: {Maaz 2010}, 716  Stift: {Bol 1985}, 139 |
| French | [insert](file:////vocabularies/insert--fr) |  |  |
| Italian | tappo | perno  perno filettato (threaded plug) | [Treccani](https://www.treccani.it/vocabolario/tappo/)  Alternate translations:  perno: {Bruni 1994}, 124–250 |
| Chinese | 塞子 | 栓塞 | {Ming 2010}, 1233  Alternate translations:  栓塞: [TNATD](https://terms.naer.edu.tw/detail/625440/?index=3) |

term: porosity

language: en

images: **figs. 127, 152, 153, 155, 165, 184, 205, 464**

definition: A common type of casting flaw that includes a group or area of cavities caused by shrinkage or trapped gases. Porosity may vary considerably in dimension and may or may not break through the surface of the bronze. See [I.3§1.3.1](#I.3§1.3.1).

Note: A common way to characterize the quality of a cast is to report the degree and extent of its porosity (see [I.3](#I.3)).

## Sources

### *Cultural Heritage Publications*

{Stone 2008}

### *Copper Industry*

{Campbell 2015}

{Brunhuber 1988}

{Ammen 1980}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/porosity>

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Porosität |  |  |
| French | [porosité](file:////vocabularies/porosite) |  |  |
| Italian | porosità | spugnoso (in early Italian no direct translation has been found, but this adjective is a descriptive term that means “spongy,” used in *bucato e spugnoso*, “with holes and spongy”) | [Treccani](https://www.treccani.it/enciclopedia/porosita/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI13/GDLI_13_ocr_924.pdf&parola=porosità)  Alternate translations:  spugnoso: {Biringuccio [1540] 1990}, fol. 90 |
| Chinese | 气孔 | 松孔  气孔巢  砂眼 | {Ming 2010}, 1128  Alternate translations:  气孔巢: [TNATD](https://terms.naer.edu.tw/detail/625404/?index=3)  砂眼: {Ming 2010}, 1247 |

term: punch

language: en

images: **figs. 238, 239, 240, 242, 244, 256, 272, 494**

definition: A tool usually made of a steel rod that may be struck with a hammer at one end in order to create a pattern in the surface of the sculpture with the other end by compressing the metal.

Note: During chasing, a number of punches with a variety of custom-made textures are often used, allowing a range of possible surface patterns. The texture of some punches may be confused with peening.

## To Be Distinguished From

**chisel**

**cold chisel**

## Sources

### *Cultural Heritage Publications*

{Bassett and Fogelman 1997}, 74

{Penny 1993}, 308

{Dillon 2002}, 302

### *Art and Craft Textbooks*

{Untracht 1982}, 122

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/punch>

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Punze |  | {Maaz 2010} , 718 |
| French | [ciselet mat](file:////vocabularies/ciselet-mat) |  |  |
| Italian | cesello | punzone | [Treccani](https://www.treccani.it/vocabolario/cesello/)  {Battaglia 1961}, [here](http://www.gdli.it/JPG/GDLI03/00000019.jpg)  {Cellini [1568] 1967}, fols. 21v, 33v  Alternate translations:  punzone: [Treccani](http://www.treccani.it/vocabolario/punzone/)  punzone: {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI14/GDLI_14_ocr_1017.pdf&parola=punzone)  punzone: {Cellini [1568] 1967}, fol. 27 |
| Chinese | 冲头 |  | {Ming 2010}, 156  [TNATD](https://terms.naer.edu.tw/detail/625279/?index=1) |

term: replica

language: en

images: **figs. 1, 554**

definition: Here used to describe the precise reproduction of a bronze made by the same artist or foundry as the original bronze. Also refers to same-scale reproductions of a model made at different stages in the casting process (e.g., a wax replica, and a refractory replica used to make the %%core%% in %%sand casting%% or piece-mold casting). In lost-wax casting, bronzes fashioned from %%inter-models%% made from the same piece molds taken from the master model are considered replicas of the original. In sand casting, it refers to bronzes made using the same %%chef-modèle%%. Numerous replicas of the same bronze are called “multiples.”

Note: Slight differences are inevitable between replicas due to deterioration of the %%mold%% or variations in the finishing of the wax or %%chasing%% of the bronze. With regard to modern bronze production, a %%replica%% may refer specifically to a cast made by someone other than the artist, but who is under license to make the cast. An “artist’s replica” is a cast made by the artist or someone sanctioned by the artist. An “authenticated replica” is certified as having been made by the artist or someone sanctioned by the artist (see [Tate Papers No. 8](https://www.tate.org.uk/research/publications/tate-papers/08/terminology-for-further-expansion)).

## To Be Distinguished From

**copy**

**variant**

**version**

Note: A “copy” is understood here to refer to a cast that reproduces the features of a model or bronze, but is not created by the original artist of the model or bronze, or cast by a licensed or sanctioned foundry.

## Sources

### *Cultural Heritage Publications*

{Dillon 2002}, 300

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/replica>

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Replik |  | {Maaz 2010}, 720 |
| French | [épreuve d’édition](file:////vocabularies/epreuve-d-edition) |  |  |
| Italian | multiplo | replica (an Italian word, but more related to later reproductions of an artwork)  riproduzione (general term) | Alternate translations:  replica: [Treccani](https://www.treccani.it/vocabolario/replica/)  riproduzione: [Treccani](http://www.treccani.it/vocabolario/riproduzione)  riproduzione: {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI16/GDLI_16_ocr_726.pdf&parola=riproduzione) |
| Chinese | 复制品 |  | {Ming 2010}, 457  [TNATD](https://terms.naer.edu.tw/detail/625076/?index=1) |

term: sand casting

language: en

images: **figs. 9, 61, 101, 107, 108, 542**

definition: A casting technique in which metal is poured into a piece mold made of a specific type of sand that is bound by clay (or resin in modern foundries). The piece mold is made by ramming the sand around a rigid model or %%chef-modèle%% within stacked metal frames (aka flasks). See [GI§2.4.1](#GI§2.4.1).

## Sources

### *Cultural Heritage Publications*

{Penny 1993}

### *Copper Industry*

{Brunhuber 1988}

### *Art and Craft Textbooks*

{Rome and Young 2003}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/sand%20casting>

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Sandformguss | Sandguss  Sandgussverfahren | {Maaz 2010}, 723 |
| French | [fonte au sable](file:////vocabularies/fonte-au-sable) |  |  |
| Italian | fusione a staffa (*staffa* is Italian for “flask,” the wooden or metal frame containing the sand) | fusione alla sabbia (a little more common than *a staffa*) | [Treccani](https://www.treccani.it/enciclopedia/fusione_%28Enciclopedia-Italiana%29/)  Alternate translations:  fusione alla sabbia: [Treccani](http://www.treccani.it/vocabolario/ricerca/fusione-alla-sabbia/)  fusione alla sabbia: [Treccani](https://www.treccani.it/enciclopedia/fusione_%28Enciclopedia-Italiana%29/) |
| Chinese | 砂型铸造 |  | {Ming 2010}, 1247 |

term: seam line

language: en

images: **figs. 6, 43, 61, 72, 73, 74, 75**

definition: A faintly raised line that forms at the joints between mold sections when a molten material or slurry is poured into a %%piece mold%%. Seam lines are found on plaster or wax casts as well as on bronzes cast in piece molds. In ancient Chinese bronzes, some seam lines were exaggerated and integrated into the design of the casts, as can be seen in the elephant-shaped vessel in [Case Study 3](#CaseStudy3) (**fig. 26**). The term also refers to the line along which the pieces of a %%refractory%% %%piece mold%% join, which is the locus of the line that forms on the bronze. Depending on the how well the piece mold pieces fit together, the seam line may be more or less raised. More extreme %%flashing%% occurs with ill-fitting pieces.

Note: Compared with flashing, which generally forms in uneven, sharp, rough flanges of metal, seam lines on the bronze surface are commonly linear, rounded, and relatively smooth, and run along the high points of convex surfaces. Seam lines are generally removed as part of the %%fettling%% and %%chasing%% processes. Some modern artists leave them intentionally as evidence of the working process (**fig. 75**).

## To Be Distinguished From

**finning**

**flashing**

**veining**

## Sources

### *Cultural Heritage Publications*

{Lie and Bewer 2014}, 47

### *Art and Craft Textbooks*

{Rome and Young 2003}

{Rich 1988}, 410

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Gussnaht |  | {Maaz 2010}, 696 |
| French | [couture](file:////vocabularies/couture) |  |  |
| Italian | linea di giunzione (literally “line of joint”) | traccia del calco  traccia dello stampo |  |
| Chinese | 范线 |  | {Zhang 2010}, 80 |

term: shrinkage

language: en

images: **fig. 41**

definition: The contraction of molten metal as it cools and solidifies after casting, resulting in a reduction of the overall dimensions of the cast as well as possible casting defects. See [II.4§1.1.1](#II.4§1.1.1).

Note: Defects resulting from shrinkage may also be called “shrinkage” ({Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}). To avoid confusion, we recommend that such casting defects be referred to as “shrinkage porosity” ({Campbell 2015}).

## Sources

### *Historical Sources*

{Buchanan 1903}

{Bolland 1894}

### *Copper Industry*

{Ammen 1980}

{American Foundrymen’s Society 1984}

{Campbell 2015}

{Brunhuber 1988}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/shrinkage>

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Schrumpfung | Schwindung |  |
| French | [retrait](file:////vocabularies/retrait) |  |  |
| Italian | ritiro |  | [Treccani](https://www.treccani.it/enciclopedia/ritiro_%28Dizionario-delle-Scienze-Fisiche%29/) |
| Chinese | 收缩 |  | {Ming 2010}, 1313  [TNATD](https://terms.naer.edu.tw/detail/941509/?index=5) |

term: soldering

language: en

images: **figs. 187, 364, 488**

definition: In bronze sculpture, a technique for joining separately cast parts, %%inlays%%, %%overlays%%, or repairs, or for filling %%casting defects%%, by adding a metal with a lower melting temperature than that of the primary cast. As a rule of thumb, solder is white (alloys of silver, tin, lead, etc.), whereas %%brazing%% is yellow (copper alloys). Two types of solder include soft solder (low-melting-temperature alloys such as a combination of lead, tin, and/or bismuth) and hard solder (higher-melting-temperature silver alloys).

Note: The use of hard solder (a silver alloy) is sometimes referred to as brazing, but to avoid confusion, we suggest it should be referred to as soldering.

## To Be Distinguished From

**brazing**

**flow fusion welding**

**flow welding**

**fusion welding**

**welding**

## Sources

### *Cultural Heritage Publications*

{Beale 1975}, 42–43

### *Historical Sources*

{Buchanan 1903}, 23, 98

### *Copper Industry*

{Schwartz and Aircraft 1951}

### *Art and Craft Textbooks*

{Untracht 1982}, 388–423

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/soldering>

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Löten |  | {Deutsches Kupferinstitut 2005}, 24 |
| French | [brasage](file:////vocabularies/brasage) |  |  |
| Italian | brasatura (a subset of *saldatura*) | saldatura | [Treccani](https://www.treccani.it/vocabolario/ricerca/brasatura/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI02/GDLI_02_ocr_364.pdf&parola=brasatura)  Alternate translations:  saldatura: [Treccani](https://www.treccani.it/enciclopedia/saldatura/)  saldatura: {Cellini [1568] 1967}, fols. 37v–38 |
| Chinese | 焊接 |  | {Ming 2010}, 596  [TNATD](https://terms.naer.edu.tw/detail/993229/?index=4) |

term: sprue

language: en

images: **figs. 44, 46, 71, 86, 124, 539**

definition: Any channel that feeds metal to the mold, in contrast to a vent, which lets air escape. Both sprues and vents make up the “sprue system,” which circulates bronze from the pouring cup through the %%refractory mold%% and allows air and casting vapors such as steam to be released. In %%lost-wax casting%%, “sprue” is the term used for the solid wax rods (rarely reeds or terra-cotta pipes) used to create the channels in the mold. Sprues are also the solid metal that has filled the channels upon cooling, which is generally removed during %%fettling%%.

Note: The terms “sprue,” “sprueing,” or “sprue system” are most commonly associated with lost-wax casting. For %%sand casting%% the equivalent would be “gating” or “gating system,” which is where all the other terms (“runners,” “risers,” “gates,” etc.) come into play. In sand and %%piece-mold%% casting the channels are cut directly into the refractory mold. See [GI§2.7](#GI§2.7). Depending on the complexity of the cast, the sprue or gating systems may also contain other elements with special functions (e.g., reservoirs, chills, drains, traps, jets, etc.).

## Sources

### *Historical Sources*

{Buchanan 1903}

### *Copper Industry*

{Campbell 1991}, 36–41

### *Art and Craft Textbooks*

{Rome and Young 2003}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/sprue>

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Gusskanal | Kanalnetz  Versorgungskanäle | {Maaz 2010}, 696  Alternate translations:  Kanalnetz: {Alscher 1987}, 555 |
| French | [jet de coulée](file:////vocabularies/jet-de-coulee) |  |  |
| Italian | getto (term also found as part of expression *getto di colata*, referring to a gate or sprue that feeds the metal into the mold. The term is also used to describe a cast [act of casting] and pour [act of pouring, as well as content of the crucible].) | attacco (small section of sprue that is often used between the wax model and the longer gate or vent; also referred to as *mozzicone*)  isfiattatoio (refers to vents; alternative modern term: *sfiato*; another alternative early Italian pronunciation/spelling: *sfiatatoro*)  mandata (refers to a sprue that feeds the metal into the mold vs. a vent that helps channel the air out)  mozzicone (small section of wax sprue that is often used between the wax model and the longer gate or vent; also referred to as *attacco*)  aria (refers to vent)  bocca (refers to gate/runner)  canale  canale di alimentazione  canale di colata  colonna di alimentazione  entrata (refers to gate/runner)  esalatorio (refers to vent)  gitto (refers to a gate [sprue that feeds the metal into the mold]; also used to describe a cast [act of casting] and pour [act of pouring], as well as content of the crucible)  sfiatatoio (refers to vent; alternative term modern: *sfiato*; alternative early Italian: *sfiatatoro, isfiattatoio*)  spiraculo (refers to vent) | [Treccani](https://www.treccani.it/enciclopedia/fusione_%28Enciclopedia-Italiana%29/)  {Bruni 1994}, 72–73  Alternate translations:  attacco: {Bruni 1994}, 73  isfiattatoio: {Cellini [1568] 1967}, fols. 48–50  mandata: {Giuffredi 2006}, 220  mandata: {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI09/GDLI_09_ocr_632.pdf&parola=mandata)  mozzicone: {Bruni 1994}, 72–74  bocca: {Cellini [1568] 1967}, fols. 51v–52  canale di colata: {Reindell and Tommasi 1999}, 353  canale di colata: {Pecchioli 1999}, 193  colonna di alimentazione: {Bruni 1994}, 72–74  entrata: {Biringuccio [1540] 1990}, fol. 81  esalatorio: {Leonardo 1490}, fol. 149v  gitto: {Biringuccio [1540] 1990}, fols. 75–78  sfiatatoio: {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI18/GDLI_18_ocr_882.pdf&parola=sfiatatoio)  sfiatatoio: [Treccani](https://www.treccani.it/enciclopedia/fusione_%28Enciclopedia-Italiana%29/)  sfiatatoio: {Leonardo 1490}, fol. 149r  spiraculo: {Biringuccio [1540] 1990}, fol. 89 |
| Chinese | 浇铸道 | 浇口  竖浇道  铸口  铸道 | [TNATD](https://terms.naer.edu.tw/detail/3505809/?index=5)  Alternate translations:  浇口: {Ming 2010}, 740  浇口: [TNATD](https://terms.naer.edu.tw/detail/11560594/?index=8)  竖浇道: [TNATD](https://terms.naer.edu.tw/detail/941804/?index=1)  铸口: [TNATD](https://terms.naer.edu.tw/detail/3505809/?index=5)  铸道: [TNATD](https://terms.naer.edu.tw/detail/3505809/?index=5) |

term: variant

language: en

images: **figs. 1, 76, 544**

definition: A bronze that is similar in form to another, but with some differences due to one having been cast from an altered or adapted wax model, or from an entirely new model. Artists can make variants of their own work, for example, by adjusting the positions of limbs between casts, or variants may be the result of others imitating the artist’s work.

## To Be Distinguished From

**after-cast**

**aftercast**

**replica**

**surmoulage**

## Sources

### *Cultural Heritage Publications*

{Dillon 2002}

{Frapiccini 2017}

{Bassett 2008}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/variant>

## Synonyms

**version**

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Variante |  | {Weihrauch 1967}, 476 |
| French | [version](file:////vocabularies/version--fr) |  |  |
| Italian | variante |  | [Treccani](http://www.treccani.it/vocabolario/variante1/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI21/GDLI_21_ocr_680.pdf&parola=variante) |
| Chinese | 变体 (literally “modification”) | 变型 (literally “modification”) | {Ming 2010}, 65  [TNATD](https://terms.naer.edu.tw/detail/1092446/?index=4)  Alternate translations:  变型: {Ming 2010}, 65  变型: [TNATD](https://terms.naer.edu.tw/detail/2795748/?index=10) |

term: welding

language: en

images: **figs. 59, 146, 185, 189, 202, 203, 204, 227, 230, 545, 548**

definition: A technique for joining separately cast parts using high temperatures resulting in partial melting of the parts. A filler metal is often applied.

Note: In a technique very specific to Greek and Roman large bronzes, a steady stream of poured molten bronze was used both to melt and to join the edges of separately cast sections or to secure repairs. This process is known as flow welding or flow-fusion welding. Modern welding processes for copper alloys include MIG (metal inert gas) and TIG (tungsten inert gas). See [I.5](#I.5), **video 12**.

## To Be Distinguished From

brazing

soldering

## Sources

### *Cultural Heritage Publications*

{Salter and Gilmour n.d.}

{Beale 1975}, 28–55

### *Copper Industry*

{Brunhuber 1988}

### *Art and Craft Textbooks*

{Rome and Young 2003}, 312

{Untracht 1982}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/welding>

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Schweissen |  | {Deutsches Kupferinstitut 2005}, 18 |
| French | [soudage](file:////vocabularies/soudage) |  |  |
| Italian | saldatura (often specified by *a fusione* or *per fusione*) | saldatura metallurgica per colata (term also used for brazing, and [in antiquity] for flow fusion welding) | [Treccani](https://www.treccani.it/vocabolario/saldatura/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI17/GDLI_17_ocr_395.pdf&parola=saldatura)  {Bruni 1994}, 122–23  {Brunhuber 1988}  Alternate translations:  saldatura metallurgica per colata: {Formigli 2010}, 20  saldatura metallurgica per colata: {Formigli 1999c}, 318–19 |
| Chinese | 熔焊 |  | {Ming 2010}, 1211  [TNATD](https://terms.naer.edu.tw/detail/633942/?index=4) |

term: castability

language: en

images: **figs. 437, 438**

definition: Ability of a liquid metal to fill and pick up every detail of a mold. See [I.2§2.2](#I.2§2.2).

## To Be Distinguished From

**fluidity**

**fusibility**

**viscosity**

## Sources

### *Copper Industry*

{Schmidt and Schmidt 1992}

{Brunhuber 1988}

{Koch and Newell 1963}

{Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}

## Synonyms

**feeding power**

### *Other*

{Hanson and Pell-Walpole 1951}, 151–52

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Fliessvermögen | Formfüllungsvermögen  Giessbarkeit  Giesseingeschaften  Giessfähigkeit  Vergiessbarkeit | {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}  Alternate translations:  Formfüllungsvermögen: {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979}  Giessbarkeit: {Brunhuber 1988}  Giessbarkeit: {Koch and Newell 1963}  Giessbarkeit: {Brunhuber 1986}  Giesseingeschaften: {Brunhuber 1988}  Giessfähigkeit: {Koch and Newell 1963}  Vergiessbarkeit: {Brunhuber 1988}  Vergiessbarkeit: {Association Technique de Fonderie, Commission Ingénieurs et Techniciens 1979} |
| French | [coulabilité](file:////vocabularies/coulabilite) |  |  |
| Italian | colabilità | facilità di fusione  fondibilità  scorrevolezza | {Brunhuber 1988}  Alternate translations:  scorrevolezza: [Treccani](https://www.treccani.it/enciclopedia/fusione_%28Enciclopedia-Italiana%29/) |
| Chinese | 可铸性 | 铸造性 | {Ming 2010}, 838  [TNATD](https://terms.naer.edu.tw/detail/628182/?index=3)  Alternate translations:  铸造性: {Ming 2010}, 1832  铸造性: [TNATD](https://terms.naer.edu.tw/detail/628182/?index=3) |

term: metal plating

language: en

images: **figs. 293, 304, 343, 365**

definition: Generic term referring to the application of a different metal to the surface of a bronze sculpture by a variety of means (mechanical, chemical, electrochemical). Typically, gold and silver are used to plate sculptures, but nickel, zinc, and tin have been used for aesthetic and/or protective reasons. When the applied metal is gold or an alloy of gold, it is referred to as %%gilding%%.

## Sources

### *Cultural Heritage Publications*

{Salter and Gilmour n.d.}

### *Copper Industry*

{Brunhuber 1988}

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Plattierung (in German, *Plattierung* [the result] and *Plattieren* [the action] are specific to obtaining the adhesion of a [noble] plate on a [less noble] substrate by mechanical pressure via hammering, rolling, friction. *Plattierung* may actually not be applicable for sculpture. In German the construction *Ver* + metal + *ung* is preferred: *Vergoldung*, *Versilberung*, *Verkupferung*, *Verzinnung*, *Verzinkung.*) |  | {Wallack 1840}, 191–219 |
| French | [placage métallique](file:////vocabularies/placage-metallique) |  |  |
| Italian | placcatura |  | [Treccani](http://www.treccani.it/vocabolario/placcatura)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI13/GDLI_13_ocr_634.pdf&parola=placcatura) |
| Chinese | 镀覆 |  | {Ming 2010}, 327 |

term: mold

language: en

images: **figs. 7, 27, 101, 112, 542, 549, 557**

definition: A three-dimensional negative form made of one or more parts that serves as a matrix for the production of a positive by casting or pressing malleable material into it. Molds allow for the production of one or more copies of an original sculpture.

Note: Molds of varying types may be used at different stages of the bronze casting process (e.g., to make a %%chef-modèle%%, a wax %%inter-model%%, or %%core%%, or to cast a bronze). See [I.1](#I.1).

## Sources

### *Cultural Heritage Publications*

{Bassett and Fogelman 1997}

{Beale 1975}

### *Art and Craft Textbooks*

{Reliance Foundry n.d.}

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/mold>

## Synonyms

**mould (UK spelling)**

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Form  Negativform | Negativformteile  Hilfnegative | {Müller 2014}, 170–71 |
| French | [moule](file:///\\vocabularies\moule) |  |  |
| Italian | calco | cavo (general term for a negative impression, or hollow; Cellini uses it as “cavo di gesso,” which is specifically a mold of plaster)  forma (general and also investment mold)  stampo (general term for an impression) | [Treccani](http://www.treccani.it/vocabolario/calco1/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI02/GDLI_02_ocr_534.pdf&parola=calco)  Alternate translations:  cavo: {Cellini [1568] 1967}, fols. 45v–46  forma: [Treccani](https://www.treccani.it/vocabolario/forma/)  forma: {Biringuccio [1540] 1990}, fols. 77v, 80v  forma: {Bruni 1994}, 85–86  stampo: [Treccani](http://www.treccani.it/vocabolario/stampo/) |
| Chinese | 范 |  | {Zhang 2010} |

term: metallurgical joint

language: en

images: **figs. 59, 146, 187, 188, 203, 204, 206, 207, 364**

definition: A type of joint between two metal parts that is undertaken using molten metal. Examples of metallurgical joints include those made using %%welding%%, %%brazing%%, %%soldering%%, and interlock casting.

Note: The correct use of this term has been disputed among CAST:ING members, but it is often used generally to distinguish from mechanical joints. Diffusion welding (an expensive twentieth-century solid-state welding technique) does not involve the use of molten metal but to our knowledge is not used for bronze sculpture.

## To Be Distinguished From

**mechanical joint**

## Sources

### *Cultural Heritage Publications*

{Lechtman and Steinberg 1970}

{Dillon 2002}, 299

{Tzachou-Alexandri 2000}, 92

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | metallurgische Verbindung | metallische Verbindung |  |
| French | [joint métallurgique](file:////vocabularies/joint-metallurgique) |  |  |
| Italian | saldatura metallurgica | giunzione metallurgica  saldatura (metallurgica) per colata (flow fusion welding [used in antiquity])  saldatura | [Treccani](https://www.treccani.it/vocabolario/saldatura/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI17/GDLI_17_ocr_395.pdf&parola=saldatura)  {Formigli 2010}, 19  Alternate translations:  saldatura (metallurgica) per colata: {Formigli 2010}, 20  saldatura (metallurgica) per colata: {Formigli 1999c}, 318–19  saldatura: {Formigli 2010}, 20  saldatura: {Formigli 1999c}, 318–19 |
| Chinese | 冶金接合 |  | {Ming 2010}, 1643 |

term: Roman joint

language: en

images: **figs. 43, 65, 127, 211, 212, 213, 217, 218**

definition: A type of joint between two separately cast elements in which one element slots into the hollow “sleeve” of the other. The joint is generally further secured using pins, rivets, or by %%soldering%%.

Note: “Join” is a verb and “joint” is a noun. We have chosen here to use the latter, but it is common to find references to Roman joins, sleeve joins, etc.

## Sources

### *Cultural Heritage Publications*

{Bassett 2008}

{Beentjes 2019}

{Grissom and Harvey 2003}

## Synonyms

**mortise and tenon join**

### *Cultural Heritage Publications*

{Bourgarit et al. 2003}

**Roman join (alternate spelling)**

**sleeve join**

**socket and tenon join**

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Steckverbindung |  | {Willer, Schwab, and Mirschenz 2016b}, 158–59 |
| French | [assemblage à la romaine](file:////vocabularies/assemblage-a-la-romaine) |  |  |
| Italian | ghiera alla romana | giuntura a innesto | {Bruni 1994}, 123 |
| Chinese | 罗馬式接合 |  |  |

term: chef-modèle

language: en

images: **figs. 102, 103, 210, 531, 553**

definition: French term for a bronze replica of the artist’s model that is used to make molds for the production of large editions in sand casting. In rare cases, a chef-modèle has been used in lost-wax casting.

Note: Metal is used rather than plaster because it can better withstand the wear caused by repeated sand molding. To aid in mold making, the chef-modèle is often cast in sections to allow their removal from the sand mold without damaging the piece-mold sections. The edition proofs (*épreuves d’édition*) produced with a chef-modèle are a kind of %%after-cast%%.

## Sources

### *Cultural Heritage Publications*

{Grissom and Harvey 2003}

{Barbour and Sturman 2017}, 83

{Lebon 2003}, 14

## Synonyms

**pattern**

“Pattern” is a more general term for such a hard model for sand casting. The term is more commonly used in the context of industrial production of machine parts, but may be applied to sculptures as well, though in the context of European bronzes from the early twentieth century onward, “chef-modèle” has been adopted more frequently.

### *Cultural Heritage Publications*

{Motture 2019}

### *Historical Sources*

{Bolland 1894}

{Buchanan 1903}

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Chef-modèle |  |  |
| French | [chef-modèle](file:////vocabularies/chef-modele--fr) |  |  |
| Italian | modello (perhaps due to the lack of consistent industrial art foundry terminology before the nineteenth century, the term is shared in all sculptural fields: marble, plaster, clay, metal) | modello di riferimento |  |
| Chinese | 主铸型 | 主铸模 |  |

term: mold extension

language: en

images: **figs. 41, 122, 123**

definition: Bridge or spacer made of refractory material between the %%core%% and the outer mold. It serves a double function as %%core support%% while also providing better air flow into the core to aid in its drying before the bronze is poured.

Note: Such mold extensions may be created naturally when the core is not fully enclosed (as in the case of a bust with an open bottom) or by leaving openings in the wall of a lost-wax model. After casting, the hole in the bronze created by the mold extension will also facilitate removal of the core material and armature. The hole may later be sealed with a metal patch.

## Sources

### *Other*

{Smith and Sepponen 2019}

## Synonyms

**core extension**

**core print**

### *Copper Industry*

{Koch and Newell 1963}

**core seat**

### *Copper Industry*

{Koch and Newell 1963}

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Mold extension |  |  |
| French | [portée de noyau](file:////vocabularies/portee-de-noyau) |  |  |
| Italian | morsa |  |  |
| Chinese | 自帶泥芯撐 | 芯撑 | {Liu 2015}, 97  Alternate translations:  芯撑: {Ming 2010}, 1572 |

term: pour

language: en

images: **figs. 549, 560**

definition: The operation of pouring or casting metal into the refractory mold.

## Sources

### *Cultural Heritage Publications*

{Mattusch 1996}, 25

{Maish 2017}, 342

### *General Dictionaries*

<https://www.merriam-webster.com/dictionary/pour>

## Synonyms

**casting**

**heat**

### *Copper Industry*

{Koch and Newell 1963}

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Gießen | Guss |  |
| French | [coulée](file:////vocabularies/coulee) |  |  |
| Italian | colata (refers to the act of casting and to the metal contained in the crucible or furnace that is poured in one session) | getto (also refers to the cast)  gitto (early Italian spelling for *getto*; also refers to the cast) | [Treccani](https://www.treccani.it/enciclopedia/colata/)  {Battaglia 1961}, [here](http://www.gdli.it/pdf_viewer/Scripts/pdf.js/web/viewer.asp?file=/PDF/GDLI03/GDLI_03_ocr_279.pdf&parola=Colata)  {Bruni 1994}, 106  Alternate translations:  getto: [Treccani](http://www.treccani.it/vocabolario/getto/)  getto: {Bruni 1994}, 106  gitto: {Biringuccio [1540] 1990}, fols. 108–10 |
| Chinese | 浇注 | 浇铸 | {Ming 2010}, 741  Alternate translations:  浇铸: {Ming 2010}, 741  浇铸: [TNATD](https://terms.naer.edu.tw/detail/14236908/?index=1) |

term: life-casting

language: en

images: **figs. 11, 27**

definition: Refers specifically to the reproduction of a once-living form (either plant or animal) that results in a cast characterized by its high realism and fine detail. Life-casts are made by encasing the form in a refractory mold and burning out the form, and are therefore generally solid, though there are some exceptions.

Note: The related term “burn-out method” is used for the replication of nonliving forms (such as textiles) in which the form is burned out in order to create the mold.

## To Be Distinguished From

**casting from life**

Note: “Life-casting” is to be distinguished from “casting from life,” in which a reusable mold is taken from a living form (e.g., a tree trunk or a body part) without harming it (e.g., a life mask). Such casts from life may be reproduced any number of times and in different materials.

## Sources

### *Cultural Heritage Publications*

{Smith and Beentjes 2010}

## Synonyms

**life casting (alternate spelling)**

## Translations

|  |  |  |  |
| --- | --- | --- | --- |
| **Language** | **Translation** | **Alternate translations** | **Sources** |
| German | Naturabguss | Abguss über die Natur | {Lein 2004}, 42–45  Alternate translations:  Abguss über die Natur: {Uhlenhuth 1920}, 51–53 |
| French | [fonte sur le vif](file:////vocabularies/fonte-sur-le-vif) |  |  |
| Italian | fusione dal vero |  |  |
| Chinese | 活体模铸 |  |  |